

July 21, 1953

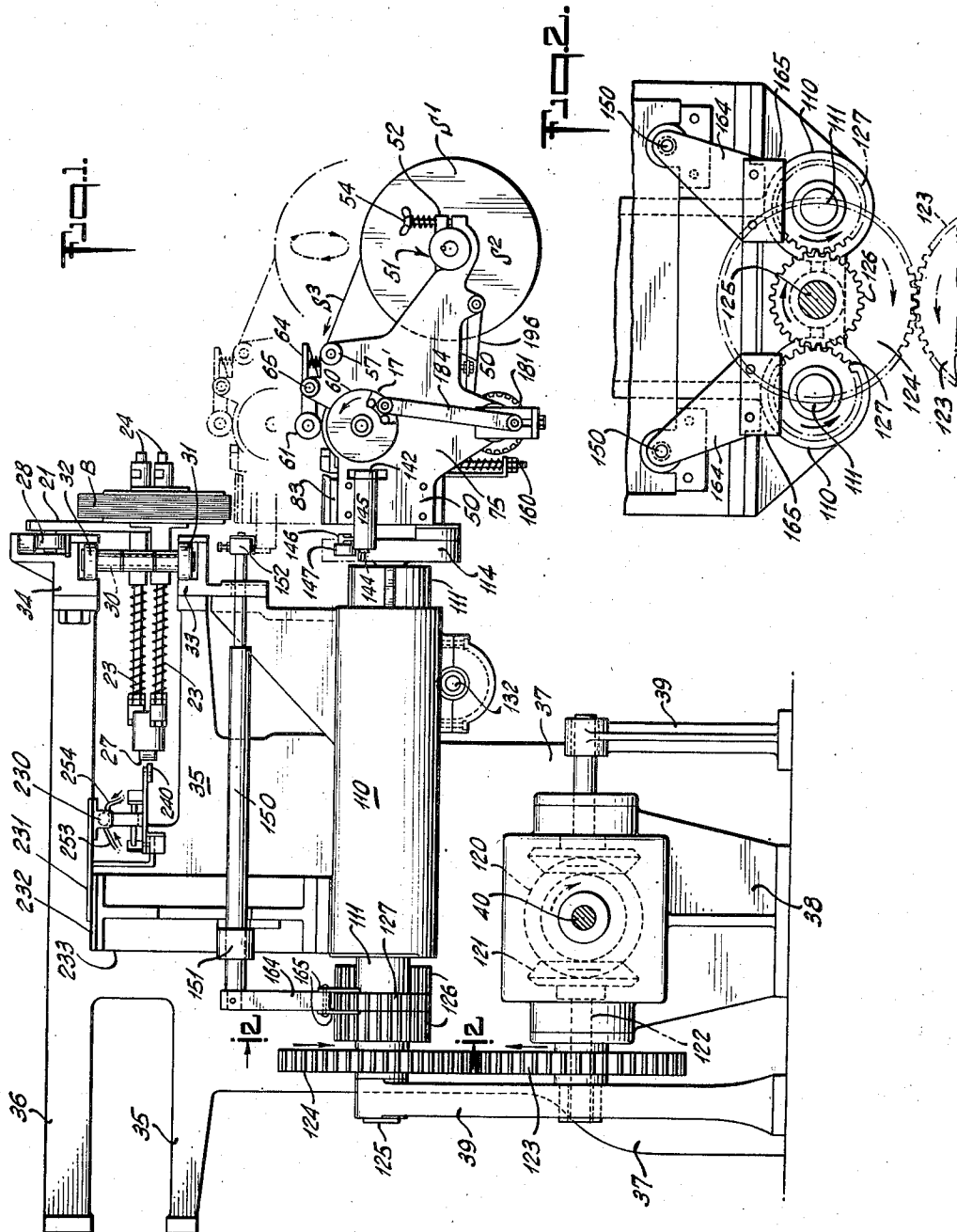
T. B. HAWKES

2,646,104

STRIP APPLYING MECHANISM IN OR FOR BOOKBINDING MACHINES

Filed Sept. 29, 1950

5 Sheets-Sheet 1



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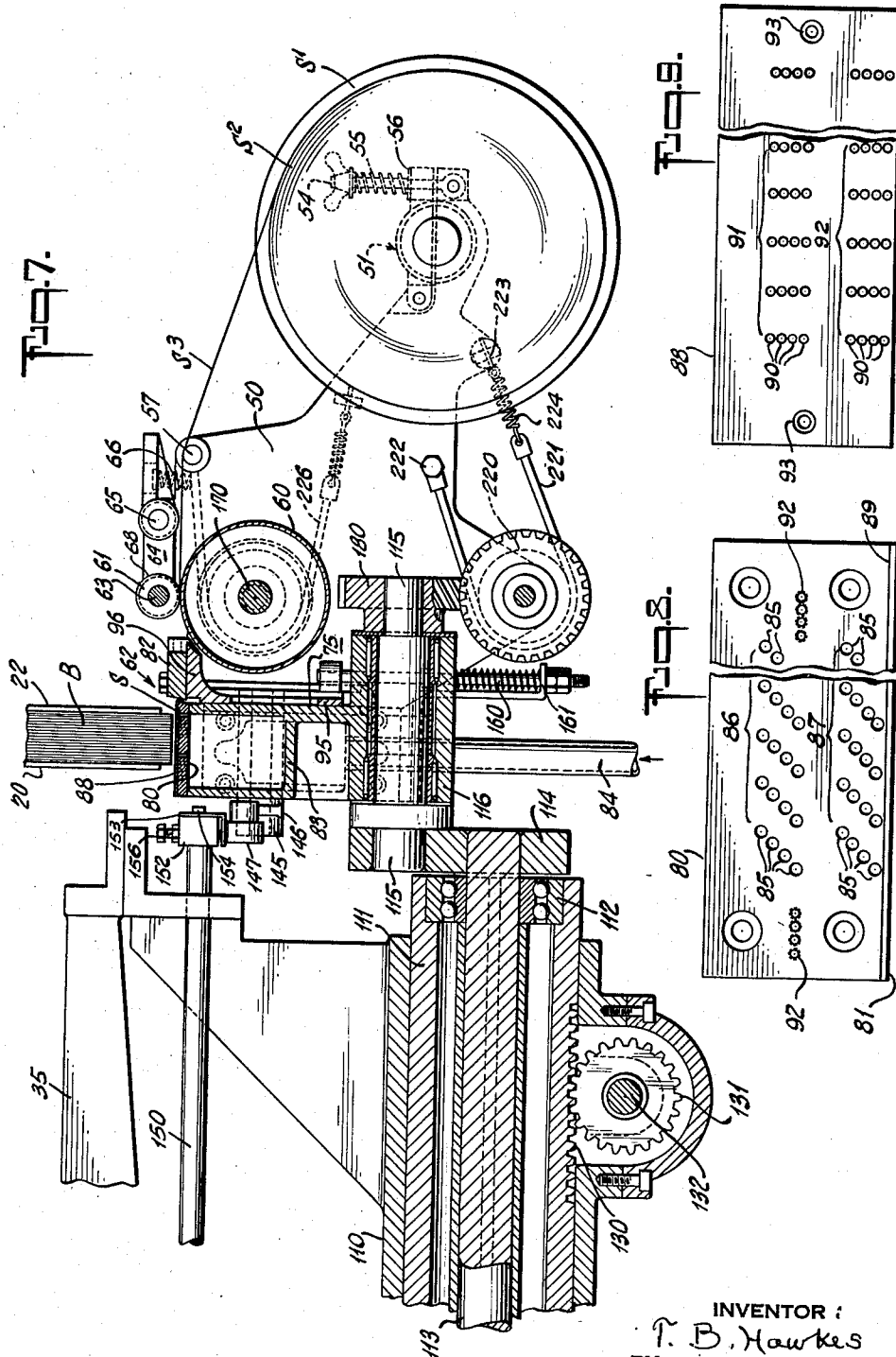
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5 Sheets-Sheet 3



A diagram of a rectangular box divided into two main sections by a vertical line. The left section is labeled '16' and contains a group of 16 circles arranged in two columns of eight. The right section is labeled '32' and contains a group of 32 circles arranged in two columns of sixteen. There are also some circles outside the box, including one labeled '32' at the top left and one at the bottom right.

