

United States Patent

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[54] **BOOK SEWING MACHINE AND METHOD**
28 Claims, 11 Drawing Figs.

[52] U.S. Cl. 112/21
112/252, 112/130

[51] Int. Cl. D05b 65/00
B42b 3/00

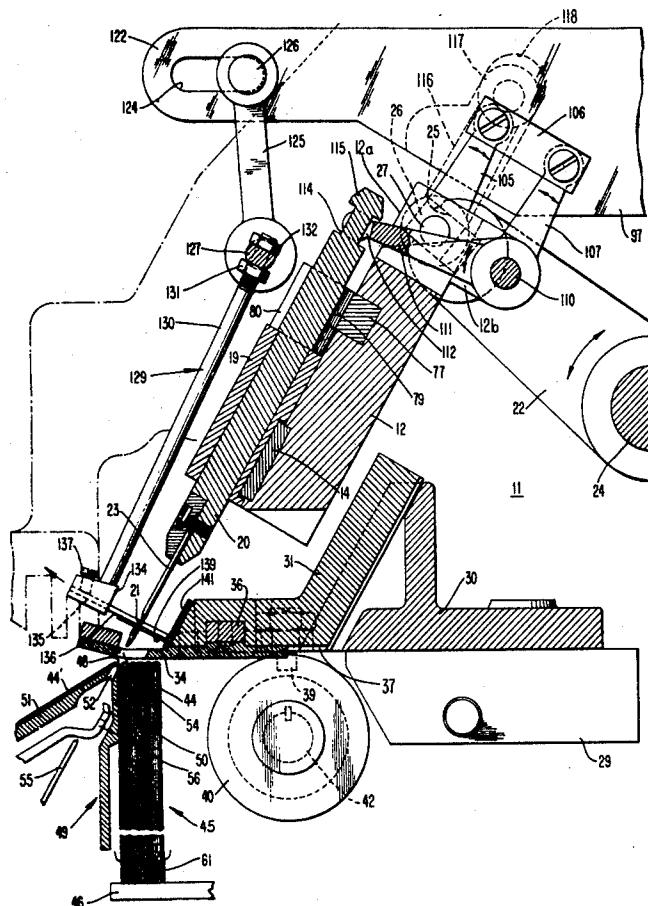
[50] Field of Search 112/21, 22,
252, 130; 93/91; 289/1.5; 11/1

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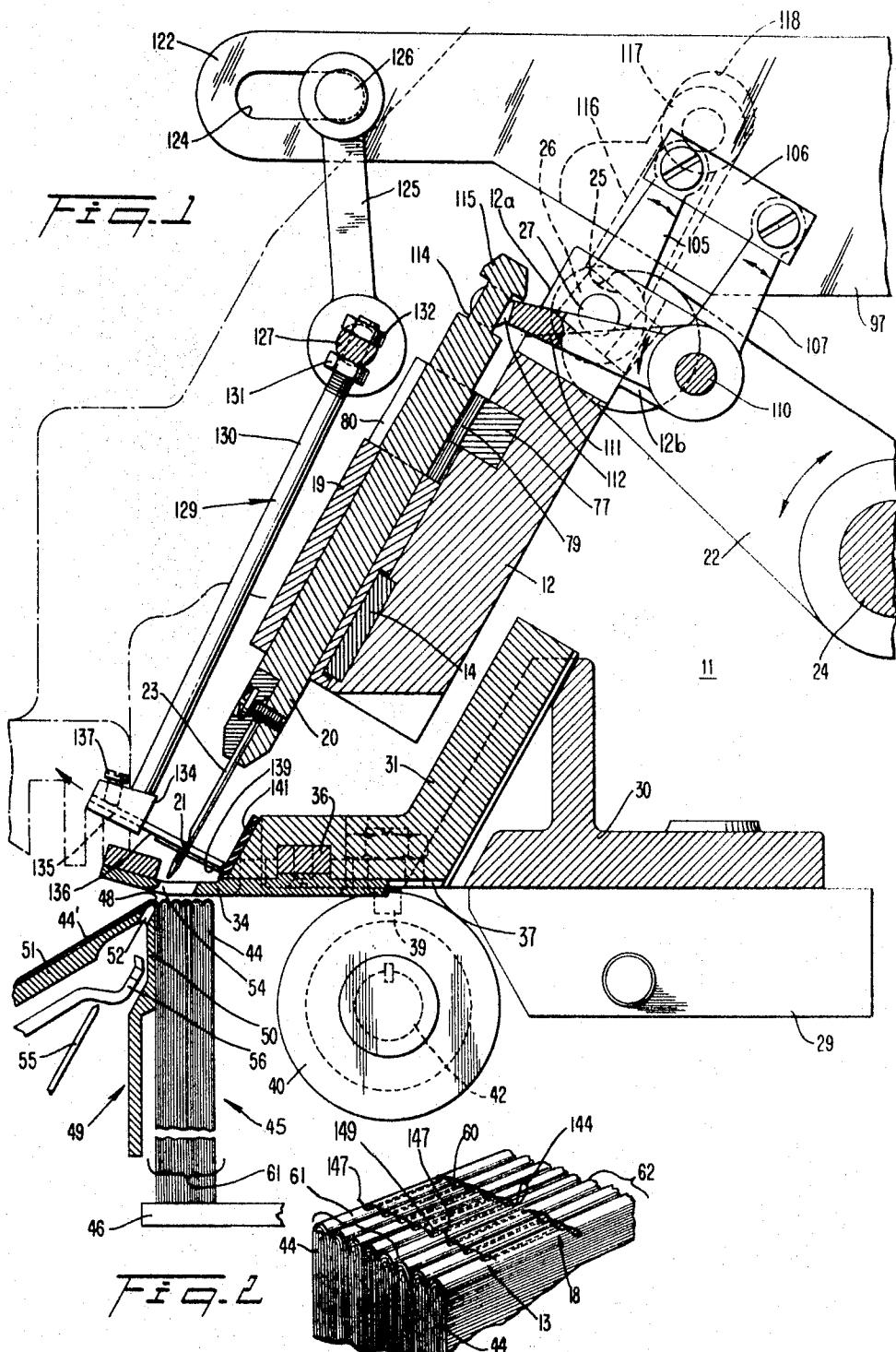
ABSTRACT: A cyclically operable book sewing or stitching machine and method wherein book signatures are successively stitched to provide spaced parallel rows of single or tail stitches and looped or chain stitches extending through the folds of each signature and connecting successive signatures together. Means is provided for interrupting the chain stitch at the end of the sewing operation upon a book, the operation of such means being initiated by the same means which operate a means for severing the tail thread, so that the stitchings of successive books are entirely disconnected from each other.



