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3,207,017

METHOD AND APPARATUS FOR TRIMMING AND SPLITTING
DOUBLE BOOKS INTO SEPARATE BOOKS

Filed Feb. 28, 1964

4 Sheets-Sheet 1

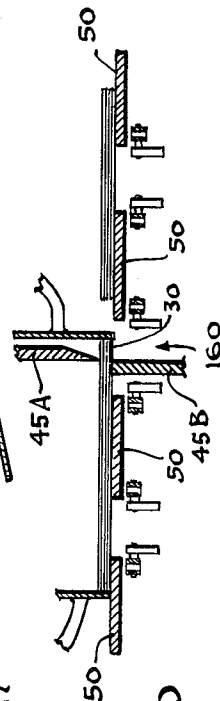
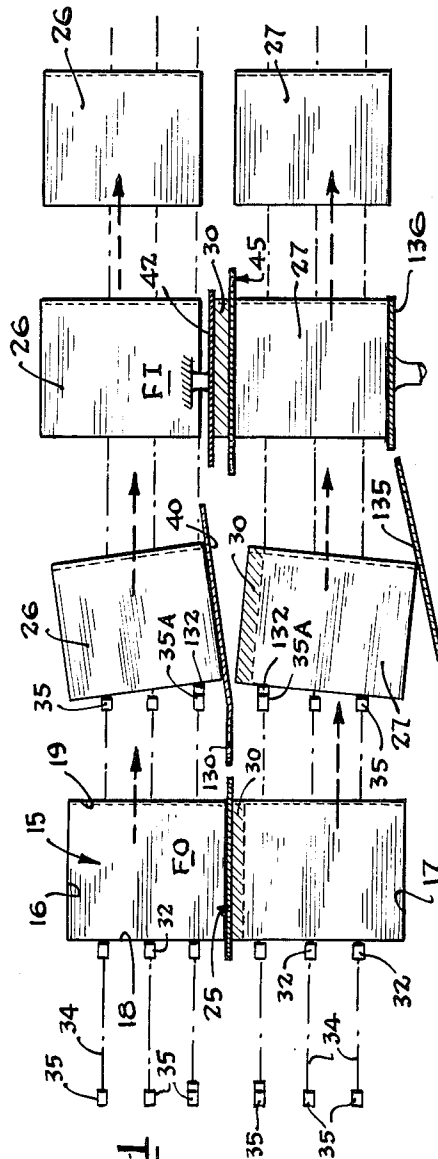
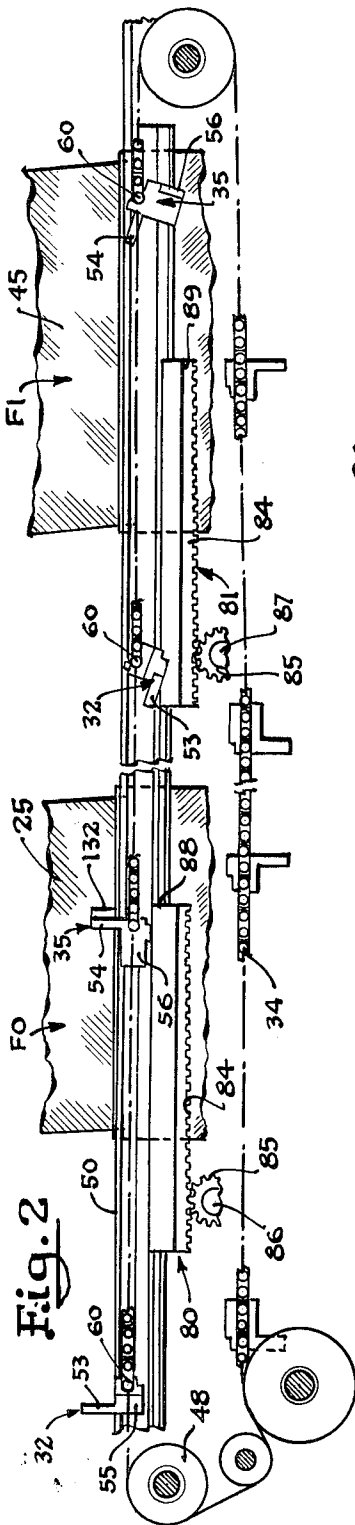


Fig. 1

Fig. 10

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4 Sheets-Sheet 2

Fig. 3

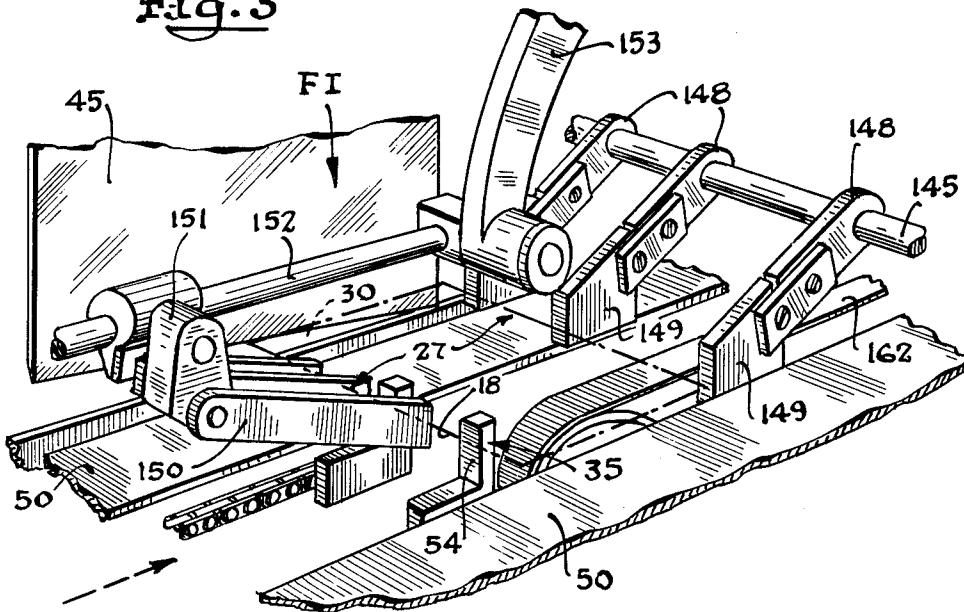
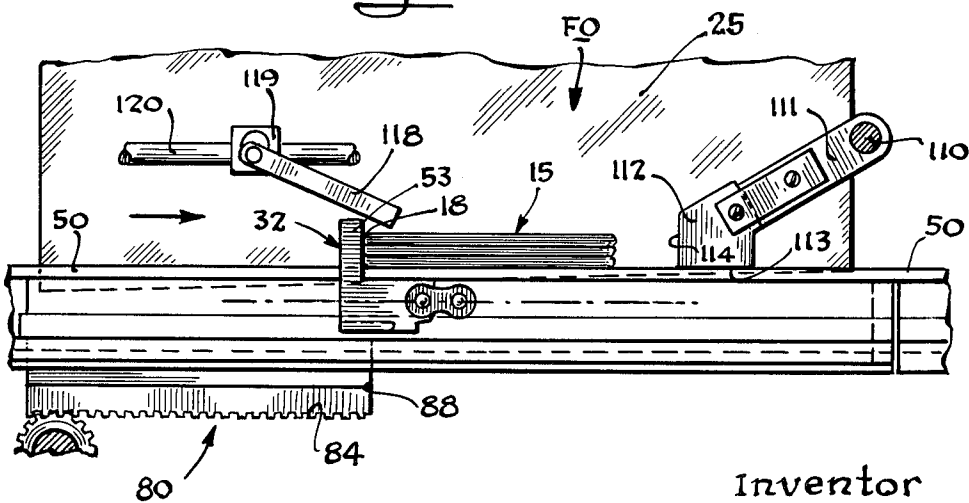