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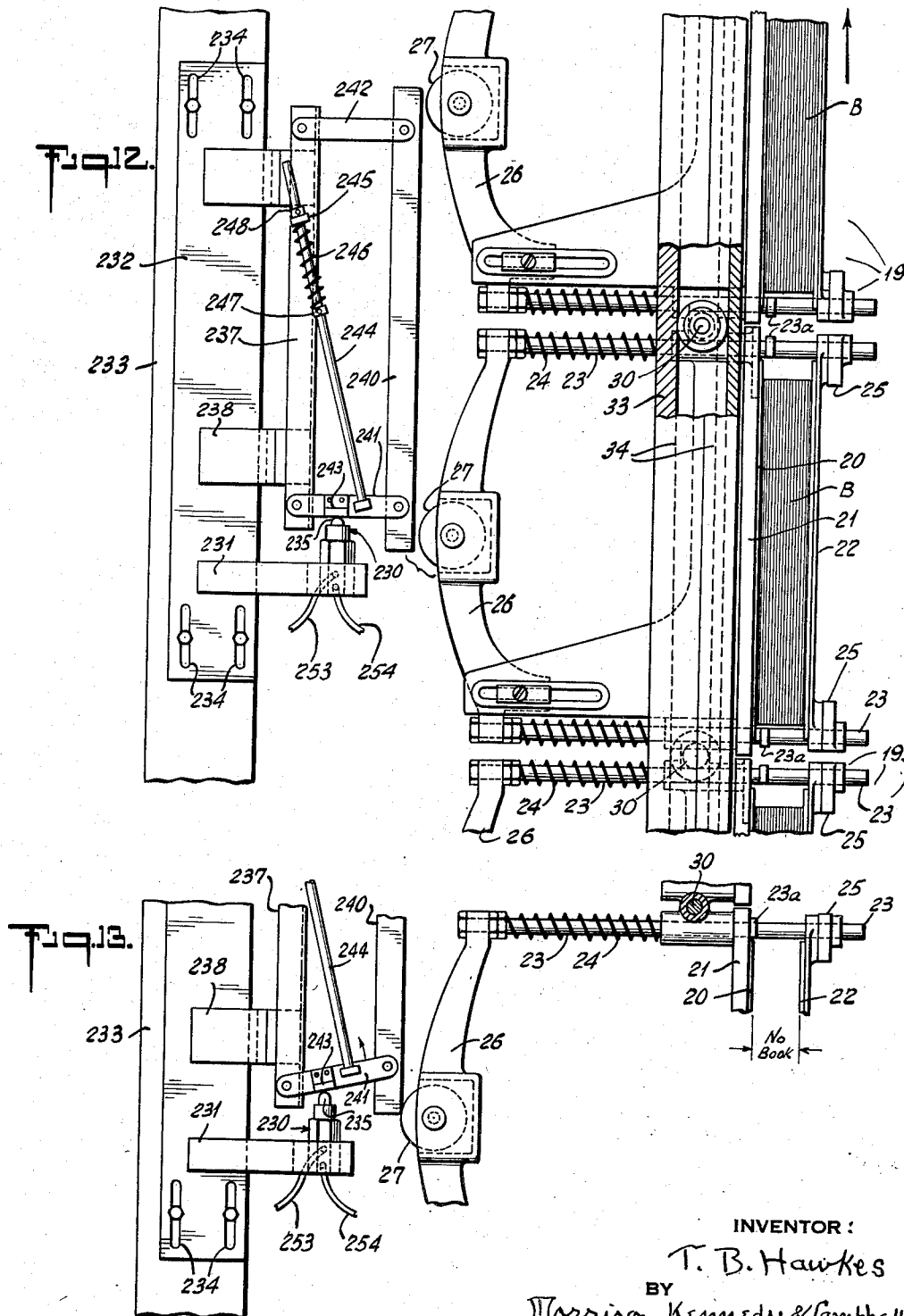
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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,646,104

