Oct. 16, 1956 L. BAKER ET AL 2,766,870

BOOKBINDING MACHINE

Filed April 4, 1952 3 Sheets-Sheet 1

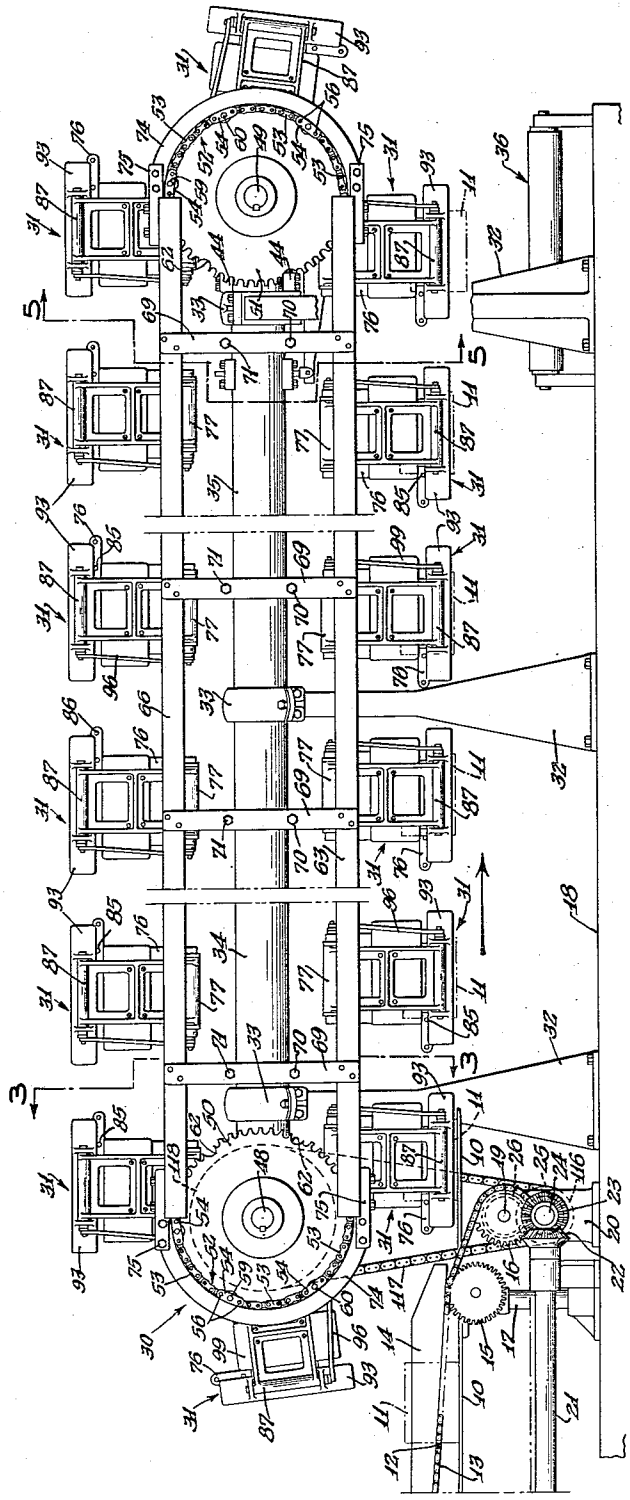


FIG. 1.

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BOOKBINDING MACHINE

Filed April 4, 1952 3 Sheets-Sheet 2

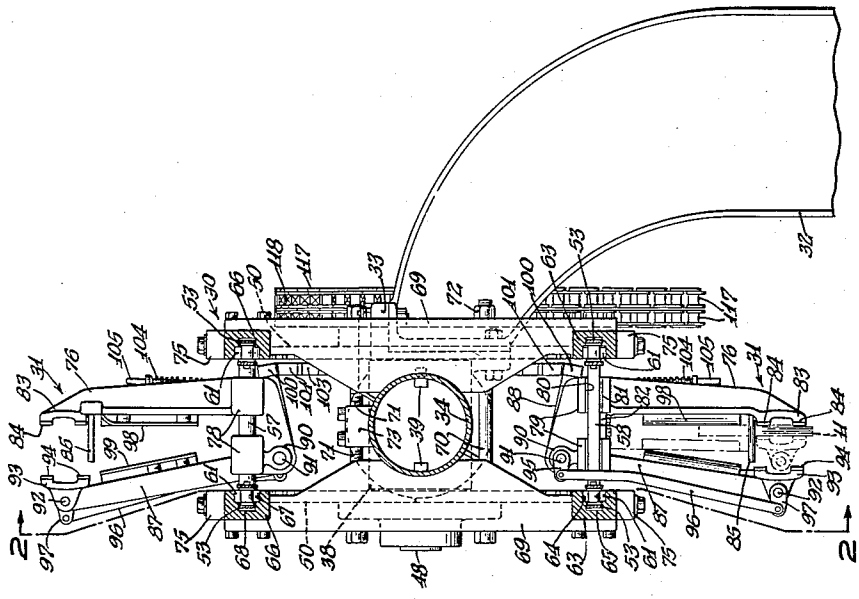


FIG. 3.

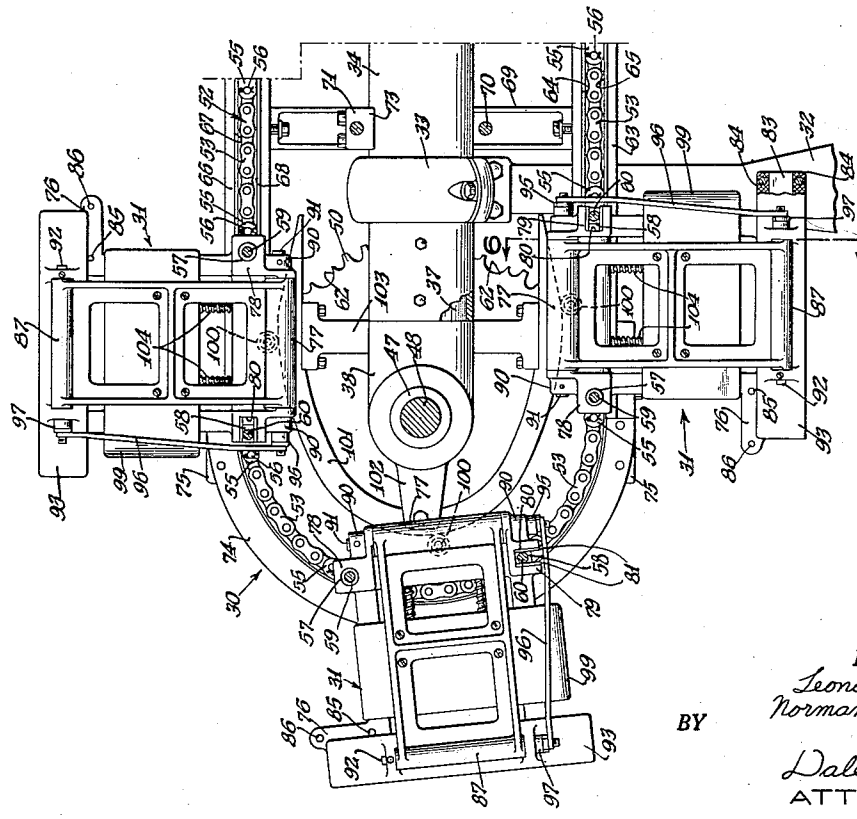


FIG. 2.