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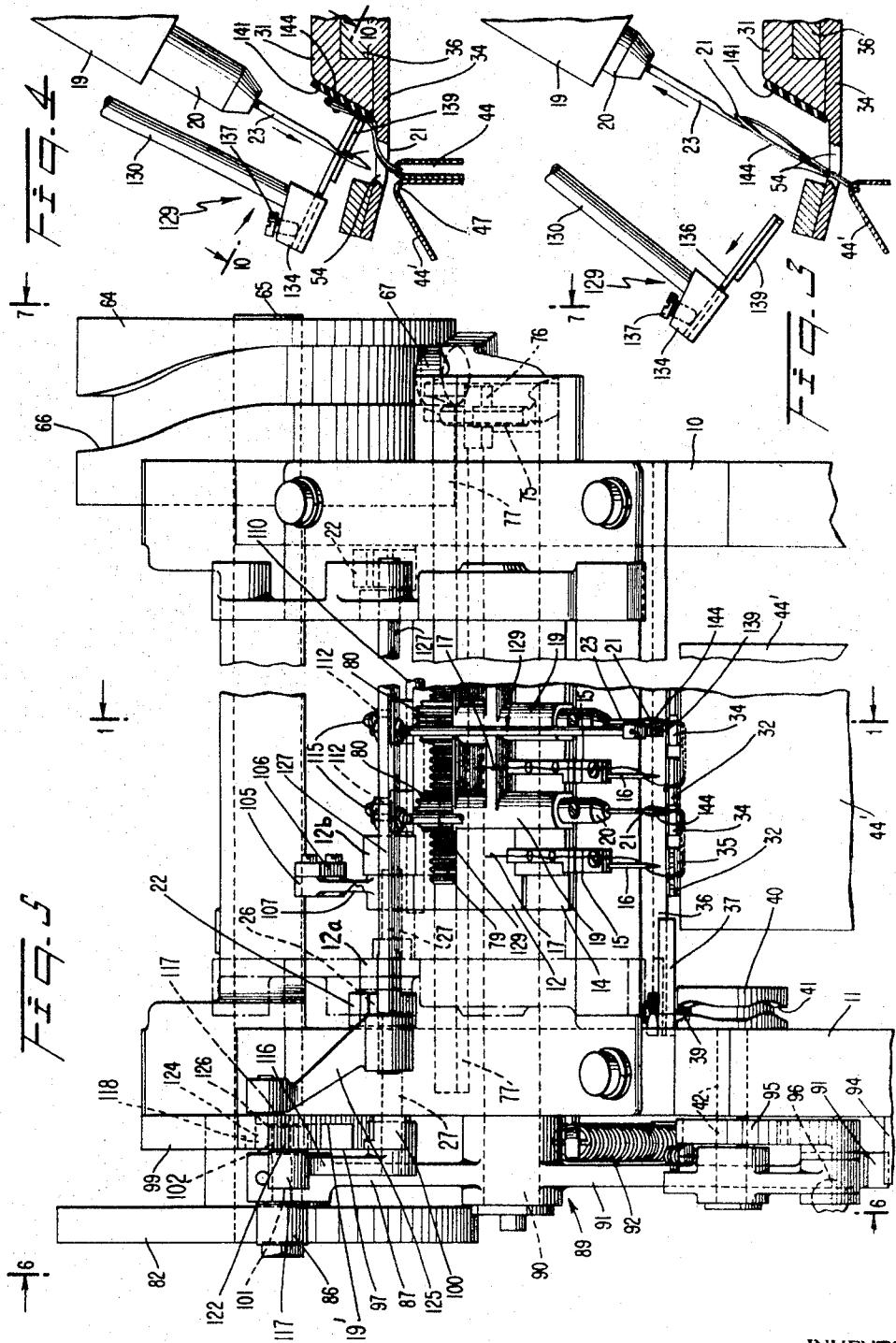


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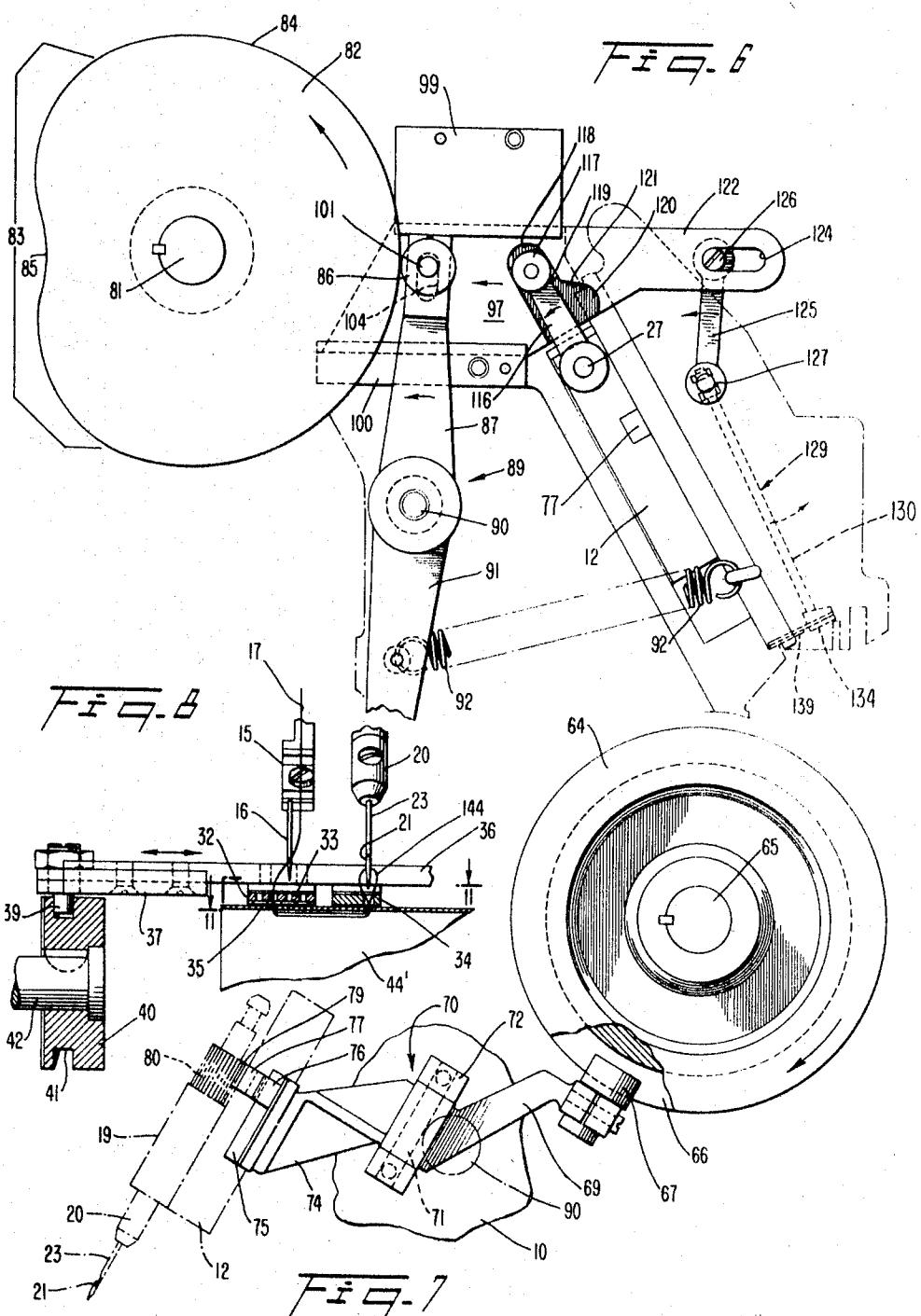
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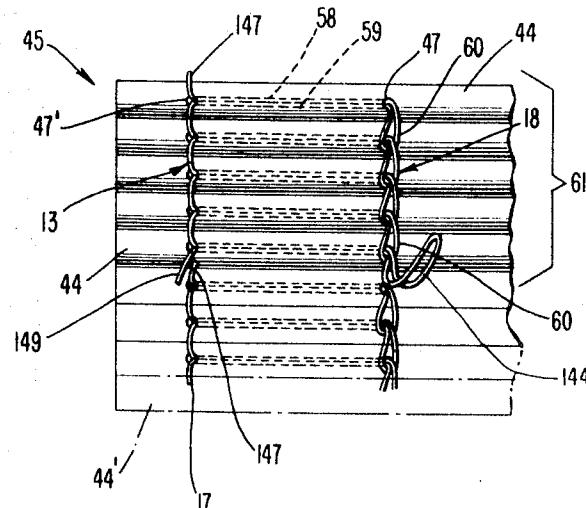