Fig. 4

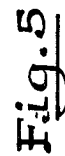


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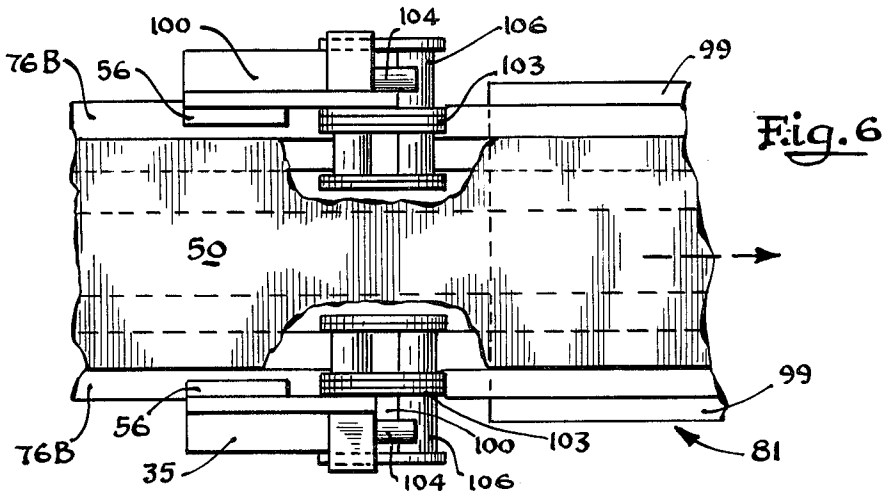


Fig. 6

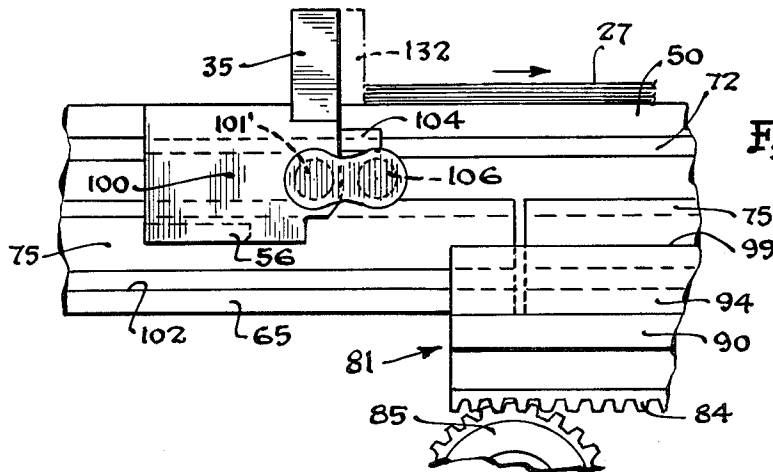


Fig. 7

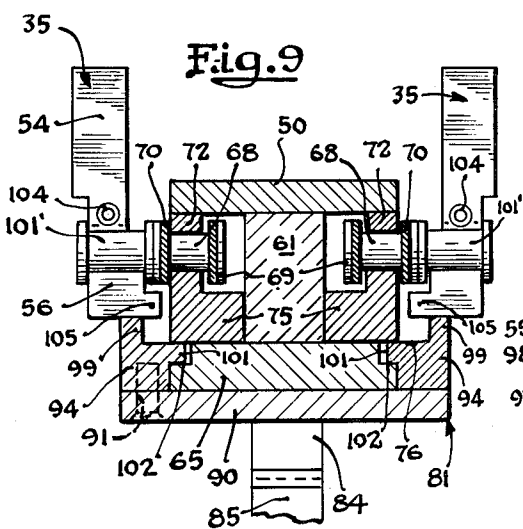


Fig. 9

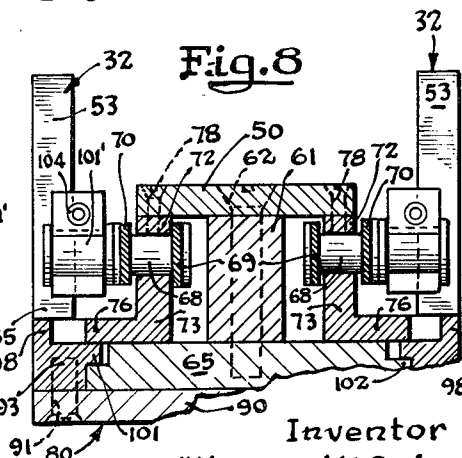


Fig. 8

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METHOD AND APPARATUS FOR TRIMMING AND SPLITTING DOUBLE BOOKS INTO SEPARATE BOOKS

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12 Claims. (Cl. 83-27)

This invention relates to the method of and an apparatus for trimming and splitting a double book or stack of double books into separate and identical books.