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BOOKBINDING MACHINE

Filed April 4, 1952 3 Sheets-Sheet 3

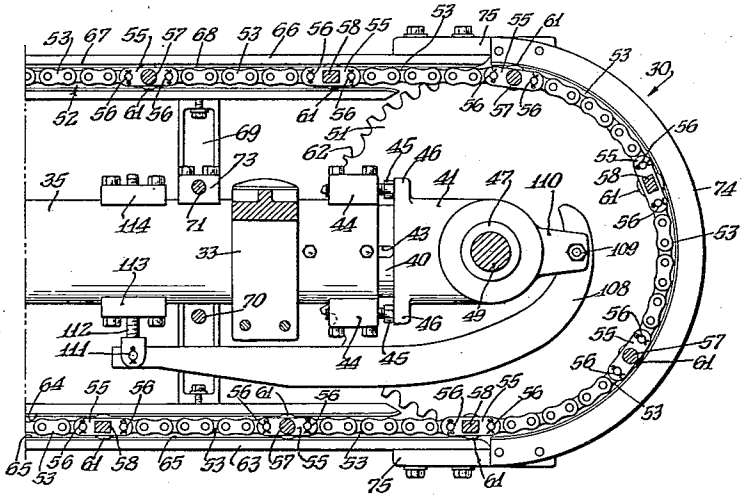


FIG. 4.

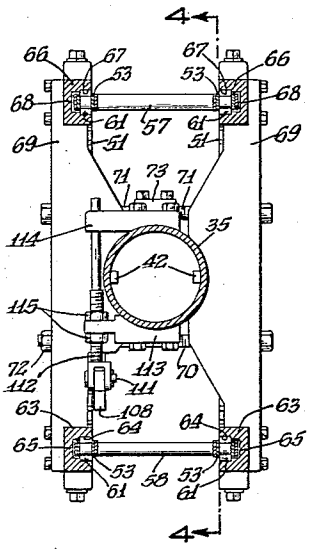


FIG. 5.

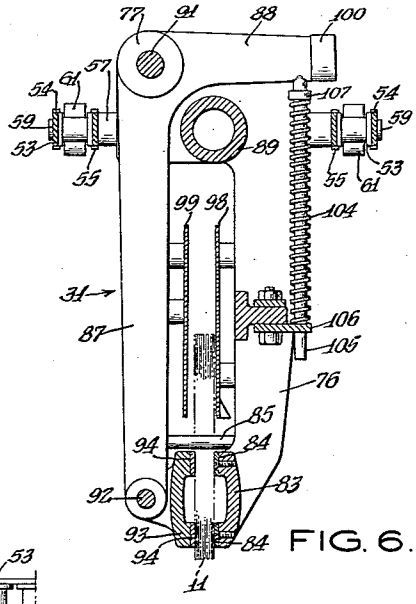


FIG. 6.

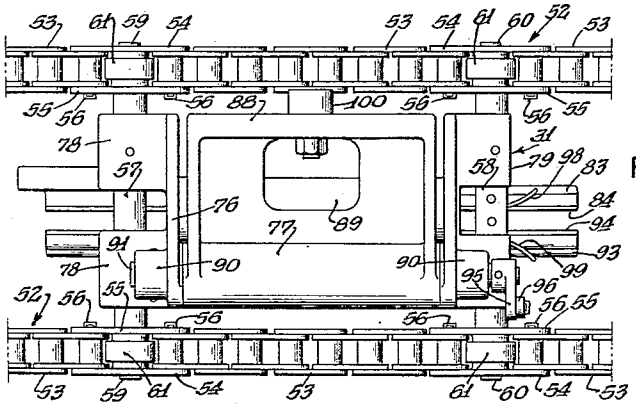


FIG. 7.

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United States Patent Office 2,766,870 Patented Oct. 16, 1956



2,766,870

# BOOKBINDING MACHINE

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Application April 4, 1952, Serial No. 280,606

12 Claims. (Cl. 198—102)

This invention relates generally to bookbinding machines, and more particularly to a chain of travelling book-clamps forming a part thereof for conveying successive groups of book-making signatures or sheets along a designated path for the performance of binding and cover applying and other operations thereon by mechanisms spaced along said path, in the manufacture of books, catalogues, directories, and the like.

One of the objects of the present invention is to provide an improved book-clamp conveyor of the above character which will effectively and accurately advance successive signature-groups edgewise and in upright position along a straight longitudinal path, whereby the various mechanisms for performing the individual steps in the binding and covering process may be advantageously arranged in a single file.

Another object of the invention is to decrease the overall floor space required for installation of the general type of bookbinding machine through the provision of a novel book-clamp conveyor structure which will occupy a comparatively small amount of floor space.

Another object is to provide a book-clamp conveyor of novel construction wherein the book-clamps are advanced edgewise and in upright position through a closed path situated in a vertical plane.

Another object is to provide a novel book-clamp conveyor of the above character wherein the book-clamps are carried by driven endless flexible means for effectively imparting movement to said book-clamps through said closed path.

A further object is to provide a book-clamp conveyor wherein the book-clamps are operatively connected to driven endless flexible means in a novel manner, whereby the angular velocity of each book-clamp in passing around the axes of said endless means is substantially constant so that no whip is imparted to the book-clamps, and a smooth, uniform operation of the latter and said endless means is assured.

Still another object is to provide a book-clamp of novel construction comprising a movable clamping jaw which is mounted for pivotal movement toward and away from a fixed clamping jaw, and which will remain parallel with said fixed jaw regardless of the position it occupies with respect to the fixed jaw, thus affording firm clamping engagement of both jaws over the entire surfaces thereof with the signature-group regardless of the thickness thereof.

The above and further objects and novel features of the invention will more fully appear from the following detail 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 designate like parts throughout the several views,

Fig. 1 is a side elevational view of a book-clamp conveyor constructed in accordance with the present invention;



Fig. 2 is an enlarged vertical longitudinal sectional view of the drive end of said conveyor, viewed at the left of Fig. 1, said view being taken substantially on the line 2—2 of Fig. 3.

Fig. 3 is a vertical transverse sectional view substantially on the line 3—3 of Fig. 1, said view being on the same scale as Fig. 2;

Fig. 4 is a vertical longitudinal sectional view of the off or driven end of said conveyor, viewed at the right of Fig. 1 with the book-clamps omitted for purposes of clearer illustration, said view being on the same scale as Fig. 2 and being taken substantially on the line 4—4 of Fig. 5;

Fig. 5 is a vertical transverse sectional view substantially on the line 5—5 of Fig. 1 with the book-clamps omitted for purposes of clearer illustration, said view being on the same scale as Fig. 3;

Fig. 6 is a vertical transverse sectional view, on a still larger scale, of one of the book-clamps, said view being taken substantially on the line 6—6 of Fig. 2; and

Fig. 7 is a top plan view of said book-clamp on the same scale.