Fig. 9

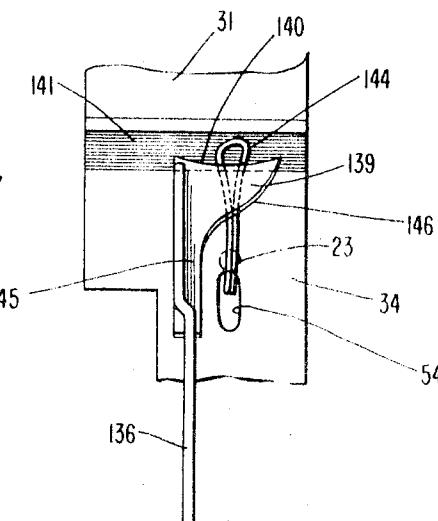


Fig. 10

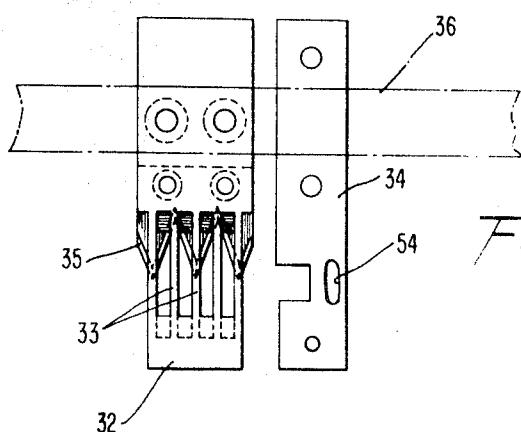


Fig. 11

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BOOK SEWING MACHINE AND METHOD

This invention relates generally to a cyclically operable book sewing or stitching machine. In such machine successive book signatures are fed to a stitching station with their folds facing upwardly; each signature when positioned at said stitching station is stitched to provide spaced parallel rows of single or tail stitches and looped or chain stitches extending through the folds of each signature and connecting successive signatures together. The invention relates more specifically to chain stitch interrupting mechanism connected for at least semiautomatic operation in synchronism with the mechanism for cutting tail thread between successive books, whereby to interrupt the looped or chain stitching between the end of one book and the beginning of a successive book. As a result, the stitchings of successive books are entirely disconnected from each other so that the books may be immediately separated from each other without the necessity of any further cutting and/or of withdrawing any of the runs of the thread from the signatures.

The above and further objects and novel features of the invention will more fully appear from the following description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only, and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views;

FIG. 1 is a fragmentary view in transverse section through the illustrative sewing machine adjacent a hook thereof, the hook being shown in an upper position and after it has been turned from its position in FIG. 4, the loop deflecting or hold-back device being shown in its inner, operative position, the parts of the machine being in the condition they assume after the machine has completed the sewing of one book and is about to begin the sewing of the next book, the section being taken along the line 1-1 of FIG. 5;

FIG. 2 is a fragmentary view in perspective of a first book made up of five signatures which has been sewed by the apparatus of the invention, a three-signature portion of a second book being shown as it appears during the sewing operation;

FIG. 3 is a fragmentary view in cross section, taken similarly to the section of FIG. 1, of the portion of the machine in the vicinity of the hook, the parts being shown as they appear during the formation of the elongated loop at the end of the chain stitch for a book;

FIG. 4 is a view similar to FIG. 3 but in a later portion of the cycle during which such elongated loop is held back in order to interrupt the chain stitch at the beginning of the sewing of the signatures which are to form a new book;

FIG. 5 is a fragmentary view in front elevation of the sewing machine with the needles and hooks thereof raised at the end of the sewing of a book and with the grid at the presser plate about to be put into position for the subsequent severing of the tail thread;

FIG. 6 is a fragmentary view in end elevation of the left-hand end of the sewing machine as shown in FIG. 5, the needle and hook bearing sewing head bar being shown in raised position in an intermediate portion of the book sewing operation, the view being taken from the line 6-6 of FIG. 5;

FIG. 7 is a fragmentary view in end elevation of the right-hand end of the sewing machine, the view showing the mechanism for cyclically turning the hooks of the machine, the view being taken from line 7-7 of FIG. 5;

FIG. 8 is a fragmentary view in vertical longitudinal section through the machine showing the left-hand needle and hook set in the position thereof shown in FIG. 5;

FIG. 9 is a fragmentary view in plan of a book sewed by the machine of the invention;

FIG. 10 is a fragmentary view in section through the sewing machine in the vicinity of a hook, the figure showing the loop deflecting or holdback device in its operative position, the section being taken along the line 10-10 of FIG. 4; and

FIG. 11 is a fragmentary view in horizontal section through the machine in the vicinity of the movable grid segment for the needle and the stationary segment for the hook, the section being taken along the broken section line 11-11 of FIG. 8.

Except for the mechanism for interrupting the looped or chain stitching between successive books, the machine herein shown and described is of known construction and a brief description will suffice. Referring to FIG. 5, the machine includes a frame including generally similar parallel vertical frame parts 10 and 11 having means not specifically shown mounting a horizontal sewing head bar 12 for reciprocation in a path which is inclined downwardly and forwardly, that is, to the left as the machine is shown in FIG. 1. Mounted upon the bar 12 is a needle holder slide 14 which may be adjusted longitudinally of the bar 12 by means not shown. A plurality of needle holders 15 are mounted upon the slide 14 in longitudinally spaced relationship as shown in FIG. 5, each needle holder being provided with a needle 16 which is supplied with its individual thread 17 from a bobbin or spool therefor (not shown) mounted on suitable supports above the machine. Fixedly mounted upon the sewing head bar 12 is a hook chuck housing 19 in which there are journaled a plurality of hook chucks or spindles 20 in longitudinally spaced relationship as shown in FIG. 5, there being one hook chuck 20 operatively associated with each needle holder 15. In the machine shown, the hook chuck 20 cooperating with a needle holder 15 is positioned to the right of the latter (FIG. 5).