STRIP APPLYING MECHANISM IN OR FOR
BOOKBINDING MACHINES

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Application September 29, 1950, Serial No. 187,414

31 Claims. (Cl. 154—41)

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This invention relates to the subject of strip applying mechanisms, such as those employed in the manufacture of books, particularly of the magazine type and in connection with automatic bookbinding or covering machines. Machines of this general type are well known and include a strip applying mechanism as one of a sequence of mechanisms, operating to apply to each traveling book, from beneath, a backstrip or so-called "super" of pervious material, such as crash or other woven fabric, strong paper and the like.

In such book machines, the strip applying mechanism is preceded by an adhesive or glue applying means, so that when the strip or super is placed upon the book back, it will adhere, giving strength to the book and permitting the glue to permeate through the strip and to serve for the adherence of another backing element, such as a cover, to the book back. For high output, a procession of books or groups of signatures is caused to travel continuously around an endless path or orbit from mechanism to mechanism for the performance on the book of various operations, which may include trimming, roughing, gluing, strip applying and cover applying and breaking. The applying of strong pervious backstrips to the successive books advancing edge-wise in a train of clamps is of especial value when used with the system of so-called flexible binding, involving no stapling; each book or group of signatures on the contrary being trimmed off at the lower or back edge to expose the individual sheets to the gluing operation, whereby the adhesive may act to penetrate between and bind together these trimmed back edges, the glue thus consolidating the sheets composing the book, and attaching the fibrous back strip thereto, serving to attach all of the sheets to the backstrip, and serving also to attach the cover to the book or magazine. The present invention was designed especially for use in a flexible binding machine.

A number of strip applying mechanisms have been developed in the prior art, these being of one or the other of two general types, the oldest employing mechanical means to apply or impress the strip against the glued book back, which presented an objectionable tendency to smear the glue upon parts of the machine. The other principal type was pneumatic, means being employed to apply suction to hold each severed strip on a liftable support arranged below the book, followed by a reversal so as to deliver a puff of air to force upwardly the strip from the elevated support to the book back. In either case, the cover is applied immediately afterward and then

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pressed to consolidate the book, the strip and the cover. The general object of the present invention is to improve upon the known strip applying mechanisms in various ways, particularly to secure greater efficiency, accuracy and reliability of operation and perfection of product. Further objects and advantages of the invention will appear in the hereinafter following description of an embodiment thereof; the invention consisting in the applying mechanism to be described and in the disclosed matters of combination, construction and detail.

A brief review of selected prior patents indicates the trend of development, it being understood that applicant has retained the use of certain old features, by combining them in novel ways with each other and with supplemental features of novelty.

Bredenberg Patent No. 1,073,324 of 1913 shows a mechanical means to apply the strips to the glued backs, the mechanism containing a fixed and a liftable support (the liftable support consisting of fingers normally occupying slots in the fixed support) together with positioning means, so that each strip, after severing, is brought accurately to the book back, and there caused to adhere, a cover being shortly thereafter applied upon the glued strip and the entirety placed under pressure to shape the product.

Bredenberg Patent No. 1,129,064 of 1915 illustrates the pneumatic principle of applying strips to glued book backs, there being a perforated supporting member upon which, at first, suction or exhaust holds the severed strip in place, a reverse in the air flow then delivering a puff which transfers the strip from the support upwardly to the book; and the gap between the raised support and the book being small so that proper register is easily attainable.