Referring now to the drawings which illustrate, by way of example, one form of book-clamp conveyor constructed, arranged, and operated in accordance with the present invention, 10 (Fig. 1) indicates a portion of the usual in-feed and leveling table of a bookbinding machine along which groups of book-making signatures or sheets 11 are successively advanced edgewise in upright position and with the binding edges thereof lowermost in preparation for the performance of binding, cover-applying and other operations thereon, as well understood in the bookbinding art. For the sake of simplicity in description, the group of book-making signatures or sheets 11 will be hereafter referred to as "books," and it is intended that said "books" shall apply to any group, block or assemblage of sheets, folded and/or unfolded, printed and/or unprinted, on which one or more operations are to be performed in the manufacture of hard or soft-cased books of various descriptions, directories, catalogues, pads, or the like.

The books 11 delivered one after another in timed relation to the table 10 by hand or by suitable conveyor means (not shown) which may be the signature gathering conveyor of an associated signature feeding and gathering unit, are advanced along said table in proper spaced relation by the usual pusher fingers 12 (Fig. 1) which are pivotally connected to and spaced at intervals along an endless chain-carrier 13. The fingers 12 project laterally from the chain 13 into book-engaging position through and between vertically disposed, transversely spaced, guide plates 14 which serve to hold the books 11 in upright position and to guide the same for movement by said fingers in a straight longitudinal path. The upper reach of the chain 13 travels in a downwardly inclined path so that each finger 12 will gradually move downwardly relative to the advancing book and pass out of engagement with said book and beneath the table 10 at a locality spaced rearwardly of the forward end of said table, the table being provided with a suitable narrow opening to enable the fingers 12 to pass therethrough. The upper reach of the chain 13 passes over an idler guide sprocket 15 and then passes around a driven sprocket 16. The sprocket 15 is suitably journalled on a standard 17 which supports the front end portion of the table 10 and is bolted or otherwise suitably secured to a base 18. The sprocket 16 is disposed below the table 10 and is fixed on a short transverse shaft 19 which is journalled in a suitable bearing provided in a bracket 20 which is bolted or otherwise suitably secured to the

base 18. The sprocket 16 and chain 13 are suitably driven with a continuous motion at a desired uniform speed from the main drive shaft 21 of the machine and for this purpose, said shaft has fixed thereon a bevel gear 22 which meshes with a similar gear 23 that is fixed on a short transverse shaft 24 which is journalled in a suitable bearing in the bracket 20 and projects beyond opposite sides of said bracket. Secured to the shaft 24 and disposed between the bracket 20 and the bevel gear 23 is a spur gear 25 which meshes with a similar gear 26 that is fixed on the shaft 19 and, hence, drives the latter shaft, the sprocket 16 and chain 13.

As each book 11 in turn approaches the forward end portion of the table 10 and while it is still being advanced under the action of the pusher finger 12, said book is taken by a novel book-clamp conveyor, indicated generally at 30 (Fig. 1), and farther advanced along said table, then firmly clamped before it has passed beyond the position in which it is supported on the table, and then still farther advanced beyond said table in a straight longitudinal path of a substantial longitudinal extent with the back or binding edge thereof protruding. Each book 11 so clamped and during movement thereof in the straight longitudinal path by the conveyor 30, is operated upon at the exposed and protruding back or binding edge thereof by various mechanisms spaced along said path for performing the individual steps in the binding and covering process. Since the various mechanisms per se, and the individual binding and cover applying operations performed thereby on the books 11, are well known and form no part of the present invention, it is believed to be unnecessary to illustrate and describe the same.

As shown in Fig. 1, the novel book-clamp conveyor 30 is wholly disposed above the plane of the leveling table 10 and comprises an endless series of upright book-clamps, indicated generally at 31, which travel around a vertical orbit, as distinguished from book-clamp conveyors heretofore employed for the same purpose which are disposed at one side of the leveling table and comprise an endless series of upright book-clamps which travel around a horizontal orbit. It will thus be apparent that by virtue of the described arrangement of the novel book-clamp conveyor 30 a comparatively small amount of floor space is required therefor, resulting in a material decrease in the overall floor space required for the book-binding machine, and the various mechanisms for performing the binding, cover applying and breaking operations on the individual books 11 may be advantageously arranged in a single file, whereby the overall construction and operation of the machine is materially simplified.

In the embodiment herein illustrated, the novel book-clamp conveyor 30 comprises the following instrumentalities, including the book-clamps 31, which are preferably constructed, arranged, and operated as follows. Spaced along the desired path of straight-line movement of the successive books 11 is a plurality of standards 32 (Fig. 1) which are bolted or otherwise suitably secured to the base 18 and project upwardly and inwardly from said base above the plane of the leveling table 10. Bolted or otherwise suitably secured to the upper inner end of each standard 32 is a split-bracket 33 (Figs. 1 to 4) having a bore extending longitudinally therethrough, the axis of which is substantially central with respect to the book path. Disposed between the standards 32 and engaged in the bores of the brackets 33 are longitudinally extending spreader-tubes 34 and 35 which are securely clamped in said brackets and are further suitably keyed thereto to positively prevent relative rotation thereof. There are shown three standards 32, i. e., one at each end and one in the center of the conveyor 30, and two spreader-tubes 34, 35, but this number of standards and tubes may be increased or decreased depending on the length of said conveyor which may be increased or decreased in accordance with the number of mechanisms employed for acting on the books 11, and to suit the requirements of different



establishments. As shown, the standard 32 at the delivery or right-hand end of the conveyor 30, as viewed in Fig. 1, is disposed at the side of said conveyor opposite that at which the remaining standards are located, for the purpose of accommodating a delivery mechanism, indicated generally at 36 (Fig. 1), which may be of the well-known endless apron or belt type, for receiving the completed books 11 discharged by the conveyor 30 and further advancing the same in a direction at right angles to said conveyor to a convenient point for removal therefrom. It is to be understood, however, that the standard 32 at the delivery end of the conveyor 30 may be disposed at the same side as the remaining standards, and the delivery mechanism 36 extended in the opposite direction for delivery of the completed books in said direction.

The free left-hand end of the spreader-tube 34, as viewed in Figs. 1 and 2, projects beyond the bracket 33 on the adjacent end-standard 32 and extends rearwardly over the forward end portion of the leveling table 10. Engaged by a tight push fit in the free open end of the tube 34 is an annular portion 37 of a bearing-bracket 38 (Figs. 2 and 3) which is provided with a horizontal bore extending transversely therethrough or at right angles to the axis of said tube. The bracket 38 is positively held against rotation relative to the tube 34 by diametrically opposite keys 39 (Fig. 3) which are bolted or otherwise rigidly secured to said tube internally thereof and are engaged in suitable keyways formed in the portion 37 of said bracket. The free right-hand end of the spreader-tube 35, as viewed in Figs. 1 and 4, projects forwardly beyond the bracket 33 on the adjacent end-standard 32. Engaged by a sliding fit in the free open end of the tube 35 is an annular portion 40 of a bearing-bracket 41 (Fig. 4) which is similar to the bearing-bracket 38 and is provided with a horizontal bore extending transversely therethrough or at right angles to the axis of said tube. The bracket 41 is positively held against rotation relative to the tube 35 by diametrically opposite keys 42 (Fig. 5) which are bolted or otherwise rigidly secured to said tube internally thereof and are slidably engaged in suitable keyways 43 (Fig. 4) formed in the portion 40 of said bracket. Blocks 44 are bolted or otherwise suitably secured to the tube 35 at the top and bottom and adjacent the free end thereof, which blocks have adjustably threaded therein bolts 45, the heads of which are engaged with vertical lugs 46 formed on the bearing-bracket 41. Accordingly, the bearing-bracket 41 and parts carried thereby to be hereinafter described, may be axially adjusted relatively to and away from the spreader-tube 35 through rotation of the bolts 45 in the proper direction and engagement of the heads of said bolts with the lugs 46, for a purpose to appear hereinafter.