During their formation, books, pamphlets and magazines are often printed as a double book with separate and duplicate printed matter on each of the sheets. The double book is split or severed into two separate and distinct books which are identical in size and subject matter. However, the double books, to which the present invention is particularly directed, have a central, unprinted portion or area which needs to be cut or severed from the double book. Inasmuch as a non-printed border on either of the split books is not acceptable, the entire unprinted portion of the double book is removed. The non-printed area between the identical printed matter on a double book is the result of a type of printing operation wherein interior retaining hooks for printed plates are disposed between adjacent printing plates for printing identical subject matter at two spaced locations on the same sheet.

In accordance with one established procedure, the double book, prior to being split, is trimmed at the head, bottom and front edges by a so-called three knife trimmer to trim the double book to the proper size. The double book then is presented to so-called fourth and fifth knife trimmers which serve to split the double book at the fourth knife to form two books, one of which is a proper size without further operations thereon, and the other of which is of a larger size and includes the blank or non-printed area which must be trimmed by a fifth knife to bring the larger book to the proper size.

Heretofore, books have been moved to and from cutting stations or the like by means of an intermittently movable conveyor means which afforded a positive drive to the books. The characteristic features of slow operation and critical timing of such a conveyor are sometimes objectionable. A positive drive for the book is desirable, since it is effective to drive the book irrespective of whether or not the proper number of books is in the stack, in comparison to a continuously moving opposed friction belt type of conveyor for delivering a stack of books to an operating station wherein the failure of the proper number of books between the friction belts results in failure of conveying. Additionally, a continuously moving friction belt renders the problem of register more difficult.

Accordingly, an object of the present invention is to convey a stack of books to and from fourth and fifth knife stations in a positive manner irrespective of the number of books in the stack, with a continuously operating conveyor, which has its positive driving means rendered automatically ineffective at the fourth and fifth knife trimming stations. Thus, according to another object of the invention, the books are moved positively by a continuously moving conveyor means to each of the fourth and fifth knife stations, at which the conveyor deposits the books while the conveyor continues to move without urging or moving the books during either the fourth or fifth knife trimming operations. Thus, under this object, the fourth and fifth knife trimmers can operate at higher speed, achieve a better quality of trim, and minimize the amount of maintenance for the conveyor means.

In accordance with another object of the present invention, a conveying apparatus first engages split books at the fourth knife station and skews the split books to assume divergently oriented positions, whereupon the conveying means causes the books to move along separate paths on either side of a barrier element which assures that the split books move along separate guideways or paths. Under a further object of the invention, the books are separated sufficiently far apart upon reaching the fifth knife station to permit registration and trimming of the excess, unprinted area and thereby the creating of a second book identical to the first split book.

A further object of the invention is the employing of a continuous chain element provided with appearing and disappearing driving lugs which are selectively controlled, not only to drive the books to and from the fourth and fifth knife stations, but which are also adapted to cause the split books to take divergent paths after being split at the fourth knife.

More specifically, under this object of the invention, a first set of lugs move the double book to the fourth knife station and disappear, while a second set of lugs, trailing the first mentioned set of lugs, after a period of elapsed time, engage the now split books and rotate the books to divergently oriented positions before moving the books onto the fifth station, at which said second mentioned lugs disappear.

According to a still further object of the invention, the trimming machine is adapted to accommodate various sizes of books and, to this end, employs adjustable devices for controlling the disappearing positions of the conveyor lugs with respect to the fourth and fifth knife stations so that various sizes of books can be trimmed at each of these stations.

A further object of the invention is the method of splitting and trimming a double book into two separate books by splitting the books to form one book of the proper size, and a larger book having a re-trim area thereon, rotating the books about their centers of gravity to orient the books for movement along divergent paths, and moving and guiding the books sufficiently far apart so that the larger size book may be engaged by a registering device and a knife at the re-trim station whereby the larger book may be trimmed to a proper size.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show a preferred embodiment of the present invention and the principle thereof and what is now considered to be the best mode contemplated for applying this principle. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention.

In the drawings:

FIG. 1 is a diagrammatic view of a double book undergoing splitting and trimming operations, according to the present invention;

FIG. 2 is a partially diagrammatic view showing a plurality of driving lugs mounted on an endless chain;

FIG. 3 is a perspective view of registering a split book at a fifth knife station;

FIG. 4 is a side elevational view showing the registering of a stack of books at a fourth knife station;

FIG. 5 is a plan view showing split books moving between the fourth and fifth knife stations;

FIG. 6 is a plan view of a pair of conveying lugs;

FIG. 7 is a side elevational view of a conveyor lug;

FIG. 8 is a sectional view of a fourth knife type of driving lug;

FIG. 9 is a sectional view of a fifth knife type of driving lug; and

FIG. 10 is a sectional view showing the re-trimming operation at the fifth knife station.

Referring now to the drawings, and more particularly to FIG. 1, there is shown in diagrammatic form the order of operations performed in splitting and trimming a double book 15 into two separate books. The double book 15 has been trimmed previously in a three knife trimmer along a bottom side 16, a top side 17, and a front side 18. The double book 15 has a folded edge or a backbone 19 which is stapled or stitched to hold the sheets together. Manifestly, the folded edge 19 is not trimmed.

The double book 15 enters the fourth knife station FO, and is registered at a proper position for splitting into two separate books by a fourth knife 25. The fourth knife 25 severs the double book 15 into a pair of separate books 26 and 27, of which the split book 27 is of larger size than the book 26 by a portion or area 30, which is not printed. The area 30 is the non-printed, re-trim area which is to be trimmed from the split book 27 in order to make the book 27 identical in size to the book 26.

The double book 15 is moved to the fourth knife station FO by fourth knife driving lugs or means 32 carried on endless conveyor chains 34. When the fourth knife driving lugs 32 reach the fourth knife station FO, the lugs 32 disappear, that is, drop to a non-operative driving position, in a manner to be hereinafter described, so that the double book 15 can be registered into proper position for severing by the fourth knife 25 while the double book 15 is at rest.

After the double book 15 has been split, the books 26 and 27 are oriented for movement along divergent paths by fifth knife conveying lugs 35 secured to the continuous driving chains 34 and spaced on the driving chains 34 to follow the fourth knife conveying lugs 32.