Juengst Patent No. 1,195,926 of 1916 discloses a simple mechanical strip applying device, the crash material being fed from the supply in a narrow width, the same as that of the severed strip, so that the feeding is relative long and endwise accompanying the similar advance of the book, as distinguished from the other plan of employing a wide roll of supply material from which, with short feed, successive narrow strips are fed and severed. This strip of the Juengst patent is fed over a rotary drum, supplying the cover sheet along with the adhering strip. This described prior mechanism could be employed with either intermittent or continuous travel of the books.

The Bredenberg Patent No. 1,248,254 of 1917

follows in general the principles of No. 1,129,064. There is a liftable holder for the pervious strips, this holder rising quite close to the back of the book, whereupon a blast of air is released, impelling the strip across the gap to be laid upon the book back and in registration therewith both longitudinally and transversely.

The companion Bredenberg Patent No. 1,248,252 shows the entire Book Binding Machine and contains a series of diagrams illustrating the successive steps; indicating also the position of the gluing and strip applying mechanisms along the path of book travel. Said patent, therefore, may conveniently be referred to to supply general disclosures as well as some details not fully illustrated in the present application.

Bredenberg No. 1,867,803 of 1932 shows a special mechanism for applying backstrips upon round-backed books in a machine having a following mechanism for backlining such rounded and strip-backed books. This mechanism handles the strips mechanically, without pneumatic action. The strips are provided or fed and severed of a width substantially greater than the book back width, thereby presenting dry margins for handling without danger of glue reaching the handling parts. A liftable carriage has a series of elevated grippers at each side of the book path, by which the strip is placed under stretching tension, with pressure against the book which yields as the rising strip is shaped around the back, the glue squeezing through to stick the strip and the subsequent backlining component.

The accompanying drawings of a preferred embodiment show the basic principles of strip applying and the departures from the prior art which constitute the present invention.

Fig. 1 is a left end elevation of the strip feeding, cutting and applying mechanism of a book-binding machine embodying the present invention and shown with the book conveyor clamps moving in a direction away from the plane of the drawing sheet as said clamps follow a closed horizontal orbit, and with said mechanism in the lowermost position of its bodily moving cycle;

Fig. 2 is a vertical section of the strip applying mechanism taken on the line 2—2 of Fig. 1;

Fig. 3 is an enlargement of part of the view shown in Fig. 1, but showing the strip applying mechanism shifted bodily to the uppermost position of the operative cycle, after the strip cutting phase, and after the absence of a book in the clamp at the strip applying station has been detected and as a result the clutch controlling the strip feed means has been disengaged;

Fig. 4 is a detail partly in vertical section and partly in lefthand elevation of the strip feed clutch drives and the strip cutting devices shown in Fig. 3;

Fig. 5 is a vertical section of the crank drive for the strip feed mechanism taken on line 5—5 of Fig. 3, but shown on a larger scale;

Fig. 6 is a perspective of the book at the instant the individual severed binder strip has been applied to the lower trimmed adhesively covered edges of said book;

Fig. 7 is a vertical section of the strip applying mechanism taken in a plane parallel to the elevational plane of observation of Fig. 1 and along the line 7—7 of Fig. 10;

Fig. 8 is a top plan view of one of the knives employed for cutting the strip material to the proper width, determined by the extent of the short feed of the wide supply material;

Fig. 9 is a top plan view of the valve plate used

in conjunction with the knife shown in Fig. 8 to control the suction and pressure air openings in said knife;

Fig. 10 is an outer side or front elevation of the strip applying mechanism;

Fig. 11 is a vertical section of the strip applying mechanism taken approximately along the line 11—11 of Fig. 3 with certain parts seen in front elevation;

Fig. 12 is a top plan view of several articulated book clamps near the strip applying position and shown occupied by books, and in conjunction therewith a feeler device to detect the absence of books in any of the clamps; and

Fig. 13 is a detail top plan view similar to that of Fig. 12, but showing a clamp near the strip applying position from which the book is missing, this absence of the book in the clamp being sensed by the feeler device, through which are controlled the actions of the applier mechanism.