The needle 16 mounted on the needle holder 15 of each needle hook set and the hook 21 mounted on the associated hook chuck 20 cooperate in the manner to be described so as to stitch together successive signatures forming a book in the manner more particularly shown in FIG. 9. As there shown, the thread 17 which is applied to the signatures by each needle and hook set forms a row of single-thread portions 13, herein called the tail thread, a row of interconnected loops 60 disposed parallel to and spaced from the row 13 and forming a chain or head stitch 18, and two runs of thread designated 58 and 59 which extend beneath or inside the fold of each of the signatures from the tail thread 13 to the head stitch 18 and from the head stitch 18 to the tail stitch 13, respectively.

The sewing head bar 12 is reciprocated in its inclined plane by conventional means including two spaced parallel sewing head bar levers 22 which are affixed in parallel relationship upon a longitudinally extending horizontal shaft 24. The shaft 24 is oscillated as indicated in FIG. 1 by conventional means (not shown). The upper free end of each of the levers 22 is provided with a slot 25 which slidably receives a block 26 which is pivotally connected to the upper end of the sewing head bar 12 by a longitudinally extending pivot shaft 27 as shown in FIGS. 1 and 5. Each shaft 27 is journaled in spaced, upwardly extending portions 12a (only one shown) on the upper edge of bar 12. Fixedly mounted upon the frame of the machine is a horizontal plate support 29 upon which there is fixedly secured a presser plate support bracket 30. A presser plate bar 31 of angular configuration has a first upwardly extending portion parallel to the sewing head bar 12 and a lower horizontal portion which functions to support a plurality of shiftable grid members 32 of the presser plate assembly 31-36, a plurality of stationary presser plate segments 34, a serrated cutoff knife 35 affixed to the lower surface of each grid member, and a grid member shifting bar 36 having a grid shifter plate 37 affixed to the left-hand end thereof (FIG. 5).

The grid members 32 are shifted longitudinally of the presser plate bar 31 by bar 36 at the end of a book-sewing operation for causing each thread portion 13 to straddle a bar 33 of a grid member to be cut when the thread is drawn into engagement with the edge on one blade of the serrated cutoff knife by the subsequent stepwise feeding of the sewed signatures. The shifting of the grid members is effected by the interaction of a cam follower pin 39 affixed to the grid shifting plate 37, pin 39 being disposed in the sinusoidal cam track 41 of a barrel cam 40 on a shaft 42 which is intermittently rotated by means to be described. It will be apparent that the bar 33 of the grid member which is straddled by the thread guides the

thread into engagement with the cutting knife is positioned on one side of the path of the needle in the sewing of one book and on the other side of the path of the needle in sewing the next book.

In FIG. 2 there is shown a book 61, formed of five signatures 44, and a portion 62 (three signatures) of the next book being stitched. The particular signature which is being stitched by the machine (FIGS. 3 and 4) is designated 44'. During each cycle of operation of the machine a signature 44 is delivered to a sewing saddle 49 and the signature is supported by such saddle until it is switched as described. The sewing saddle 49 is mounted for pivotal movement by face cams (not shown) between the position thereof shown in FIG. 1 and a position counterclockwise thereof.

After stitching, the saddle 49 is swung forwardly and downwardly to free the stitched signature. Immediately following such last movement of the saddle a push back bar (not shown) is pivotally moved downwardly and rearwardly so as to engage the newly stitched signature and push it rearwardly. As soon as such signature and the stack 45 of previously stitched signatures have been pushed back, a plurality of holdback rods (not shown) move downwardly in unison to hold the signature in its last-said position, the push back bar then being returned to its elevated, inoperative position. The hold back rods remain in their lower positions until a new signature is moved into stitching position by the movable saddle 49, the holdback rods being raised immediately thereafter. After the stitching of each signature, the stitched signatures are pushed rearwardly or backwardly along a guideway, which includes a bottom support 46 upon which they are supported, by the next following signature advanced by the push back bar. For further details of such conventional structure of the machine thus far described, reference may be had to the patent to Schramm, U.S. Pat. No. 2,800,095.

The saddle has two angularly disposed wings, one of which, designated 50, is disposed vertically when the saddle is in the operative sewing position of FIG. 1, the other wing designated 51 extending downwardly and forwardly. The signature 44' which is about to be sewed is disposed in spreadout condition with one set of pages lying vertically alongside the portion 50 of the saddle and the other set of pages lying upon the wing 51 thereof with the fold 48 between the pages being disposed at the apex of the saddle.

The sewing saddle 49 is provided with a plurality of inclined slits or holes 52 through the apex thereof, such holes being spaced longitudinally of the saddle and aligned with the respective sets of needles 16 and hooks 21. Slots or holes 54 through the segments 34 are aligned with the holes 52 to receive the lower ends of the hooks 21. A plurality of punches 55 disposed between the wings of the saddle and operated by conventional cam means (not shown) are periodically operated in order to punch needle and hook receiving holes 47' and 47, respectively, through the fold 48 of the signatures after they have been fed to the sewing station. A longitudinally movable looper hook 56 is provided for each needle and hook set, the looper hooks being movable in the proper timed relationship by cam means (not shown). Each looper hook 56 is movable from the vicinity of the path of its needle to a position in the vicinity of the respective hook 21. The looper 56 carries a loop of the thread 17 from the needle 16, after the eye of the needle has past downwardly through the punched hole 47' in the signature, laterally beneath the fold 48 in the signature to a location beneath the hook 21. In so doing, the looper 56 extends the thread 17 into the runs 58 and 59 inside the fold in the signature. As the looper hook 56 approaches the position of the hook 21, the looper hook 56 tilts forwardly to bring the looped thread carried thereby into contact with the hook 21 which now faces rearwardly. Thereupon the sewing head bar 12 rises carrying with it the needles 16, the hooks 21, and the loops 60 of the thread engaged by the hooks 21.

The saddle 49 then tilts counterclockwise from the position thereof shown in FIG. 1 so that, as above described, the last sewed signature is then added to the stack 45 of signatures

which are to form the book, and a new as yet unsewed signature is fed onto the saddle. The same punching and sewing operations are then conducted upon the new signature. As the sewing head bar 12 begins to descend in its next operative stroke, the hooks 21 are turned 180° from their former position in which the hooks 21 face rearwardly to one in which the hooks 21 face forwardly. The shank 23 of the hook then travels freely downwardly through the previously formed loop which is disposed upon the hook. As the bar 12 approaches its lower terminal position, the hooks 21 are again turned 180° so that they face rearwardly and will be in position to receive the loop of thread presented thereto by the looper hook 56. As the sewing head bar 12 again rises, a new loop of thread 60 caught by the hook 21 is pulled upwardly through the previously formed loop, thereby forming one of the stitches in the row of chain or head stitches 18. The described cycle of operations continues until a complete book, here shown at 61 and here consisting of five stitched signatures, has been sewed together.