As will be hereinafter explained in greater detail, the interior two lugs 35A of the fifth knife driving lugs 35 are provided with forwardly extending surfaces, which lead the leading surfaces of the remaining lugs 35, so that the interior driving lugs engage each of the respective books 26 and 27 near the fourth knife 25, and cause the books 26 and 27 to rotate about their respective centers of gravity. The other driving lugs 35 engage the respective books and move the books forwardly in the direction of the arrows in FIG. 1.

Rotation of the books 26 and 27 assures the books will be on either side of a vertical barrier or guide 40 as the books 26 and 27 move forwardly from the fourth knife 25. The barrier 40 prevents the books 26 and 27 from moving back together and guides the book 26 away from the book 27 to provide sufficient space between the split books for a trimming operation at the fifth knife station FI.

At the fifth knife station FI, as shown in FIG. 1, the larger size book 27 is registered with an interior stop 42, and the fifth knife 45 is operated to remove the trimmed portion 30, which falls downwardly into a trim chute disposed between the fifth knife 45 and the stop 42. The formerly oversized book 27 is now trimmed to the same size as the book 26, and is removed in a downstream direction for collection along with the books 26.

A double book 15, or alternatively a stack of two or more books, is conveyed from a three knife trimmer machine (not shown) which is the present instance is a separate machine, to the left end of the fourth and fifth knife trimmer machine, shown in FIG. 2, of the present drawings. Each stack or double book 15 is fed sufficiently forward of the sprocket 48 at the left end of the machine so that the fourth knife conveyor lugs 32 can be rotated to their upper positions by the sprocket 48 before engaging the forward edge 18 of a stack or a double book 15. While not shown, the preferred embodiment of the fourth and fifth knife trimmer of the present invention employs a small separate conveyor disposed leftwardly of the

sprocket 48, FIG. 2, to assure that the stack or double book 15 is fed forwardly of the pulley 48.

The books are supported on spaced parallel supporting bars 50, which constitute a flat bed or table for supporting the books. As best seen in FIG. 5, four spaced bars 50 are employed and between each pair of bars 50 moves a pair of either fourth or fifth knife conveying lugs 32 and 35.

The fourth and fifth knife conveying lugs 32 and 35, respectively, differ in construction in that their respective book engaging fingers 53 and 54, FIG. 2, are disposed differently on their respective lugs. That is, the fingers 53 of the fourth knife driving lug 32 are disposed at the rearward portion at the fourth knife driving lug 32, and the book engaging fingers 54 of the fifth knife driving lugs 35 are disposed at the forward portions of the driving lugs 35.

Each of the driving lugs 32 and 35 has a lower foot portion 55 and 56, respectively, adapted to ride along one of a plurality of cam tracks or rails so as to maintain the driving lugs 32 and 35 in the position shown in the left portion of FIG. 2, wherein the respective driving lugs 32 and 35 are in position to engage positively a book and carry the books forwardly. When the foot portions 55 and 56 of the driving lugs 32 and 35 are no longer supported by individual cam tracks, the driving lugs 32 and 35 rotate under their own weight about their pivotal connections 60 with their respective drive chains 34 and drop to ineffective positions as shown in the right hand portion of FIG. 2 wherein the respective driving lugs 53 and 54 are no longer raised above the plane of the supporting bars 50 so as to be effective to drive the books across the book supporting bars 50.

Referring now to FIGS. 8 and 9, FIG. 8 illustrates in section a fourth driving lug 32, and FIG. 9 illustrates in section a fifth knife driving lug 35. The sectional view of FIG. 8 is taken prior to the fourth knife station FO, and the section view of FIG. 9 is taken just prior to the fifth knife station FI, it being understood that each of the seven of the driving lugs 32 is identical at any given transverse section as are each of the seven driving lugs 35.

The book supporting plates 50 form the upper and main supporting elements to which are secured a plurality of chain guiding and cam track devices for controlling the movement and disappearance of a driving lug 32 or 35, the disappearance being rotation of a driving lug 32 or 35 to an ineffective position.

Each of the supporting plates 50 has a rectangular cross-sectioned spacer block 61, FIGS. 8 and 9, secured to its underside by a plurality of countersunk cap screws 62 extending from the supporting plate through bores in the spacer block 61 to a lower bed plate 65 whereby the cam track 50, spacer block 61 and bed plate 65 are secured together in a rigid unit.

Secured to the underside of each of the supporting plates 50 at the outer edges are a pair of upper chain guide or wear strips 72 which are secured in a fixed position by countersunk cap screws 78, FIG. 8. Secured to the bed plates 65 are a lower pair of chain guide or wear strips 73, FIG. 8, and wear strip 75, FIG. 9. As seen in these figures, the links of the endless chain are guided at the left end of the machine by wear strips 72 and 73, and at the right end of the machine by wear strips 72 and 75.

The wear strips 72 and 73, and 72 and 75 are spaced apart to permit the longitudinal passage of a drum 68 of each chain link while preventing the transverse movement of the links of the chains 34 due to vertical height of the opposed side plates 69 and 70 of the chain links being greater than the spacing between the opposed wear strips. The chains 34, thus, are guided on a relatively straight line path from one end of the machine to the opposite end of the machine, and thereby assure that the respective conveying lugs 32 and 35 thereon also

partake of a straight line movement during their course of travel.

It is important that the chains and conveying lugs 32 and 35 be prevented from partaking of excessive lateral movement since it is a register of the feet 55 and 56 of the respective driving lugs 32 and 35, with cam tracks or flanges such as the flange 76 on the wear strips, FIG. 8, or with the cam tracks or flanges 98 and 99 on movable cam track means or devices 80 and 81.

It will be remembered that so long as the cam foot 65 or 66 is in engagement with a cam track such as 76, 98 or 99, that the respective driving lug 32 or 35 will be held upwardly in an effective driving position, as shown in FIGS. 8 and 9, and in the left hand portion of FIG. 2. But it will be remembered that when the respective cam feet 55 and 56 are no longer in engagement with one of these cam tracks or surfaces, that the respective driving lug will pivot about the pin 60 to rotate to a downward ineffective position as shown in the right hand portion of FIG. 2. As can best be understood from FIGS. 5 and 6, the lower chain guides 73 are provided with cam tracks or flanges 76, which decrease in size from the left hand portion of the machine, as viewed in these figures, to the right hand portion of the machine. Thus, the cam flanges or cam tracks 76A in the left portion of FIG. 5 extend farther outwardly from the edges of the support plate 50 than do the cam flanges 76B, shown to the right of the break in FIG. 5.