The bearing-brackets 38, 41 have equal portions disposed at opposite sides of the common axis of the spreader-tubes 34, 35, and said brackets have journalled in the bores thereof, by means of appropriate anti-friction bearings 47, short transversely extending horizontal shafts 48 and 49, respectively (Figs. 1 to 4). Arranged at opposite sides of the bracket 38 and substantially in contact therewith, except for a slight running clearance, are identical sprockets 50 of a relatively large diameter which are keyed or otherwise suitably secured to the shaft 48. Arranged at opposite sides of the bearing-bracket 41 and substantially in contact therewith, except for a slight running clearance, are sprockets 51 which are identical with the sprockets 50 and are keyed or otherwise suitably secured to the shaft 49. Engaged with and passing around the rear halves of the sprockets 50 are identical chain assemblies, indicated generally at 52 (Figs. 1, 2 and 4) which extend horizontally and lengthwise from said sprockets to and pass around the front halves of the sprockets 51. As thus supported, the chain assemblies 52 provide two transversely spaced, parallel, and aligned endless flexible carriers which are symmetrically disposed at opposite sides of the common axis of the

spreader-tubes 34, 35, and each of which is arranged for movement through a closed or circulatory path lying in a vertical plane and defined by a lower outgoing straight course extending from the respective sprocket 50 to the respective sprocket 51, an upper return straight course extending from the respective sprocket 51 back to the respective sprocket 50, and semi-circular courses connecting said straight courses at their ends and leading from one to the other.

As clearly shown particularly in Figs. 4 and 7 of the drawings, each chain assembly or endless flexible carrier 52 comprises a multiplicity of chain sections 53 of predetermined equal lengths and of a predetermined pitch, preferably sections of roller chain, which are spaced apart a distance equal to twice said pitch and are connected together at their ends by special outer and inner link-plates 54 and 55, respectively. Each connecting-link-plate 54 has riveted or otherwise suitably secured therein two pins 56 which are spaced apart a distance equal to twice the pitch of the roller chain sections 53. These pins 56 in each plate 54 project inwardly from said plate and extend through the aligned openings in the links and rollers at the free ends of adjacent chain sections 53 and then pass through suitable clearance openings in the companion connecting-link-plate 55. Endwise displacement of the plates 55 from the respective pins 56 is prevented by suitable means, such as cotter pins inserted in the projecting ends of said pins.

Each endless flexible carrier 52 is thus formed by the roller chain sections 53 pivotally interconnected in succession by the connecting links comprising the plates 54, 55 and pins 56, and both carriers 52 are so arranged about the sprockets 50 and 51 that the sections and connecting links thereof are in exact transverse alignment. Any slack in the upper and lower reaches or runs of the endless carriers 52 may be taken up, and the desired degree of tightness of said reaches or runs may be obtained, through axial adjustment of the bearing-bracket 41 by the adjusting bolts 45, as hereinbefore described.

The roller chain sections 53 of each endless carrier 52 are of an equal number, and since said chain sections are all of the same length, the connecting links comprising the plates 54, 55 and pins 56 will be equally spaced along the carriers. Alternately arranged between the endless carriers 52 and extending transversely of said carriers are short shafts 57 and short rectangular bars 58 (Figs. 4 and 7) which are formed at opposite ends thereof with reduced annular journals 59 and 60, respectively. The shafts 57 and bars 58 combined are equal in number to the number of connecting links in a chain assembly, and the journals 59, 60 of the respective shafts 57 and bars 58 are extended through suitable axially aligned bearings provided in the plates 54, 55 of all of the connecting links, said bearings being located centrally between the connecting pins 56, 56. Disposed between the plates 54, 55 of all of the connecting links and rotatably fitted on the journals 59, 60 of the respective shafts 57 and bars 58 are anti-friction rollers 61 which are of a diameter slightly larger than the vertical dimensions of said plates and the plates of the links of the chain sections 53. The sprockets 50 and 51 are provided with semi-circular notches or recesses 62 (Figs. 1, 2 and 4) in and properly spaced about the peripheries thereof to receive the rollers 61 as the endless carriers 52 travel around said sprockets.

The lower reaches or runs of the endless carriers 52 are supported and guided for straight-line outgoing movement by two track bars 63 (Figs. 1 to 5) which extend longitudinally between the sprockets 50 and 51 and are milled at and along the inner sides thereof to provide trackways 64 therein for receiving said reaches and upon which the rollers 61 ride. The rollers 61 contact the upper and lower surfaces of the trackways 64, and substantially contact the inner walls of said trackways, except for the slightest possible clearance, whereby the lower reaches or runs of the endless carriers 52 are held against upward, downward and outward displacement, said inner walls being undercut to provide clearance grooves 65 for the connecting-link-plates 55 and for the outer link-plates of the chain sections 53. The upper reaches or runs of the endless carriers 52 are supported and guided for straight-line return movement by two similar longitudinally extending track bars 66 which, like the track bars 63, are provided with trackways 67 and undercut grooves 68 for receiving said reaches or runs with the rollers 61 thereof contacting the upper and lower surfaces of said trackways and substantially contacting the inner walls of the latter. The upper portions of the lower track bars 63 extend substantially to the respective sprockets 50 and 51, and the lower portions of said bars extend below said sprockets, and said portions at the opposite ends thereof are rounded, bevelled, or flared to facilitate movement of the rollers 61 into and out of the trackways 64. The upper portions of the upper track bars 66 extend over the respective sprockets 50 and 51, and the lower portions of said bars extend substantially to said sprockets, and said portions are likewise rounded, bevelled, or flared at the opposite ends thereof to facilitate movement of the rollers 61 into and out of the trackways 67.

The two lower track bars 63 and the two upper track bars 66 are bolted or otherwise suitably secured to the lower and upper ends, respectively, of a plurality of vertically extending, longitudinally spaced brackets 69 which are disposed at opposite sides of the spreader-tubes 34, 35 (Figs. 1 to 5). The brackets 69 at one side of the spreader-tubes 34, 35 are aligned with the brackets 69 at the other side of tubes, and said brackets are adjustably clamped in pairs to the tubes 34, 35 for pivotal movement about said tubes for track-bar aligning purposes. Accordingly, each pair of brackets 69 has extended loosely therethrough a relatively long bolt 70 and two relatively short bolts 71, the long bolt 70 passing beneath the spreader-tube 34 or 35 as the case may be and having a clamping nut 72 threaded thereon, and the short bolts 71 passing over said tube and being threaded into opposite sides of a block 73 which is bolted or otherwise suitably secured to the tube. The semi-circular courses or runs of the endless carriers 52 are guided and maintained in engagement with the respective sprockets 50 and 51 by curved track bars 74 which are engaged by the rollers 61 of said carriers. These track bars 74 are bolted or otherwise suitably secured at their ends to brackets 75 which, in turn, are adjustably bolted to the track bars 63 and 66.