The books to receive pervious backstrips are indicated by the letter B in Figs. 1, 3, 4, 6, 7 and 12. Each book, in the process of production, consists of numerous sheets, which may be grouped signatures trimmed off at the back to expose the edges of all the sheets. The strips S are shown in Figs. 1, 3, 4, 6 and 7; each having been severed from the supply carried on a spool S'; the wound body S² of the strip material being fed along a stretch S³ extending from the spool to the point where each strip is severed. Fig. 6 shows the temporary condition existing after the strip has been applied to the glued back of the book but before any other backing or cover has been added.

For carrying a procession of edgewise standing books through various operations, an endless series or train of clamps 19 is employed, as in various conventional types of bookbinding machines. Referring to Figs. 12, 13, and others, each clamp 19 comprises an inner or thin fixed clamp plate 20, carried on a heavier bar or edgewise plate 21, and an outer plate 22, between which plates the books are squeezed and held. The outer plate is supported by a pair of rods 23, at the two ends of each clamp, these clamp rods being adapted to slide in and out through bearings provided at the ends of the clamp, and being secured to the ends of said outer plate by releasable locks or latches 25 of conventional construction. On the rods 23, collars 23^a provide stop shoulders limiting the clamp closing action on occasions when the book is missing.

The plan is followed of closing and holding closed each clamp 19 by strong springs 24, a pair thereof thrusting rearwardly upon the two rods 23 and thereby upon the outer clamp plate 22, the springs conveniently surrounding the rods; the full spring pressure thus acting to squeeze and firmly hold the partially made book throughout its travel and the operations upon it. This clamp structure is shown best in Figs. 12 and 13 but also in Figs. 1, 3 and 7.

The clamp includes preferably a quadrilateral frame, of members 22, 23 and 23, completed by a rear cross piece or bridge 26, rearwardly arched and carrying a follower or contact roller 27 adapted to ride on a cam rail (not shown) for clamp opening and closing operations during the delivery and infeed phases. By means of this roller the clamp may be activated to open, by forcible frontward shift of its sliding frame, for purposes of outfeed and infeed of books; or allowed to close upon the book and hold the book firmly by the spring thrust during the operations upon the book.

To describe further the train of traveling clamps, which may have to traverse both straight and curved stretches, they are shown as articulated by upright pivot pins 30, one between each two adjacent clamps, and each pin having a lower runner or roll 31 and an upper roll 32, running or rolling along lower and upper fixed tracks 33 and 34 which extend clear around the travel orbit. See Figs. 1, 3 and 7. The lower tracks 33 are mounted on a series of lower frame brackets 35, and the upper tracks 34 upon upper brackets 36.

General machine cross frames 37 resting on the foundations give support to the brackets 35 and 36 and numerous other parts. A heavy base standard 38 supports the lower shafting etc. Various upright standards 39, tall and short, provide fixed mountings for shaft bearings and for other fixed or movable parts. All actions are derived from a primary shaft 40, known as the cam shaft, which extends centrally the full length of the machine, near the floor, produces the continuous travel of the clamp train, and actuates the gluing, strip applying, covering and other mechanisms.

On an upward extension of the bar or plate 21 of each clamp, Fig. 1, is a roller 28 running on a high track, these rollers taking the weight of the clamp train.

The clamps carry the books in procession continuously through the successive units or stations of the machine, where the books are subjected to the different operations, some of which were above described. At the strip feeding, cutting and applying station, after adhesive has been applied to the trimmed back edge of the book, the continuous strip material S³ from the supply spool S¹ is fed underneath the clamped book and is cut to the proper width to form the individual strip S. This strip S is then applied, as the book travels through this station, to the adhesive-coated book back.