The driving lugs 32 and 35 each have a central body portion 100 which is apertured to receive a barrel 101 of a chain link extension 102. The link extensions 102 have side plates 103, the inner one of which is connected to an outer side plate 70 of a link of a chain 34. The driving lugs pivot about their barrels 101 of the chains extensions 102 and are limited against clockwise rotation, FIG. 7, by a pin 104 engaging a forward barrel 106 on the link extension 102.

As can best be appreciated from FIG. 2, there are two respective cam track slides 80 and 81 which are selectively movable to determine the positions of the respective end portions of the cam tracks or flanges 98 and 99, and thereby at what positions the respective fourth and fifth driving lugs 32 and 35 rotate to an ineffective position.

Each of the cam track slides 80 and 81 has secured to the lower portion thereof a central rack 84 which is in meshing engagement with a pinion gear 85 secured on rotatable shafts 86 and 87, respectively, FIG. 2. To accommodate a larger width of sheet or book, the respective shafts 86 and 87 are rotated in a counterclockwise direction to move the racks 84 leftwardly, and thereby move leftwardly the left end or drop-off portions 88 or 89 of the cam track slides 80 and 81.

Thus, the respective pushing lugs 32 and 35 pivot to release the book for a trimming operation at the fourth and fifth trimming stations at an earlier time in their rightward movement than the driving lugs 32 and 35 release for smaller size books. The velocity at which the chain 34 is moving is also changed when changing the positions of the drop-off portions 88 or 89 to maintain proper timing between the third knife trimming machine and the fourth and fifth knife trimming machine.

Referring now to FIGS. 8 and 9, the fourth and fifth knife cam track slides 80 and 81 each have a lower tie plate 90 adapted to be in sliding engagement with the underside of its respective lower bed plate 65. Secured to the outer edges of each of the tie plates 90 by fasteners 91 are cam plates 93 for the cam slide 80 and cam plates 94 for the cam slide 81. The cam plates 93 and 94 have upwardly extending cam flanges 98 and 99, respectively, for engagement with a cam foot 55 and 56, respectively.

Additionally, the cam plates 93 and 94 are formed

with interially directed tongues 101 for sliding engagement with the grooves 102 in the respective bed plates 65, so that the respective cam tracks 80 and 81 have a sliding tongue and groove relationship with a stationary bed plate 65. As should be apparent, the turning of either of the pinions 85 by either of the shafts 86 and 87 causes a tie plate 90 to move relative to its supporting bed plate 65, and thereby cause the respectively upstanding cam flanges 98 and 99 to move rightwardly or leftwardly.

Recapitulating, the cam flanges 76 of the respective plates 50 are of progressively decreasing dimensions proceeding from left to right, in FIGS. 2 and 5. Thus, at the leftward portion of these figures, the cam flanges 76 are of sufficient width to extend beneath the narrow cam 55 of the pusher lug 32 as well as beneath the wider foot 56 of the pusher lug 35. As seen in FIG. 8, the cam flange 76 is not in engagement with the cam feet 55 of the pusher lugs 32 when the pusher lugs 32 are moving across the cam surfaces 98 of the cam slide 80.

Thus, when the cam feet 55 are moved rightwardly past the end portion 88 of the cam track slide 80, the finger 53 on the pusher lug 32 falls downwardly and rotates to a counter-clockwise or inoperative position where-in the finger 53 is disposed beneath the plane of the top of the plates 50. The feet 56 of the pusher lugs 35 are wider than the foot 35 of the pusher lug 32. The feet 56 are of sufficient width, that when the end portion of the cam track 88 is passed, the inwardly directed portions 105 on the feet 56 are adapted to rest on a cam flange 76B (FIG. 5) which is of a narrower width than the cam flange 76A.

Thus, the pusher fingers 35 will remain in operative upright position while moving entirely through the fourth position FO, and in the space between the fourth knife station FO and the fifth knife station FI. However, when the fifth knife driving lugs 35 proceed rightwardly past the end 89 of the cam track slide 81, the driving lugs 35 rotate to drop downwardly to the position shown at the rightward end of FIG. 2. The fourth knife driving lugs 32 are disposed outwardly of the cam surfaces 76B and cam slide 81 so as not to engage them as the lugs 33 pass through the fifth knife station in their ineffective positions.

When the fourth knife driving lug 32 brings the books into the fourth knife station FO, a rock shaft 110, FIG. 4, rotates in a counterclockwise direction to rotate a plurality of attached arms 111, carrying stops 112, to engage lower surfaces 113 of the stops 112 against the top surfaces of the supporting plates 50.

Preferably, the rock shaft 110 has three stop supporting arms 111 and stops 112 on each side of the fourth knife 25. The books are moved positively by fingers 43 of the driving lugs 32 to within approximately one-quarter of an inch of engaging the register surface 114 on each of the stops 112. At this point, the driving lugs 32 have rotated downwardly to an ineffective position since the cam feet 55 on the respective driving lugs 32 have passed rightwardly of the supporting flanges 98 on the respective cam slides 80. The double books 15 remain stationary until a plurality of registering fingers 118, FIG. 4, move downwardly and forwardly to engage the front edges 18 of the double book 15 to move the books against the register surfaces 114 of the stops 112.

The registering fingers 118 are adjustably mounted on a mounting block 119 secured to an oscillatable arm 120. The oscillating movement of arm 120 is controlled by a suitable cam means (not shown) which lowers the registering fingers 118 into a registering position to engage the double book 15 as the fourth knife driving lugs 32 fall away. The cam means causes the oscillatable bar 120 to move forwardly to cause the registering movement of the double book 15 against a registering surface 114 on register stops or shoes 112.

In addition to the longitudinal registration afforded by the stops 112 and registering fingers 118, the double book

is also transversely registered by a pair of interiorly reciprocating push bars 125 and 126 (FIG. 5) carried on crank arms 127, which are also oscillated by suitable cams to move inwardly toward each other to register the book beneath the fourth knife 25. When properly registered, the fourth knife oscillates to trim the book 26 to the proper size, and to leave all of the unprinted area 30 on the book 27.