The shafts 57 and bars 58 serve to support and to operatively connect the book-clamps 31 with the endless carriers 52 at equally spaced intervals throughout the lengths of said carriers and such that said clamps are successively disposed with their lengths parallel to the lengths of the carriers. For this purpose, the shafts 57 and bars 58 are paired with each pair consisting of one shaft 57 and the next following bar 58 considered in the direction of travel of the endless carriers 52, as clearly shown in Fig. 2, and for each book-clamp 31 one of said shafts and one of said bars is utilized. The book-clamps 31 are identical in construction, mounting and operation and a description of one of said book-clamps will therefore suffice for all of the same.

As shown particularly in Figs. 2, 6 and 7, each book-clamp 31 comprises a vertically extending fixed clamp member 76 disposed at one side of the book path, and a companion vertically extending movable clamp member 77 disposed at the opposite side of said book path and mounted on said fixed member for pivotal movement toward and away from the same. The fixed clamp member 76 is in the form of a plate-like casting made of a suitable strong but light weight material such as, for example, magnesium, and suitably ribbed for added stiffness and strength. The fixed clamp member 76 is provided at the top and rear end thereof with two suitably bored transversely spaced bosses 78 which are engaged over the shaft 57 and pinned or otherwise suitably secured to said shaft. The fixed clamp member 76 is provided at the

top and front end thereof with two transversely spaced bosses 79 which are transversely milled to provide aligned grooves 80 to slidably receive the bar 58 therein. The depth of the grooves 80 is greater than the width of the bar 58 so that as the book-clamp 31 travels from the upper straight return course around the semi-circular course defined by the sprockets 50, and thereafter travels from the lower straight course around the semi-circular course defined by the sprockets 51, at which times the flexible connections between the shaft 57 and bar 58, effectively and advantageously afforded by the chain sections 53, are curved about said sprockets causing a shortening of the center distance between said shaft and said bar, the bar 58 may effectively slide relative to the book-clamp towards the shaft 57, in the manner clearly to be understood from an inspection of Fig. 2, and thereby compensate for and permit this shortening of said center distance. Thus, the endless carriers 52 may effectively follow the contour of the sprockets 50 and 51, and by virtue of the flexible connections between each shaft 57 and the companion bar 58, and the mounting of said shaft and bar on the special connecting links which define relatively short chords as they travel around said sprockets, the angular velocity of each book-clamp 31 as the latter travels around the semi-circular courses will remain substantially constant, whereby a substantially smooth and uniform movement of the endless carriers and book-clamps is obtained.

Wear plates 81 (Figs. 2 and 3) are preferably disposed between the bar 58 and the bosses 79, said plates being removably carried by said bosses in a suitable manner for replacement purposes. The clamp member 76 being fixed to the shaft 57, as described, is thereby held against axial displacement relative to said shaft, and in order to further guard against any lateral displacement of said clamp member relative to the shaft 57 and the bar 58 a block 82 is snugly fitted in the space between the bosses 79 and bolted or otherwise suitably secured to said bar. The fixed clamp member 76 is formed at the lower end thereof with a book-engaging jaw 83 (Figs. 2, 6 and 7) which is of a desired length to accommodate the maximum size book 11 that may be handled, said jaw having suitably secured to its inner surface two vertically spaced metallic strips 84 which extend the entire length of the jaw and are suitably knurled, scored or otherwise roughened to increase the gripping action of said jaw on the books 11. The fixed clamp member 76 is located substantially central between the endless carriers 52, in which position the inner book-contacting surfaces of the strips 84 on the jaw 83 are located substantially in the same vertical plane as the common axis of the spreader-tubes 34 and 35, thus establishing a definite lateral position for all the books 11 of varying sizes and thicknesses that may be handled to insure accurate performance of the binding, cover applying and other operations thereon.

The fixed clamp member 76 has removably secured thereto at the rear end thereof a book-engaging pin 85 (Figs. 2, 3 and 6) which projects inwardly therefrom above the jaw 83 and across the book path, said pin serving to head-up or align the individual signatures or sheets of the book 11, and to impart continued advancing movement to said book until the clamp 31 closes thereon, and serving as a gage to properly determine the longitudinal position of the book 11 in said clamp. For books of average size lengths, the pin 85 is located on the fixed clamp member 76 in the position thereof shown in the drawings, and for longer books 11 up to the maximum length that may be handled, said pin is repositioned in an opening 86 provided in said clamp member for this purpose.

As shown in Figs. 2, 6 and 7, the companion movable clamp member 77 is centrally located lengthwise with respect to the fixed clamp member 76 at the side of the latter facing the jaw 83, and is in effect in the form of a bell crank having a relatively wide downwardly projecting arm 87 and a relatively wide arm 88 projecting inwardly over and beyond a brace 89 which is formed integrally with the fixed clamp member adjacent the upper end thereof and serves to connect and strengthen the portions of said fixed member carrying the bosses 78 and 79. The movable clamp member 77 is also made of a strong but light weight material such as, for example, magnesium, and is suitably ribbed for added strength and stiffness. The movable clamp member 77 is fitted between longitudinally spaced bosses 90 formed integrally with the fixed clamp member 76, and said movable clamp member is pivotally mounted on a longitudinally extending shaft 91 which is carried by said bosses and is pinned or otherwise suitably secured thereto.

Extending longitudinally of the movable clamp member 77 and journalled in suitable bearings provided in the lower free end of the arm 87 of said member is a shaft 92 (Figs. 2, 3 and 6) having suitably secured to the projecting opposite ends thereof a companion book-engaging jaw 93 which is aligned with and is of the same length and width as the jaw 83 on the fixed clamp member 76. The jaw 93 has suitably secured to its inner surface two vertically spaced longitudinal metallic strips 94 which are knurled, scored or otherwise roughened to increase the gripping action of said jaw on the books 11. Pinned or otherwise suitably secured to the projecting forward end of the shaft 91 which is fixed in the fixed clamp member 76, as hereinbefore described, is a short arm 95 to the free end of which is pivotally connected the upper end of a link 96. The lower end of this link 96 is pivotally connected to the free end of an arm 97 which is of the same length as the arm 95 and is pinned or otherwise suitably secured to the shaft 92 which carries the jaw 93 and is pivotally mounted in the movable clamp member 77, as hereinbefore described.

The movable clamp member 77 is rocked toward and away from the fixed clamp member 76 to clamp closing and opening positions, respectively, to firmly clamp the book 11 between the jaws 83 and 93 for imparting straight-line advancing movement to said book, and to firmly hold the book 11 during such movement while the binding and cover applying and other operations are being performed on the protruding back or binding edge thereof, and to thereafter release the completed book at a point above the delivery mechanism 36 for discharge thereto. It will thus be apparent that when the movable clamp member 77 is rocked toward the fixed clamp member 76, as well as away from said fixed clamp member, the jaw 93 on said movable clamp member will, by virtue of the described parallel arms 95, 97 and connecting link 96, always remain parallel with the jaw 83 of the fixed clamp member 76 regardless of the positions it may occupy with respect to the jaw 83, as will be clearly seen from an inspection of Figs. 3 and 6. In this manner, no wiping action will be imparted to the book 11 by the jaw 93 to disarrange the outer signatures or sheets of said book upon engagement of the latter by said jaw, and a firm clamping engagement of each book 11, regardless of its thickness, by and between both jaws 83 and 93 in parallel relation is assured.