The hooks 21 are rotated in synchronism as above described while being reciprocated along their inclined path by the following mechanism. Fixedly connected to a cam shaft 65, which is driven in a conventional manner in timed sequence to the other driven elements of the machine, is a hook-rotating cam 64 which is of the barrel cam type. Cam 64 has a cam track 66 in its peripheral surface, there being a cam follower roll 67 accurately disposed in the cam track between the opposed walls thereof. The cam follower roll 67 is journaled upon the outer free end of a first lever arm 69 of a first-class lever 70 (FIG. 7). Lever 70 is pivotally mounted upon a shaft 71 mounted in a bracket 72 affixed to the frame member 10, the shaft 71 being disposed parallel to the plane of reciprocation of the sewing head bar 12. The second arm 74 of lever 70 has a rounded elongated head 75 on the outer free end thereof, head 75 extending parallel to the axis of shaft 71. The head 75 is received within a notched end or clevis 76 at the right-hand end (FIG. 5) of a longitudinally extending slide 77 which is mounted in a groove in the upper surface of the sewing head bar 12 (FIG. 1). The forward, exposed surface of the slide 77 bears a rack gear 79 which meshes with a pinion 80 which is affixed to each of the hook chucks 20. It will thus be seen that the hook chucks are rotated in the proper timed sequence by the swinging of the lever 70 by the cam 64, the lever 70 in turn reciprocating the rack slide 77, 79.

A cam shaft 81 (FIG. 6) which is driven in timed sequence with the cam 64 and other parts of the machine has a cam 82 affixed thereto. The shaft 81 is driven so as to rotate the cam 82 through one revolution for each cycle of the sewing head bar 12. Cam 82 has a periphery 84 which is of circular cylindrical configuration with the exception of a symmetrical portion 83 having a low zone 85 and smoothly rounded ramp portions leading thereto. A cam follower roll 86 is journaled upon a stub shaft 101 affixed to the upper free end of a first arm 87 of a cutoff lever 89 journaled upon a shaft 90 affixed to the frame member 11. Lever 89 is constantly urged counterclockwise, to urge the roll 86 toward engagement with the surface of the cam 82, by a coil tension spring 92 which extends between a lower portion of a second arm 91 of the lever 89 and a fixed portion of the frame.

The arm 91 is extended downwardly (FIG. 5), the lower end of arm 91 having a tooth thereon which is normally engaged by a detent on a trip lever 94 so as to hold the lever 89 in the position thereof shown in FIG. 6. A link 96 is connected between the lower end of the arm 91 and a ratchet and pawl device 95 which is drivingly connected to the shaft 42 for the grid shift cam 40. So long as the lever 89 remains in the position of FIG. 6, the grid members 32 remain fixed with respect to the needles 16. When the lever 89 is released by the trip lever 94, either automatically or manually in a known manner, the position of the lever 89 is then governed by cam 82. Under such condition, when the cam 82 rotates to bring the low zone 85 thereof under the cam follower roll 86, the lever 89 rotates counterclockwise so as to advance the pawl of the ratchet and pawl device 95 through a distance of one tooth, following

which the cam 82 upon further rotation drives the cam 40 through a distance of one step so as to shift the slide 36 and grid members 32 alternately to the left and to the right as above described.

In accordance with the invention, the cam 82 also governs the formation of the chain or head stitch 18 in such manner that at that the end of the stitching operation upon one book and the chain stitch is interrupted. As a result, when the tail stitch is severed by the cutter 35, the stitched book is completely disconnected from the next book which is to be sewed by the machine. The operator is thus relieved from the necessity of pulling the sewed book away from the book being sewed, of himself severing any threads, or of pulling any runs of threads which have already been applied to the sewed book out of the book. In addition, there are left upon the sewed book thread formations at the ends of both the tail and head stitches which may be readily further secured to the book as during the further operation in forming the book which involves the application of a tape or "crash" to the bound end of the book.

At the left-hand end of the machine as it is shown in FIG. 5, there is provided a hook lift slide 97 which is guided for horizontal reciprocation in a direction forwardly and rearwardly of the machine by upper and lower slide guides 99 and 100, respectively, affixed to the frame member 11. As noted, the cam follower roll 86 is journaled upon the upper end of the lever arm 87 by a stub shaft 101 (FIG. 5). The end of the stub shaft 101 inwardly of lever arm 87 has a portion 102 integral therewith extending into and accurately fitting within a vertical parallel walled slot 104 adjacent the left-hand end of the slide 97 as it is shown in FIG. 6. Thus upon oscillation of the lever 89 the slide 97 is simultaneously reciprocated.

Each of the shafts 27, by means of which the blocks 26 and hence, levers 22 are pivotally connected to the sewing head bar 12 (FIG. 1), extends longitudinally of the machine as shown in FIG. 5. Adjacent the right-hand end thereof, one shaft 27 has affixed thereto a hook rod lever 105 (FIGS. 1 and 5), lever 105 rising from the shaft 27 in general alignment with the plane of reciprocation of the sewing head bar 12. The upper end of the lever 105 is pivotally connected by a link 106 to the upper end of a lever 107 which is fixedly mounted upon one end of a longitudinal shaft 110 journaled in spaced ears 12b (only one shown) integral with sewing head bar 12 and extending upwardly and rearwardly therefrom (FIG. 1). Affixed to the shaft 110 at the location of each of the hook spindles 20 is a lever 111, the forward end of each of which is provided with a yoke 112. The yoke 112 fits within an annular groove 114 disposed somewhat below the upper end 115 of the respective hook spindle. The levers 105, 107, 111, and the link 106 provide an intermittently operated mechanism whereby the hook spindles 20 and the hooks 21 carried thereby are elevated at the end of a sewing operation upon a book, to a markedly higher position than their normal elevated position, whereby to form an elongated loop 144 (FIG. 3) at the end of the head or chain stitch.

Such hook elevating mechanism includes a lift cam lever 116 (FIGS. 1 and 6) which is affixed to the left-hand end of the shaft 27 as the machine is shown in FIG. 5. Journaled upon the upper end of the lever 116 and extending to the right therefrom is a cam follower roll 117 which fits within and cooperates with a cam slot 118 in the hook lift slide 97. Slot 118, which is open sided to the left (FIG. 5), has a closed bottom 119' or right side so as to strengthen the slide 97. The cam slot 118 has an upper parallel sided inclined portion 119 (FIG. 6) which accurately receives the cam follower roll 117. Portion 119 of the cam slot is disposed parallel to the plane of reciprocation of the sewing head bar 12. The cam slot 118 is provided in its lower right hand or forward portion with a pocket 120 having a cam surface 121 which joins the right hand wall of the inclined portion 119 of the cam at generally the midportion of the length of the cam slot. Cam surface 121 slopes downwardly and forwardly to some extent as shown in FIG. 6. In the operation of the machine while the cutoff lever

89 and slide 97 remain locked in the positions thereof shown in FIG. 6 the cam follower roll 117 remains in the upper portion 119 of the cam slot 118. Thus as the sewing head bar 12 reciprocates during its normal sewing operation the lever arms 116, 105, 107 and 111 remain in the positions relative to the sewing head bar 12 shown in FIGS. 1 and 6, and the hooks 21 are lifted through the same distance as the needles 16.