The fourth knife 25 includes an upper blade 25A and a lower blade 25B, as shown in FIG. 5. While not shown, the double book is clamped adjacent the severing cut by a clamp immediately prior to the cutting operation by the fourth knife 25. As the upper knife 25A begins to enter the book, the register fingers 118 begin to oscillate upwardly and rearwardly to release the double book, and likewise the opposed, side-register plungers 125 and 126 move slightly outwardly from the register positions. At this time, the portion of the double book 15 that will become book 26 is released and the portion of the double book 15 that will become book 27 is held stationary.

The upper knife blade 25 has a bevelled edge causing the book 26 to move slightly as it severs the double book 15. If the book 26 were not released by the registering devices, the bevel of the upper knife 25A may cause the edges of the separate books 26 and 27 being severed to be forced downwardly into the groove for the upper knife 25A and be bound therein after an upward movement of the knife 25A.

After the knife 25A moves upwardly to a position above the plane of the books on the supporting plates 50, the rock shaft 110 oscillates to lift the stops 112 also above the tops of the now-separate books 26 and 27 so that the books 26 and 27 may pass thereunder.

The chains 34 have been continuously moving during the splitting operation at the fourth station FO with the fourth knife driving lugs rotated downwardly to their inoperative positions. Thus, the chains 34 are continuously moving the driving lugs 35 that follow the fourth knife driving lugs, toward the front edge 18 of the now-split books 26 and 27. The movement of the conveyor and spacing of the lugs 35 from the lugs 32 is such that the severing operation has been completed prior to the engagement of the split books by the driving lugs 35. Also, the register stops 112 are rotated upwardly above the plane of the split books or stack of split books 26 and 27 prior to engagement of these books by the driving lugs 35 so as not to interfere with movement of the books to the fifth knife station FI.

As will be explained hereinafter, the fifth knife driving lugs 35 function to rotate the split books 26 and 27 about their centers of gravity so that the split books 26 and 27 are oriented with their inner leading and adjacent edges spread apart so as not to encounter a leading edge 130, FIGS. 1 and 5, of the barrier element. The interior two driving lugs 35A of the fifth knife driving lugs 35 have suitably fastened to their forward faces an additional and forwardly extending plate 132, FIGS. 2 and 5, to engage the front edges 18 of the books 26 and 27 prior to engagement by the other driving lugs 35. That is, since the driving lugs 35 and 35A are all aligned in a straight line across the path of travel, the additional forward plates 132 on the interior driving lugs 35A engage the interior portions of the split books 26 and 27 prior to engagement of these books by the outer pairs of driving lugs 35 and hence cause the books to rotate about their respective centers of gravity. Thus, the interior and adjacent edges of the books 26 and 27 swing apart and away from the fourth knife 25 so that the books 26 and 27 do not encounter the forward edge 130 of the guide 40.

Immediately after rotation of the books by the forward portions 132 of the driving lugs 35A, the remaining driving lugs 35 engage the respective hooks 26 and 27 and together with the lugs 35A push the books 26 and 27 forwardly to the fifth knife station FI. The book 26 is guided by the barrier element 40 to move farther apart

from the book 27 for the purpose of affording sufficient spacing between books at the fifth knife station FI for the final trimming operation. This space is needed to permit oscillational movement of a side register 42 to and from a registering position and for release and dropping of the trimmed portion 30 into a trim chute therefor.

It will be noted that the fourth knife 25 and fifth knife 45 (FIG. 5) are aligned along a line parallel to the plates 50 and path of movement of the driving lugs 32 and 35. Thus, the guide element 40 guides the book 26 away from the book 27 so that the unprinted portion 30 of the book 27 may be moved beneath the fifth knife 45 and into the space vacated by the book 26 adjacent the fifth knife 45.

The register 42 is cam controlled to oscillate into a predetermined register position and remain stationary in this position during the trimming operation. A side guide 135, disposed along the outer edge of the trimming machine between the fourth and fifth knife stations serves to direct the book 27 to a side edge register or pusher 136. The side register pusher 136 slides the book 27 transversely against the now stationary side register stop 42.

For the purpose of longitudinal registration at the fifth knife station FI, as best seen in FIG. 3, a rock shaft 145 has fixed thereon a plurality of stop supporting arms 148 for rotation to bring stops 149 downwardly into engagement with supporting pairs 50 to hold the book 27 in a predetermined position so that only the excess area 30 is removed by the fifth knife blade 45. Also at the fifth knife station FI, a plurality of register fingers 150 are carried on a mounting block 151 secured to an oscillatable rod 152. The oscillatable rod 152 is secured to a crank arm 153, FIG. 3, to move the register fingers 150 against the front edge 18 of the book 27 to move the book 27 into engagement with the stops 149, this movement being approximately one quarter of an inch. The fingers 54 of the lugs 35 have, immediately prior to engagement of the book 27 by the register fingers 150, rotated from their driving positions to inoperative positions below the surface of the support plates 50 because the cam feet 56 of the driving lugs 54 have moved past the end portion 89 of the cam slide 81.

That is, as the cam feet 56 move past the end portion 89 of the adjustable cam track 81, the driving lugs 35 rotate to the position, shown in the right hand portion of FIG. 2. After the upper blade 45A, FIG. 10, of the fifth knife blades 45A and 45B has severed the trim portion 30, the trim portion 30 falls into a chip chute 160 beneath the surface of the supporting plates 50. Thus, the book 27 has been trimmed to the identical size of book 26. The book 27 is removed from the fifth knife station when the stops 150 are moved upwardly. At this time, a drop roller (not shown) comes down on the upper surface of the book 27 and engages book 27 against a continuously rotating friction belt 162 shown disposed beneath the book 27 in FIG. 3.

From the foregoing, it will be seen that a double book 15 is moved by positive acting fingers on the fourth knife driving lugs 32 to the fourth knife station and adjacent the fourth knife registering stops 112, whereupon registering devices register the double book 15 prior to cutting by the fourth knife 25. The double book is split so that one book is formed to size, while the other book has a marginal portion 30 thereon which is removed at a fifth knife station.

Fifth knife lugs 35 are spaced on the endless chains 34 and follow the fourth knife driving lugs at a predetermined distance so as to move into engagement with the split books 26 and 27 after completion of the cutting operation. The interior two of the fifth knife driving lugs 35 are provided with forwardly extending portions 132, which engage the books at their interior portions, and rotate the books about their centers of gravity, to an orientation with the forward, inner edges directed apart.