The members 76, 77 of the book-clamp 31 have bolted or otherwise suitably secured thereto opposed longitudinally extending upright guide plates 98 and 99, respectively (Figs. 6 and 7), which serve to hold the upper loose portions of the signatures or sheets of the book 11 against flaring outwardly during movement of said book by said clamp, and in order to eliminate the possibility of said plates striking the book 11 upon rotary movement of the book-clamp 31 into book engaging position, the forward or leading end portions of said plates are bent or flared outwardly, and the lower longitudinal edge portion of the plate 98 is bent or flared outwardly with a gradual increase from the forward end to the rear end thereof.

The book-clamp conveyor 30 is continuously driven at a proper speed in relation to the speed of the pusher-pin chain 13 by driving means to be hereinafter described, and in the operation of said conveyor, as each book-clamp 31 travels from the upper straight return course or

run into the semi-circular course around the sprockets 50, said book-clamp is opened, as shown at the top of Fig. 3, and maintained in opened condition while it passes downwardly around said semi-circular course and until it begins to enter the lower straight outgoing course or run, at which time the book-clamp 31 is closed with the same in substantially true vertical position. Under these conditions, as the opened book-clamp 31 travels downwardly around the lower half of the semi-circular course, the fixed clamp member 76 passes alongside of and parallel to the adjacent guide plate 14, and the movable clamp member 77 passes alongside of and parallel to the other adjacent guide plate 14, thus straddling the leading book 11 on the feed table 10 with the header-up pin 85 on said clamp extending across the top of the guide plates 14 and coming up behind said book. The guide plates 14 have portions thereof removed at their upper forward ends to clear the header-up pin 85 for movement of the latter over said plates.

As the leading book 11 approaches the forward end portion of the feed and leveling table 10 and while it is still being advanced under the influence of the pusher-pin 12, said book is engaged at the rear edge thereof by the header-up pin 85 on the moving book-clamp 31 and continued along said table with said clamp by said latter pin until the book-clamp closes on and firmly clamps the book by and between the jaws 83 and 93 thereof, which occurs before said book has passed beyond the position in which it is supported on the table 10 and when said clamp is in true vertical position. Upon engagement of the book 11 by the header-up pin 85 on the moving book-clamp 31, the pusher pin 12 ceases to act on said book and passes downwardly through and beneath the feed table 10 and around the sprocket 16.

The book 11 firmly held by the book-clamp 31 is then farther advanced from and beyond the leveling table 10 by said clamp in a straight longitudinal path with the back or binding edge of said book protruding beyond the lower edges of the jaws 83 and 93, as shown in Fig. 6, for the performance of binding and cover applying and/or other operations thereon by suitable mechanisms (not shown) spaced along and arranged beneath said path of book travel. As the book-clamp 31 with the book 11 approaches the far or delivery end of the lower straight outgoing course or run, the movable clamp member 77 is swung away from the fixed clamp member 76, thereby opening the clamp 31 and releasing the completed book to fall downwardly onto and along a guide chute (not shown) which directs the completed book with the cover thereof closed onto the delivery conveyor 36. The opened book-clamp 31 then proceeds upwardly around the semi-circular course of the sprockets 51 and is again closed before it reaches the top of said course. From the semi-circular course the closed book clamp 31 travels into and along the upper straight return course or run until it approaches the far end of said return course, at which time said book-clamp is again opened and the above described operations are repeated to engage, clamp, and advance another book 11. The operations described above in connection with one book-clamp 31 are repeated for each successive book-clamp, whereby successive books 11 are engaged, clamped and advanced in a continuous process for operations thereon, and completed books are successively discharged to the delivery conveyor 36.

The described clamp opening and closing operations at the book receiving end of the conveyor 30 are effected through movement of the book-clamp 31 and for this purpose, each book-clamp has journalled on the arm 88 of the movable bell-crank clamp member 77 thereof a roller 100 (Figs. 2, 3, 6 and 7) which is adapted to engage the outer peripheral surface of an oval-shaped cam track 101. This cam track 101 is bolted or otherwise suitably secured centrally thereof to a horizontal lug 102 formed integrally with the bearing bracket 38, and is further bolted or otherwise suitably secured adjacent the free ends thereof to the upper and lower ends of a vertical bracket 103 which is also bolted or otherwise suitably secured to said bearing bracket. The cam track 101 is so proportioned that the free ends thereof overlap the adjacent ends of the upper and lower straight runs of the endless carriers 52, and said free ends of said cam track are tapered, as shown in Fig. 2, to provide for a gradual and smooth opening and closing of the book-clamps 31.

The movable clamp member 77 of each book-clamp 31 is continuously urged under heavy spring pressure towards the companion fixed clamp member 76 to hold said book-clamp firmly closed and in firm gripping engagement with the book 11. For this purpose, each book-clamp 31 is provided with at least two heavy coil compression springs 104 (Fig. 6) surrounding rods 105 and having corresponding ends thereof engaging against a plate 106 and the opposite ends engaging against annular shoulders provided by collars 107 secured to or formed integrally with said rods. The lower ends of the rods 105 extend loosely through suitable clearance openings formed in the plate 106 which is bolted or otherwise suitably secured to the fixed clamp member 76, and the upper ends of said rods extend into suitable recesses formed in the underside of the arm 88 of the movable clamp member 77. If desired, a suitably recessed steel wear plate may be bolted or otherwise suitably secured to the arm 88 of the movable clamp member 77 for engagement by the upper ends of the rods 105.

It will thus be apparent that when the roller 100 on each moving book-clamp 31 engages the tapered end of the upper half portion of the cam track 101, which occurs as said book-clamp approaches the far end of the upper straight return course, the movable clamp member 77 will be gradually and smoothly swung outwardly away from the companion fixed clamp member 76 against the action of the springs 104, thus opening the book-clamp, and through continued engagement of the roller 100 with the cam track 101 effected by the springs 105, the book-clamp 31 will be maintained in opened condition as it travels around the sprockets 50 and until said roller rides into the tapered end of the lower half portion of the cam track 101, which occurs shortly after said book-clamp passes into the lower straight outgoing course. Thereupon the movable clamp member 77, upon continued forward movement of the book-clamp 31, will be gradually and smoothly swung inwardly towards the fixed clamp member 76 and into firm clamping engagement with the book 11 by the expanding action of the springs 104. The extent of inward movement of the movable clamp member 77 and consequently the extent that the roller 100 follows the tapered end of the cam track 101 is dependent upon the thickness of the book 11 being handled. Accordingly, upon engagement of the movable clamp member 77 with the book 11 and continued forward movement of the book-clamp 31, the roller 100 will leave the cam track 101 and, hence, said book-clamp with said book therein will remain closed substantially throughout the remainder of its straight outgoing course or until it approaches the far or delivery end of said course.