When the last signature of a book has been sewed, the trip lever 94 is pulled downwardly, either automatically or by operation of a treadle (not shown) by the operator. The cam follower roll 86 is now free to follow cam 82, so the cutoff lever 89 oscillates through one cycle and the slide 97 reciprocates through one cycle as the cam 82 rotates through one revolution from the position thereof shown in FIG. 6. The slide 97 moves to the left as the cam 82 rotates through 180° to bring the low zone 85 under the cam follower roll 86. This causes the shaft 27 to be turned counterclockwise from the position thereof shown in FIG. 6 (clockwise from its position shown in FIG. 1). This causes the shaft 110 to rotate clockwise (FIG. 1) thereby to lift, relative to bar 12, the yokes 112 and the hook spindles 20 connected thereto into an upper position in which the hooks 21 lie markedly above their normal upper terminal position. Each hook thereby forms an elongated loop 144, as shown in FIG. 3. During the travel of slide 97 to the left (FIG. 6) the cam follower roll 117 will be thrust downwardly by the right hand wall of the upper inclined portion 119 of the cam slot 118 so that in an intermediate portion of such travel of the slide 97 the cam follower roll 117 enters the pocket 120 of the cam slot. Further travel of slide 97 to the left thus turns the shaft 27 only slightly further counterclockwise (FIG. 6). Travel of the slide 97 to the left ceases when the low zone 85 of cam 82 engages the cam follower roll 86, at which time the roll 117 is fully seated in the pocket 120 of the cam slot 118.

As the cam 82 continues to rotate, the slide 97 is thrust to the right (FIG. 6). During such travel of the slide, the lever 116 turns slightly clockwise (FIG. 6) from its terminal counterclockwise position while roll 117 engages cam surface 121. Upon leaving the pocket 120 of cam slot 118, the roll 117 rises in portion 119 of the cam slot, thus rotating lever 116 and shaft 27 clockwise (FIG. 6), thereby to restore the hook spindles 20 to the position thereof relative to the sewing head bar 12 which is shown in FIG. 1. To permit such elevation of the hook spindles relative to the sewing head bar 12, the pinions 80 on the hook spindles are made of substantially greater axial length than the width of the rack gear 79 so that the rack gear remains in mesh with the pinions 80 at all times. As during normal operation of the machine, after the chucks 20 have been raised into the position of FIG. 3 and after the hooks have traveled downwardly somewhat in the next stroke, the hooks are then rotated 180° to return them to the position thereof shown in FIG. 1.

In order to insure the interruption of the chain stitch 18 at the end of the sewing of a book, each elongated loop 144 of one thread is held pushed rearwardly and out of the path subsequent travel of its hook 21 so that the next formed normal loop 60 does not extend through the long loop 144. As a consequence the chain stitches 18 of two successive books are entirely unconnected. In order to hold the elongated loop 144 rearwardly, as described, there is provided a thread or loop deflector 129 which is operated by the slide 97 in the manner shown in FIGS. 1, 3 and 4.

Slide 97 is provided with a forwardly extending horizontal nose portion 122 having an elongated horizontal slot 124 therein. A shaft 127 which extends longitudinally of the machine as shown in FIG. 5 is journaled at its ends in the fixed frame members 10 and 11 of the machine. Affixed to one end of the shaft 127 is an upstanding lever 125 having a pin 126 affixed to its upper end, the pin 126 fitting within and being slidably along the slot 124. The slot 124 and pin 126 provide a lost-motion connection between the slide 97 and the lever 125, the distance of lost motion being somewhat less than the difference between the radius of the circular cylindrical main

portion of cam 82 and the radius of the low zone 85 of such cam. The left-hand end of the slot 124 (FIG. 6) cooperates with the pin 126 to hold the lever 125 and shaft 127 in the position shown in such figure when the slide 97 is in its right-hand terminal position. After the slide 97 has travelled sufficiently to the left for the pin 126 to engage the right-hand end of slot 124, the shaft 127 is rotated counterclockwise from its position in FIG. 6. The thread loop deflectors 129 each have a rod 130 the upper end of which extends through bores in the shaft 127 and is affixed thereto by nuts 131, 132. When the parts are in the position shown in FIG. 6, the thread loop deflector 129 is swung into its rearward, loop-deflecting and clamping position whereas when the slide 97 is in its left-hand terminal position the thread loop deflectors are swung forwardly, away from the path of the hook 21 as shown in FIG. 3.

Each loop or thread deflector 129 comprises a plate 139 that is mounted upon a fitting 134 on the lower end of the rod 130. Fitting 134 has a passage therethrough which receives a shank or wire portion 136 of the thread loop deflector, such shank portion being retained in the fitting by a set screw 137. The thread loop deflector plate 139 is mounted on wire 136 and the rear edge 140 thereof is of shallow concave arcuate shape. Such edge 140 selectively engages a resilient pad 141 mounted upon the forward inclined surface of the presser plate bar 31 so that when the thread loop deflector is in the position shown in FIGS. 4 and 10 the elongated loop of thread 144 is deflected and substantially clamped between the edge 140 of the thread deflector plate and the pad 141. The forward portion of the thread loop deflector plate 139 has a narrow extension 145 at the side thereof to which the wire 136 is secured as by being welded thereto. Rearwardly of the portion 145, the edge 146 of the plate 139 is arcuately concavely curved so as to provide clearance between the hook 21 and the plate 139 when the thread loop deflector is positioned rearwardly as shown in FIGS. 1 and 4. The rear end of such concave edge portion of plate 139 merges smoothly with a rear convexly curved edge portion.

During the normal sewing operations of the machine in which the lever 89 and the slide 97 remain latched in the position thereof shown in FIG. 6, the thread loop deflectors 129 remain in their rearward position with the hooks 21 disposed relative thereto in the manner shown in FIG. 10. In such position of the slide 97, the left-hand end of slot 124 engages the pin 126 to lock the thread deflectors in such position. When a complete book has been stitched, and the lever 89 and slide 97 have been released by the trip lever 94, as the portion 83 of cam 82 comes under the cam follower roll 86 and zone 85 of the cam approaches roll 86 the slide 97 moves to the left. In the initial and intermediate portions of the travel of slide 97 to the left, the thread loop deflectors 129 remain in their rearward position (FIG. 1) under the action of gravity, even though they are now unlocked by the removal of the left-hand end of slot 124 from engagement with pin 126 on lever 125. The parts of the machine are so synchronized that the hooks 21 are raised above the thread loop deflector plates 139 before the right-hand end of slot 124 engages the pin 126 and begins to swing the thread loop deflectors 129 forwardly. The thread loop deflectors are thus swung forwardly as shown in FIG. 3 without interference with the hooks 21. As the thread loop deflectors swing forwardly, the runs of the thread in the loop 144 which is being extended by the described interaction between the cam slot 118 and the cam follower roll 117 slip rearwardly and sidewardly along the edge 146 of the plate 139 of the thread loop deflector, so that they finally escape from the thread loop deflector. The loop 144 thereupon extends directly from the hole 47 in the signature, through slot 54 in the segment 34 of the presser plate assembly, to the hook 21, as shown in FIG. 3.