In this manner, the forward edges of the books are oriented from encountering a forward edge 130 of a barrier or element 40 as the driving lugs 35 move the books

from the guide fourth knife station FO. The barrier element 40 guides the book 26 away from the book 27 so that by the time the books reach the fifth knife station FI there is sufficient space between the adjacent edges of the respective books for registering and severing of the marginal area 30 from the larger size book 27.

The driving lugs 35 disappear or drop into ineffective position at the fifth knife station FI where longitudinal and side registering of the book 27 is made relative to a fifth knife 45. The fifth knife 45 severs the re-trim area 30 from book 27, thereby making the book 27 the same size as book 26.

Thus, it will be seen that under the present invention the books are moved by a continuously moving and endless conveying means including the endless chains 34, a first set of driving lugs or means 32, and a second set of driving lugs or means 35. The sets of driving lugs 32 and 35 are retained in their upper, operative, book-moving positions by one of the cam flanges 76 and 99 or 98, collectively, which constitute a means for holding the first and second lugs in operative book engaging positions. Moreover, the respective cam slides 80 and 81 constitute movable supporting means for the first and second set of driving lugs 32 and 35, respectively.

Additionally, the forwardly extending surfaces 32 on the driving lugs 35A constitute means associated with said second set of driving lugs 35 to engage the books prior to engagement by the remainder of the second set of driving lugs 35 to rotate the books about their respective centers of gravity. Thus, the books are canted or oriented to move past the barrier means 40 without engaging the barrier means 40. The barrier means 40 assure separation of the books, and guide the book 26 away from the larger book 27 and the fifth knife 45 so that the unprinted area 30 can be moved beneath the fifth knife 45 and into the position vacated by the book 26.

Hence, while preferred embodiments of the invention have been described and illustrated, it is to be understood that these are capable of variation and modification.

I claim:

1. In a book trimming machine for separating a double book into separate books at a separating station, and trimming at least one of said separate books at a re-trim station, a first knife means at said separating station for severing said double book into two separate books at least one of which requires further trimming, means to convey said books and including spaced book engaging lugs for moving the double book to said first knife means and for engaging said separate books on opposite sides of said first knife means and skewing said books apart prior to moving said books to said re-trim station, divider means for preventing said books from moving into engagement with each other, and a second knife means at said re-trim station for trimming at least one of said books.

2. In a book trimming machine for separating a double book into separate books and trimming at least one of said separate books at a re-trim station, a first cutting means at a first station for severing said double book into two separate books, at least one of which separate books requires further trimming; a continually moving endless conveying means, including a first set of driving means disposed in an operative position to engage positively, and to move said double book to said first cutting means, said conveying means also including a second set of driving means disposed in an operative position to positively engage said severed books after said books have been separated and to move said separated books from said first station to said re-trim station; and a second cutting means at said re-trim station for trimming at least one of said separate books.

3. In a book trimming machine for separating a double book having a centrally located non-printed portion into

two separate identical books and for trimming said central portion from said double book, cutting means at a first station for splitting the books into two separate books; an endless conveying means including a first set of driving means pivotally mounted on said endless conveying means and extending to engage a double book when in an operative position and to move the double book to said first station at which station said driving means pivots to an inoperative position, said endless conveying means also including a second set of driving means being pivotally mounted on said endless conveying means, said second set of driving means extending to engage the separate book when in an operative position and to move the separated books from said first station to a second re-trim station; and means for holding said first set of driving means in an operative position until said first set of driving means reaches said first station where said first set of driving means pivots to an inoperative position; said means holding said second set of driving means in an operative driving position until said re-trim station where said second set of driving means pivots to an inoperative position.

4. In a book trimming machine for separating a stack of double books having centrally located non-printed portions into two stacks of separate and identical books, and for trimming said central portion from said double books, cutting means at a first station for splitting the double books into separate books; an endless conveying means including a first set of driving lugs pivotally mounted on said endless conveying means and upstanding above the plane of the books when in an operative position to engage and to move the double books to said first station at which station said driving lugs pivot to an inoperative position, said endless conveying means also including a second set of driving lugs being pivotally mounted on said endless conveying means, said lugs upstanding above the plane of the books when in an operative position to engage the separate books and to move the books from said first station to a second re-trim station; means for holding said first set of driving lugs in an operative position until said first station is reached where said driving lugs pivot to an inoperative position and for holding said second set of lugs in an operative driving position until said re-trim station is reached where said second set of driving lugs pivot to an inoperative position; said means for holding said first and second set of lugs in an operative position including a first movable supporting means for said first set of driving lugs, and including a second movable supporting means for holding said second set of driving lugs in an operative position, said first and second movable means being movable to various positions which render said first and second set of lugs, respectively, inoperative at corresponding various positions for different size books.

5. In a book trimming machine for separating double books having centrally located non-printed areas into separate and identical books and for trimming said central areas from said double books, cutting means at a first station for splitting double books into separate books; an endless conveying means including a first set of driving lugs pivotally mounted on said endless conveying means and extending to engage one or more of the double books and to move the double books to said first station at which station said driving lugs pivot to an inoperative position, said endless conveying means also including a second set of driving lugs being pivotally mounted on said endless conveying means and extending to engage the separate books and to move the separate books from said first station to a re-trim station; means for holding said first set of driving lugs in an operative position until said first station where said first set of driving lugs pivot to an inoperative position, and for holding said second set of lugs in an operative position until said re-trim station where said second set of driving lugs pivot to an inoperative position; means associated with said second set of

driving lugs to engage said books prior to engagement by said second set of driving lugs to rotate said books about their respective centers of gravity, and thereby orient said separate books to have their inner, adjacent and leading edges rotated apart; and barrier means adjacent said cutting means to assure separation of said separate books, as said books are moved to said re-trim station.