The described clamp opening and closing operations at the book delivering end of the conveyor 30 are also effected through movement of the book-clamp 31 and for this purpose, a cam arm 108 is provided (Figs. 4 and 5) which is disposed in the path of forward movement of the rollers 100 on the book-clamps 31 and is formed with a relatively long horizontal straight portion terminating in a forwardly and upwardly curved portion. The rollers 100 on the book-clamps 31 engage the lower or outer edge of the cam arm 108, and said edge at the roller receiving end of the horizontal portion of said arm is tapered, as shown in Fig. 4, to provide for a gradual and smooth opening of each book-clamp 31. The curvature of the roller engaging edge of the curved portion of the cam arm 108 is so chosen and proportioned

to provide for a gradual and smooth closing of each book-clamp 31 as the latter proceeds around the lower half of the semi-circular return course. The cam arm 108 is pivotally mounted, as at 109, on an extension 110 of the bearing bracket 41 (Fig. 4) so that said arm may be adjusted in a vertical plane in accordance with the thickness of the books 11 being handled, whereby opening of the successive book-clamps 31 and discharge of the complete books therefrom will always occur at the same locality of the book path for all the books of different thicknesses that may be handled. Pivotally connected at 111 to the free end of the horizontal portion of the cam arm 108 is the lower end of an externally threaded rod 112 which extends upwardly from said arm through suitable elongated clearance openings formed in lower and upper brackets 113 and 114, respectively, which are bolted or otherwise suitably secured to the bottom and top, respectively, of the spreader-tube 35. Threaded on the rod 112 and disposed above and below the bracket 113 are adjusting and lock nuts 115 which are tightened against said bracket. The cam arm 108 is thus held by the nuts 115 in adjusted position and against pivotal movement about the pivot 109, and upon rotation of said nuts in the proper direction, the cam arm may be raised or lowered to a desired position.

It will thus be apparent that as each book-clamp 31 with the treated book 11 therein approaches the far or delivery end of the lower straight outgoing course, the roller 100 on said book-clamp will pass into engagement with the tapered end of the surface of the cam arm 108 and then ride along said surface, whereupon the movable member 77 of said clamp will be gradually and smoothly swung outwardly away from the companion fixed member 76 against the action of the springs 104, thus opening the book-clamp and releasing the completed book for discharge to the delivery conveyor or mechanism 36. Shortly after this opening of each book-clamp 31 and release of the completed book thereby, said clamp moves upwardly around the semi-circular return course, and through said movement, the continued engagement of the roller 100 with the cam arm 108 effected by the springs 104, and the curvature of the curved portion of said arm, the movable member 77 of the clamp is gradually and smoothly swung inwardly towards the companion fixed member 76 by the expanding action of the springs 104 to fully closed position with the jaws 83 and 93 of said members in contact with each other, at which time the roller 100 leaves the cam arm 108. The book-clamps 31 so opened and closed successively, as described, then remain closed for substantially the remainder of their return course and until they successively approach the far end of said course, whereupon said book-clamps are again successively subjected to the above described clamp opening and closing operations at the book receiving end and at the book discharging end of the conveyor 30.

The book-clamp conveyor 30 is continuously driven at a predetermined speed in relation to the speed of the pusher-pin chain 13 such that the successive book-clamps 31 will accurately meet and engage the successive books 11 as the latter are being advanced along the table 10 by the pusher pins 12 and arrive at the forward end portion of said table. For this purpose, the continuously driven transverse shaft 24 has fixed thereon a relatively small diameter twin sprocket 116 around which passes a twin chain 117 of the roller type, which also passes around and drives a relatively large diameter twin sprocket 118 that is keyed or otherwise suitably secured to the shaft 48.

The operation of the book-clamp conveyor 30 constructed and arranged in accordance with the present invention will be clearly understood from the foregoing description, and while said description and the accompanying drawings set forth with more or less particularity one embodiment of the invention, it is to be expressly understood that said invention is not limited to said embodiment. Various changes may be made therein, particularly in the design and arrangement of the parts illustrated, as well as in the mode of operation and manner of use, without departing from the spirit and scope of the invention, as will now be clear to those skilled in the art.

What is claimed is:

1. In apparatus of the class described, a substantially horizontal support, means for advancing books one after another edgewise and in upright position along said support, a plurality of upright book-clamps arranged above said support for successively receiving and clamping the successive books while on said support and further advancing said books edgewise and in upright position from and beyond said support, said book clamps each comprising a fixed member and a companion member mounted on said fixed member for movement toward and away from the latter, means for driving said book-clamps through a circulatory path defined by a lower straight outgoing course and an upper return course, said courses being connected at their ends by semi-circular courses leading from one to the other thereof, and means spaced along and connected to said book-clamp-driving means for supporting the fixed member of each book clamp and drivably connecting the same to said driving means, one of said spaced supporting means being capable of movement toward and away from the other of said spaced supporting means relative to both members of each book clamp as the latter travels around said semi-circular courses and passes from said semi-circular courses to said straight courses, respectively.

2. In apparatus of the class described, a support, means for continuously advancing a succession of books in spaced relation edgewise and in upright position along said support, a plurality of upright book-clamps arranged above said support for successively receiving and clamping the successive books while in motion and continuing the advance of said books edgewise and in upright position from and beyond said support, said book clamps each comprising a fixed member and a companion member mounted on said fixed member for movement toward and away from the latter, endless flexible means for imparting continuous movement to said book-clamps through a closed path defined by a lower straight outgoing course and an upper return course, said courses being connected at their ends by semi-circular courses leading from one to the other thereof, and means spaced along and connected to said endless flexible means for supporting the fixed member of each book clamp and drivably connecting the same to said endless flexible means, one of said spaced supporting means being capable of movement toward and away from the other of said spaced supporting means relative to both members of each book-clamp as the latter travels around said semi-circular courses and passes from said semi-circular courses to said straight courses, respectively.

3. In apparatus of the class described, a table, means for advancing books one after another edgewise and in upright position along said table, a plurality of upright book-clamps arranged above said table for successively receiving and clamping the successive books while on said table and further advancing said books edgewise and in upright position from and beyond said table, each clamp comprising a fixed member disposed at one side of the book path and a companion member disposed at the other side of said book path and mounted on and movable towards and away from said fixed member to clamp closing and opening positions, respectively, endless flexible means for imparting movement to said book-clamps through a closed path defined by a lower straight outgoing course and an upper straight return course, said courses being connected at their ends by semi-circular courses leading from one to the other thereof, said endless means being arranged so that the lower outgoing

straight course of the clamps begins at a locality overlying said table, means spaced along and connected to said endless flexible means for supporting the fixed member of each book clamp and drivably connecting the same to said endless flexible means, one of said spaced supporting means being capable of movement toward and away from the other of said spaced supporting means relative to both members of each book-clamp as the latter travels around said semi-circular courses and passes from said semi-circular courses to said straight courses, respectively, means for closing each clamp after a book is received between the said members thereof and said clamp has entered said lower outgoing straight course, and means for thereafter opening each clamp to release the book therefrom at a further locality of said closed path.