As the cam 82 continues to rotate and the low zone 85 thereof leaves the cam follower roll 86, the slide 97 moves to the right (FIG. 6). So long as the cam follower roll 117 remains in pocket 120 of the cam slot 118, the hooks 21 remain held in generally their highest position by the levers

111. As above noted, the upper surface 121 of the pocket 120 is slightly inclined. As the slide 97 moves forwardly, the roll 117 follows surface 121 to turn shaft 27 clockwise as it is shown in FIG. 6. Thus the hooks 21 are lowered a short distance as the roll 117 rides up surface 121. This provides slack in the loops 144 so that the bights of the loops can escape from the hooks 21 as the hooks descend.

Before the hooks have descended sufficiently to interfere with the thread deflector plates 139, continued travel of the hook lift slide 97 to the right (FIG. 6), with the pin 126 in engagement with the right-hand end of slot 124, will permit the thread loop deflectors to pivot clockwise to the position thereof shown in FIGS. 1, 4, and 6. This deflects the loops 144, which have now been freed from hooks 21, rearwardly so that when pin 126 is engaged by the left end of slot 124 the runs of thread forming the loop are substantially clamped between the arcuate rear edge 140 of the thread deflector plates and pad 141 to hold loop 144 out of the path of the hook 21. The hook now descends to start a sewing operation upon a new book, with the roll 117 restored to the inclined portion 119 of the cam slot 118 and with the hooks now reciprocated through the same distance as the needles 16. The first thread loop 60 which is subsequently formed by the hooks 21, at the beginning of the sewing of a new book, does not pass through the elongated loop 144, which is left unconnected to the new head stitch 18 being formed. The chain or head stitch 18 is thus interrupted at the end of the sewing of a book. The first loop 60 in the head stitch 18 of the new book, however, is connected to the second and subsequent loops 60 of its head stitch 18 by having the second loop pass through the first, the third loop pass through the second, etc., as above described.

It will thus be seen that at the end of the sewing of a book such book is left entirely unconnected to the next book being stitched. The cutting of the tail thread leaves a length 147 of tail thread at the beginning of the tail thread of a book and a length 149 of tail thread at the end of the tail thread, as shown in FIG. 9. The elongated loop 144 at the end of the head or chain stitch 18 is also of substantial length. Such threads 147, 149 and the loop 144 may readily be further secured to the book, as above described, as by being caught under a tape applied and adhered to the back or binding of the book in a subsequent book forming operation.

The following is an illustrative but nonlimiting example of the manner of reciprocating the sewing head bar 12 and the needles and hooks thereon. The cams which drive the levers 22 for reciprocating the bar 12 rotate through one revolution for each cycle of oscillation of the levers 22 and thus each cycle of reciprocation of the sewing head. Such cams have cam tracks therein which provide for a (1) dwell of the sewing head at the top of its stroke while the cams rotate through 235°. Following such a dwell, a (2) 35° turning of the cams produces a fall of the sewing head of 1.00 inch. During the next (3) 10° turning of the cams the sewing bar rises 0.093 inch to decrease the tension in the thread loops so that they may be engaged by the loopers. There then follows (4) a 25° turning of the cams in which the sewing head is at rest in its slightly elevated position. Finally, (5) the last 55° turning of the cams causes the sewing head to rise 0.907 inch to its uppermost (235°) dwell position.

At the completion of the stitching of the last signature of a book, the lever 91 is released so that the roll 86 can then follow the surface of cam 82. The zone 83 of the cam 82 then engages the cam follower roll 86 in the interval 1, during which interval the hooks rise approximately three-eighths inch to their topmost position to produce the long loops 144. The descent of the hooks from such topmost position to their normal intermediate elevated position to free loops 144 takes place in the latter part of interval 1.

Although only one embodiment of the invention has been illustrated in the accompanying drawings and described in the foregoing specification, it is to be expressly understood that various changes, such as in the relative dimensions of the parts, materials used, and the like, as well as the suggested

manner of use of the apparatus of the invention, may be made therein without departing from the spirit and scope of the invention, as will now be apparent to those skilled in the art.

The embodiments of the invention in which I claim an exclusive property, or privilege, are defined as follows:

1. A book-stitching machine comprising a sewing support upon which successive book signatures are placed in stitching position and from which stitched signatures are discharged to form a connected stack, means for forming from a continuous thread a chain stitch comprising a row of linked thread loops connecting successive signatures together to form books each comprising a plurality of stitched signatures, and means for interrupting the row of linked thread loops between said books by preventing the linking of successively formed thread loops.

2. A book-stitching machine as defined in claim 1 wherein said last-named means comprises means for deflecting the thread loop formed during the stitching of the last signature of a book to thereby prevent the linking thereof with the thread loop formed by the next stitch.

3. A book-stitching machine as defined in claim 1 wherein said row of linked loops is interrupted without parting the thread.

4. A book-stitching machine comprising a sewing support upon which successive book signatures are placed in stitching position and from which stitched signatures are discharged to form a connected stack, means for forming a chain stitch connecting successive stitched signatures together, means for interrupting the chain stitch after the stitching of the last signature of each book, the signatures of each book being connected by said chain stitch at a first zone and by a single tail thread at a second zone spaced from the first zone, and means for severing the tail thread between successive books after interrupting the chain stitch therebetween.

5. A book-stitching machine according to claim 4, comprising a common means for initiating the operation of the means for severing the tail thread and the means for interrupting the chain stitch.

6. A book-stitching machine comprising a sewing support upon which successive book signatures are placed in stitching position and from which stitched signatures are discharged to form a connected stack, means for forming a chain stitch comprising a row of interconnected thread loops connecting successive stitched signatures together, and means for interrupting the chain stitch after the stitching of the last signature of each book comprising means for deflecting the last loop of the chain stitch of a book, after it has passed through the last signature of the said book, out of the path of the next loop which is to pass through the first signature of the next book.

7. A book-stitching machine comprising means for feeding successive folded book signatures to a stitching position, means for holding the signature at the stitching position suspended from its fold, means for passing a needle carrying the bight of a doubled thread in one direction through the fold at a first zone, means for carrying the resulting thread loop along the fold and for pulling it, in the reverse direction from the introduction of the doubled thread, through the fold of the signature at a second zone spaced from the first zone and through the previously formed loop extending through the fold of the previously stitched signature whereby to form a chain stitch connecting successive signatures to form a book, and means for interrupting the chain stitch between adjacent books while forming the next thread loop after the stitching of the last signature of a book.

8. A book-stitching machine according to claim 7, wherein the signatures of a book are connected by said chain stitch at said second zone and by a single tail thread at the first zone, and comprising means for severing the tail thread after the stitching of the first signature of the next book.

9. A book stitching machine according to claim 8, comprising a common means for initiating the operation of the means for severing the tail thread and the means for interrupting the chain stitch.

10. A book-stitching machine according to claim 7, wherein the means for interrupting the chain stitch comprises means for deflecting the loop extending through the fold at the second zone of the last signature of the book out of the path of the loop which is pulled through the fold at the second zone of the first signature of the next book.

11. A book-stitching machine according to claim 7, wherein the means for pulling the resulting loop in the reverse direction through the fold of the signature at a second zone and through the previously formed loop comprises a hook reciprocable to pull the resulting loop through the fold, said hook having a shank upon which the previously formed loop freed from the hook normally remains during the next cycle of reciprocation of the hook, whereby the resulting loop is pulled through the previously formed loop, and said means for interrupting the chain stitch comprises means for selectively freeing a formed loop from the hook and its shank before the next loop is pulled through the fold of a signature by the hook.