6. In a book trimming machine for separating a stack of double books having centrally located non-printed portions into two stacks of separate and identical books, and for trimming said central portion from said double books, cutting means at a first station for splitting the double books into separate books; an endless conveying means including a first set of driving lugs pivotally mounted on said endless conveying means and upstanding above the plane of the books when in an operative position to engage and to move the double books to said first station at which station said driving lugs pivot to an inoperative position, said endless conveying means also including a second set of driving lugs being pivotally mounted on said endless conveying means, said lugs upstanding above the plane of the books when in an operative position to engage the separate books and to move the books from said first station to a re-trim station; means for holding said first set of driving lugs in an operative position until said first station where said first set of driving lugs pivot to an inoperative position and for holding said second set of lugs in an operative driving position until said re-trim station where said second set of driving lugs pivot to a pivot position; said means for holding said first and second set of lugs in an operative position including a first movable supporting means for said first set of driving lugs, and including a second movable supporting means for holding said second set of driving lugs in an operative position, said first and second movable means movable to various positions which render said first and second set of lugs, respectively, inoperative at corresponding various positions for different size books; and barrier means adjacent said cutting means to assure separation of said separate books, as said books move toward said re-trim station, said barrier means inclined at an angle to the path of movement of said second set of driving lugs to guide at least one of said books away from the other said books as said books are moved forwardly by said second set of driving lugs, said barrier means causing said books to separate a distance to provide operating space at the re-trim station to register and sever said unprinted area from the larger of said separate books.

7. In a book trimming machine for separating a double book or a stack of double books having a centrally located non-printed area into two separate identical books or stacks of identical books and for trimming said central area from said double book or books, cutting means at a first station for splitting the books into two separate books; an endless conveying means including a first set of driving lugs pivotally mounted on said endless conveying means and upstanding above the plane of the books when in an operative position to engage one or more of the double books and to move the double books to said first station, where said driving lugs pivot to an inoperative position, said endless conveying means also including a second set of driving lugs being pivotally mounted on said endless conveying means, and upstanding above the plane of the books when in an operative position to engage one or more of the books to move the books from said first station to a re-trim station; means for holding said first set of driving lugs in an operative position until said first station is reached where said driving lugs pivot to an inoperative position, and for holding said second set of lugs in an operative driving position until said re-trim station is reached where said second set of driving lugs pivot to an inoperative position; a second cutting means at said re-trim station and being aligned with said first cutting means along a path parallel

to the path of movement of said endless conveying means, means on said endless conveying means to engage said books prior to engagement by said second set of driving lugs to rotate said books about their respective centers of gravity, and thereby re-orient said books about their respective centers of gravity to have their inner adjacent and leading edges rotated apart; barrier means adjacent said first cutting means to assure separation of said separate books as said books move to said re-trim station, said barrier means being inclined at an angle to the path of movement of said second set of driving lugs to guide at least one of said books away from the other of said books as said books are moved forwardly by said second set of driving lugs, said barrier means causing said books to separate to provide operating space at the re-trim station to register and sever said unprinted area from the larger of said separate books; and register means at said re-trim station to position said book having the re-trim area thereon to a proper position to sever said re-trim area therefrom.

8. In a book separating and trimming machine for a double book having a centrally located re-trim portion, which, when removed from a double book leaves two separate and identical books, a frame means; a plurality of spaced supporting bars extending longitudinally from a first separating station to a re-trim station, and adapted to receive and support one or more of said double books arranged in a stack; endless conveying means disposed between said spaced bars and having pivotally mounted thereon first and second sets of bell crank means; a first arm on each of said bell crank means for engaging and pushing the stack of books along said spaced bars; track means on said spaced bars for slideable engagement with the other arm of each of said bell crank means and operable to hold said bell crank means in operative driving positions so long as a track is disposed in engagement with said other arms; a first knife means for severing said double book to form one book which is of a predetermined size, and a second book which is larger than said predetermined size, by the re-trim area present along its inner edge; a second cutting means at said re-trim station, and aligned with said first cutting means along a line parallel to the path of movement of said endless conveying means; barrier means disposed between said first and second knife means and operable to guide said second book away from said first book to afford space between the books at the re-trim station for registering of the re-trim area on the side of the said one book at said second cutting means; and forwardly disposed surfaces on the interior ones of said second set of bell crank means for engaging said books at the first station prior to engagement by the remainder of the set of second driving lugs to rotate said separate books about their respective centers of gravity so that the interior and leading edges of the books are separated to prevent engagement with the leading edge of said barrier element.

9. The trimming machine of claim 8 wherein said supporting bars have successively narrowing width of track means, said other arms of said second sets of bell crank means extending inwardly of said other arms on said first set of bell crank means; a first movable track means for holding the first set of bell crank means in an operative position past the point where said other arms on said first set of bell crank means are engageable with said track means so that said movable track determines the position at which said first set of bell crank means pivot to their inoperative positions; and a second movable track means for holding said second bell crank means in an operative position past the point at which the other arms of said second bell crank means are engageable with said track means on said supporting bar so that said second movable track means determines the position at which said second set of bell crank means pivot to an inoperative position.

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10. In a book trimming machine for separating a double book having a centrally located non-printed area into two separate identical books and for trimming said central area from said double book, cutting means at a first station for splitting the books into two separate books; an endless conveying means including a first set of driving lugs pivotally mounted on said endless conveying means and extending to engage a double book when in an operative position and to push said double book to said first station, at which station said driving lugs pivot to an inoperative position, said endless conveying means also including a second set of driving lugs being pivotally mounted on said endless conveying means and extending to engage the separated books when in an operative position and to push the separated books from said first station to a re-trim station; means for holding said first set of driving lugs in an operative position until said first station where said driving lugs pivot to an inoperative position, and for holding said second set of lugs in an operative driving position until said re-trim station where said second set of driving lugs pivot to an inoperative position; longitudinal and transverse registering means at said first and re-trim stations for registering said double book so that said first cutting means severs said double book to form one book of the proper size and includes all the unprinted area on another separate book, and a second cutting means at the re-trim station to sever said unprinted area from said other book to form said other book of a size identical to said first book.

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11. The method of separating and trimming a double book having a centrally located portion into two separate identical books with the central portion trimmed from each one of said books, said method comprising the steps of: transporting the books to a splitting station and cutting one of said books to the desired size and leaving said central portion on said second of said books; rotating said books to separate their forward edges for movement in separate paths; and moving said books to a further station where said central portion is cut from said second book.

12. The method of separating and trimming a double book having a centrally located portion into two separate identical books with the central portion trimmed from each one of said books, said method comprising the steps of: transporting the books to a splitting station and cutting one of said books to the desired size and leaving said central portion on said second of said books; rotating said books about their centers of gravity to separate their forward edges for movement in separate paths; moving said books to a further station where said central portion area is cut from said second book; and guiding said books apart during movement of said books to said further station to afford sufficient space to register said second book at said further station.

No references cited.

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