4. In apparatus of the class described, a book-clamp conveyor for advancing a succession of books along a predetermined path for the performance of operations thereon, said conveyor comprising two horizontally extending endless flexible carriers arranged in opposed spaced parallel relation and having aligned straight runs at one side thereof and aligned straight runs at the opposite side thereof, rotary means arranged at opposite extremities of said runs for supporting said carriers and for imparting advancing movement thereto in unison, a plurality of book-clamps disposed between and spaced along said carriers and projecting outwardly therefrom at right angles to said runs, double means carried by and spaced along said carriers for supporting each book-clamp and for connecting the latter to said carriers for movement thereby through a closed path, one of said double means being capable of movement toward and away from the other of said double means relative to the book-clamp as the latter travels around said rotary means and passes from said rotary means to said straight runs, respectively, said book-clamps each comprising a fixed member receiving said double means and providing for said relative movement of the said one of said double means, and a companion member mounted on and movable towards and away from said fixed member to clamp closing and opening positions, respectively, each of said book-clamps being adapted to receive a book at one locality of the aforesaid path and hold said book with an edge thereof protruding beyond the outer end of the clamp during movement of the latter to a further locality of said path, spring means carried by each book-clamp for closing the latter, means arranged at the said one locality for controlling the closing of each book-clamp by said spring means, and means arranged at said further locality for opening each book-clamp.

5. In apparatus of the class described, a book-clamp conveyor for advancing a succession of books edgewise and in upright position along a predetermined path, said conveyor comprising two laterally spaced rear means rotatable about a common horizontal axis, two correspondingly spaced front means rotatable about a common horizontal axis coplanar with the axis of said rear means, two endless flexible carriers extending between and passing around said rear and front means and providing aligned lower and upper straight runs, means for advancing said carriers in unison and such that the lower straight runs thereof travel toward said front means, a plurality of book-clamps disposed between said carriers and spaced therealong equal distances apart, said clamps extending lengthwise of said carriers and projecting outwardly therefrom at right angles to said runs, a first means carried by said carriers and engaged in fixed relation with each clamp for supporting the latter and connecting the same to said carriers for movement thereby through a closed path, a second means carried by said carriers and spaced longitudinally from said first means for further supporting each clamp, said second means being fitted in each clamp for sliding movement toward and away from said first means so as to provide for contraction and extension of the carrier portions between said first and second means as said portions and the clamp pass around said rear and front means and pass from said latter means into said lower and upper runs, said clamps each comprising a fixed member receiving said first and second means, and a companion member mounted on said fixed member for relative movement towards and away from said fixed member to clamp closing and opening positions, respectively, spring means carried by the fixed member of each clamp and engaging the companion member for closing the clamp so as to hold a book with the back edge thereof protruding beyond the outer end of said clamp, means arranged adjacent said rear means for controlling the closing of each clamp by said spring means when the clamp has entered said lower runs, and means arranged at a further locality of the aforesaid closed path for opening each clamp.

6. In apparatus of the class described, a book-clamp conveyor for advancing a succession of books edgewise and in upright position along a predetermined path, said conveyor comprising two laterally spaced rear sprockets rotatable about a common horizontal axis, two correspondingly spaced front sprockets rotatable about a common horizontal axis coplanar with the axis of said rear sprockets, two endless chain assemblies extending between and passing around said rear and front sprockets and providing aligned lower and upper straight runs, each of said assemblies comprising an equal number of chain sections of equal lengths and of a predetermined pitch and spaced apart a distance equal to twice said pitch, and links for connecting said sections successively together in such spaced relation and form an endless assembly thereof, said assemblies being so arranged that the sections and connecting links thereof are in transverse alignment, a plurality of cross elements disposed between and extending transversely of said assemblies and carried by the aligned pairs of connecting links of said assemblies, each cross element being located centrally between adjacent chain sections, means for advancing said assemblies in unison and such that the lower runs thereof travel toward said front sprockets, a plurality of book-clamps disposed between said assemblies and of a number one-half the number of the sections of each chain assembly, said clamps extending lengthwise of said assemblies and projecting outwardly therefrom at right angles to said runs, each clamp extending between and being supported by two of said cross elements, and comprising a fixed member and a companion member mounted on said fixed member for movement toward and away from said fixed member to clamp closing and opening positions, respectively, said fixed member being arranged to receive one of the said two cross elements in fixed relation so as to operatively connect the clamp with said assemblies for movement thereby through a closed path and to receive the other of said two elements in sliding relation so as to enable movement of one of said two elements toward and away from the other element and thereby provide for contraction and extension of the aligned chain sections between said two elements as said sections and the clamp pass around said rear and front sprockets and pass from said sprockets into said lower and upper runs, spring means carried by the fixed member of each clamp and engaging the companion member for closing the clamp so as to hold a book with the back edge thereof protruding beyond the outer end of said clamp, means arranged adjacent said rear sprockets for controlling the closing of each clamp by said spring means when the clamp has entered said lower runs, and means arranged at a further locality of the aforesaid closed path for opening each clamp.

7. A book-clamp conveyor as defined in claim 6, wherein the companion member of each book-clamp is pivotally mounted on the fixed member of the clamp, and including a book-engaging jaw pivotally mounted on said companion member, and means for maintaining said

jaw in parallel relation with said fixed member in all positions that it may occupy with respect to said fixed member.

8. A book-clamp conveyor as defined in claim 7, wherein said means for maintaining the jaw in parallel relation with the fixed clamp member comprises co-operating interconnected parallel arms, one of said arms being immovably connected to said fixed clamp member, and the other of said arms being operatively connected to said jaw.

9. A book-clamp conveyor as defined in claim 6, including rollers journalled on each of the cross elements, and track bars engaged by said rollers for supporting and guiding the lower and upper runs of the chain assemblies for straight-line movement.

10. A book-clamp conveyor as defined in claim 6, wherein the endless chain assemblies are composed of sections of roller chain, and including rollers journalled on each of the cross elements and confined by the connecting links, said rollers projecting above and below the planes of said links and said sections, and track bars engaged by said rollers for supporting and guiding the lower and upper runs of said chain assemblies for straight-line movement, the rear and front sprockets for supporting and driving said chain assemblies being provided with suitable recesses in the toothed peripheries thereof to receive said rollers.

11. A book-clamp conveyor as defined in claim 6, wherein the companion member of each book-clamp is pivotally mounted on the fixed member of the clamp and includes an upper inwardly projecting arm having a roller journalled thereon, and the clamp opening means is arranged to open each clamp before the latter leaves the lower straight run of the chain assemblies, said clamp opening means comprising a normally stationary cam arm engageable by said roller during movement of the clamp along said lower run, said cam arm being mounted for pivotal movement about a horizontal transverse axis and extending rearwardly beyond the front sprockets above and adjacent said lower run, and means for adjusting said cam arm about its pivotal mounting toward and away from said lower run and for holding said cam arm in adjusted position.

12. A book-clamp comprising a fixed upright member having a planar book engaging surface, a companion upright member mounted at the upper end thereof on said fixed member for pivotal movement about a horizontal axis extending parallel with said surface towards and away from said fixed member to clamp closing and opening positions, respectively, a jaw mounted on said companion member adjacent the lower end thereof for pivotal movement about a horizontal axis extending parallel with said surface, said jaw having a complementary planar book engaging surface, and means for maintaining said jaw in parallel relation with the planar book engaging surface of said fixed member in all positions that it may occupy with respect to said fixed member, said means comprising two arms arranged in parallel relation, one of said arms being immovably connected to said fixed member and located co-axially with the pivotal axis of said companion member, and the other of said arms being operatively connected to said jaw and located co-axially with the pivotal axis of said jaw, and a link for pivotally connecting said arms.

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