12. A book-stitching machine according to claim 11, wherein the means for interrupting the chain stitch after the stitching of the last signature of a book comprises means for deflecting the freed loop out of the path of the hook so that the hook pulls the next loop through the fold of the next signature free from engagement with such deflected loop.

13. A book-stitching machine according to claim 12, comprising means for reciprocating the hook during the stitching of the signatures of a book together between a first terminal position on the first side of the fold and a second terminal position on the second side of the fold, and means for driving the hook, after the stitching out of the last signature of a book, to a third terminal position further displaced from the fold on the first side thereof than the first terminal position of the hook whereby the last loop of the chain stitch of a book is longer than the other loops of the chain stitch of the book.

14. A book-stitching machine according to claim 13, wherein the hook faces in a first direction when it picks up the thread beyond the second side of the fold and while it pulls the loop of thread through the fold as it moves to its first terminal position, and comprising means for turning the hook so that it faces in a second, opposite direction after it has thereafter moved somewhat from its first terminal position toward its second terminal position, whereby to free the resulting loop from the hook while retaining it on the shank of the hook, and for thereafter turning the hook so that it faces in said first direction when it is in its second terminal position, the hook remaining turned to face in said first direction when it is moved into its first terminal position and when it is moved further into its third terminal position at the end of the sewing of a book.

15. A book-stitching machine according to claim 14, comprising means for moving the hook slightly from its third terminal position toward its first terminal position, whereby the bight of the longer loop is freed from the pull of the hook, and means for moving the loop deflecting means in the said first direction on the first side of the fold between the free end of the hook and the fold in the signature while the hook faces in said first direction so that the said longer loop is engaged by said deflecting means and freed from the hook and for retaining the loop deflecting means in its loop deflecting position during the subsequent strokes of the hook into and through the fold of the signature and then outwardly from the fold, said loop-deflecting means being of such shape that when it is in its loop-deflecting position the hook travels freely past it.

16. A method of stitching books which comprises holding successive book signatures in a stitching position, forming with a continuous thread a loop stitch in each of the signatures and normally linking together the bight ends of the resulting thread loops of successive stitches to form a chain stitch connecting successive signatures together, discharging stitched signatures from the stitching position to form a stack of books each comprising a plurality of stitched signatures, and intermittently interrupting the chain stitch by failing to link the thread loops of the stitches formed in the adjacent signatures of adjacent books.

17. A method of stitching books which comprises holding successive folded book signatures in a stitching position, passing the bight of a doubled thread in one direction through the fold in the signature in the stitching position at a first zone, carrying the resulting thread loop along the fold, pulling the loop in the reverse direction through the fold at a second zone spaced from the first zone and through the previously formed loop extending through the fold of the previously stitched signature whereby to form a chain stitch connecting the signatures at said second zone and a single tail thread connecting the signatures at said first zone, discharging stitched signatures from the stitching position to form a stack of books each comprising a plurality of stitched signatures, interrupting the chain stitch after the stitching of the last signature of a book, and thereafter severing the tail thread connecting said last signature to the next book.

18. A method according to claim 17, comprising deflecting the loop which is pulled through the fold of the last signature of a book at the second zone out of the path of the next loop which is pulled through the first signature of the next book at the second zone.

19. A method according to claim 18, comprising pulling the bight of said thread loop which passes through the fold of said last signature, before the deflection of such loop, further from the fold of the last signature of the book than the bights of the chain stitch loops which pass through the other signatures of the book.

20. A method according to claim 19, wherein the thread loop is pulled in the reverse direction through the fold by a hook which pulls the bight of the loop into a first terminal position in the sewing of the first and the intermediate signatures of a book and which pulls the bight of the loop into a further extended terminal position in the sewing of the last signature of a book.

21. A method according to claim 20, wherein the hook has a shank, and comprising disposing the hook so that it is in a first angular position, facing in a first direction, to engage the loop before pulling it through the fold in the signature, retaining the hook in such first angular position as it pulls the bight of the loop into its first terminal position, turning the hook substantially 180° after the hook has moved in its subsequent stroke toward the fold of the signature to free the loop from the hook and to permit it to move along the shank of the hook, and again turning the hook to return it to its first angular position prior to its engagement with the next thread loop.

22. A method according to claim 20, comprising retaining the hook in its first angular position as the hook pulls the bight of the loop into its further extended terminal position, returning the hook from its further terminal position toward said first terminal position to free the extended loop from the hook, and deflecting the extended loop laterally away from the hook by

passing a loop deflector between the hook and the fold of the signature.

23. A method of stitching books which comprises holding successive book signatures in a stitching position, forming 5 with a continuous thread a loop stitch in each of the signatures and normally linking together the bight ends of the resulting thread loops of successive stitches to form a chain stitch connecting successive signatures together, discharging stitched signatures from the stitching position to form a stack of books each comprising a plurality of stitched signatures, and selectively deflecting the thread loop of one stitch before forming the thread loop of the next stitch to prevent linking thereof and thereby interrupt the chain stitch.

24. A method according to claim 23 comprising subsequently severing the thread at the juncture of said one and next stitches.

25. A book-stitching machine comprising a sewing saddle upon which folded signatures are successively placed and from which stitched signatures are discharged to form a stack 20 of signatures, means for forming from a continuous thread stitches connecting successive signatures, each said stitch comprising tail thread portions and a thread loop extending through the fold of a signature at spaced locations and two runs of thread in the bight of said fold connecting said tail thread portions to said thread loop, said stitch forming means including means normally operative to pull each thread loop as it is being formed through the previously formed thread loop of a preceding stitch whereby the loops of successive stitches are linked together, and means for selectively rendering said last-named means inoperative to so pull the loop being formed thereby through the previously formed loop to thereby interrupt the linking of the loops.

26. A book-stitching machine comprising a sewing saddle upon which folded signatures are successively placed and from which stitched signatures are discharged to form a stack 35 of signatures, means for forming from a continuous thread stitches connecting successive signatures, each said stitch comprising a thread loop extending from the fold of a signature and said loops of successive stitches being normally linked together to form a continuous linkage, and means for selectively effecting interruption of said linkage without parting the thread.

27. A book-stitching machine as defined in claim 26 comprising means for rendering said last-named means operative to effect such interruption of said linkage between successive groups of said signatures.

28. A book-stitching machine as defined in claim 27 wherein said stitches have tail thread portions connecting successive signatures and which further comprises means for severing said tail thread portions between selected groups of said signatures.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,595,183 Dated July 27, 1971

Inventor(s) William W. Stoothoff

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 14, after "cutting" insert -- the --. Column 2, line 67, "on" should read -- of --. Column 3, line 11, "switched" should read -- stitched --. Column 5, line 7, delete "that" (second occurrence); line 8, delete "and". Column 6, line 55, "one" should read -- the --; after "path" insert -- of --. Column 10, line 30, delete "out". Column 11, line 16, the claim reference numeral "20" should read -- 21 --.

Signed and sealed this 18th day of January 1972.

(SEAL)

Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Acting Commissioner of Patents