The strip feeding, cutting and applying unit comprises a pair of opposed side frames 50 (Figs. 1, 3, 7, 10 and 11) supporting at their outer ends bearings 51 for the axle of the supply spool S¹. Each of these bearings 51 has an upper cap 52 pivoted with respect to the corresponding lower bearing part 53 to permit the supply spool S¹ to be loaded onto or removed from its side frame bearing supports and yieldably held in operative position by a winged stud 54 threaded into the lower bearing part 53 and passing loosely through said bearing cap. A spring 55 on the stud 54 bearing against the cap 52 supplies the necessary braking action on the spool S¹ and its force can be adjusted through said stud. The bearing cap 52 is desirably lined with friction material, such as leather to prevent overtravel of the supply spool S¹. The frame walls 50 plus a head 83 provide a movable carriage 75 for the unit.

The strip material S³ from spool S¹ passes over a stretcher bar 57 (Figs. 1, 3, 7, 10) supported on and between the side frames 50, through the bite of a pair of superposed lower and upper feed rolls 60 and 61 respectively (Figs. 1, 3, 4, 7) and into the field of action of a strip severing cutting device 62, where the strip S (Fig. 6) of proper width is cut and applied to the adhesively coated edges of the book. The lower or larger feed roll 60 (Figs. 1, 3, 4, 7) extends between the side frames 50 and is constructed and positively driven in a manner to be described. The upper feed roll 61 (Figs. 1, 3, 7, 10) comprises

a shaft 63 supported on bearings in a pair of arms 64 pivoted at 65 and urged into position to press the roll yieldably against the lower feed roll 60 by means of compressed coil or other springs 66. This upper roll 61 is multiple, being made up of a series of endwise spaced collars or sleeves 67 secured to the shaft 63 and carrying a series of rubber or friction rings 68 bearing down upon the under feed roll 60. This shaft 63 is driven from the lower feed roll 60 by a gear 70 (Fig. 10) on said shaft meshing with a gear 71 on the shaft 170 of said lower feed roll, to be described more fully.

The strip cutting device 62 comprises a pair of shearing knives or blades, namely a first knife 80 (Figs. 3, 4, 7, 8, 11) presenting a cutting edge 81, and a second knife 82 movable with respect to said knife 80 for strip cutting action, in a manner to be more fully described. The knife 80 is secured to the upper end of a pneumatic suction-and-pressure head 83 secured to and mounted between the side frames 50 of the strip feeding unit and having its interior connected by a pipe 84 (Figs. 3, 11) alternately to sources of air suction and pressure for suctionally holding the strip material S³ in position while it is being moved up towards the book edge and also while it is being cut to sever each strip S and for pneumatically impelling the severed strip towards the adhesive covered book back.

The knife 80 is in the form of a flat plate and is provided with a system of perforations or ports 85 (Fig. 8) by which communication with the interior of the pneumatic or sucker and pressure head 83 is established. These perforations 85 are arranged as shown, in a manner to permit the air to be sucked into or blown out from the head 83 along two parallel air passages or stream paths, at opposite sides of and equidistant from the centerline of the severed strip S, and to permit the distance between these stream paths or courses to be adjusted. To that end, the air holes or perforations 85 are arranged into two similar opposed series or groups 86 and 87, each group consisting of a plurality of parallel rows of holes 85 (four holes being shown in each row) each row being inclined at a substantial slant, as 45°, with respect to the longitudinal axis of the knife 80. Cooperating with this knife 80 is a valve plate 88 (Fig. 9) seated flatly and snugly upon said knife plate and held in contact against a longitudinal guide shoulder 89 formed by the low flanging of said knife plate.

The valve plate 88 likewise has a system of holes or ports 90 arranged in two opposed series or groups 91 and 92, each series consisting of a plurality of parallel rows of holes 90 (four holes being shown in each row), and each row extending at a substantial angle to the knife plate rows, as at a right angle to the longitudinal axis of the plate and thereby across the respective inclined rows of holes 85 in the knife or plate 80 when in mounted position of said valve plate.

The head casting 83 has rigid extensions to both frame walls 50, these parts providing the floating carriage 75 which supports the working parts of the feeding, severing, impelling and other operating means.

When the valve plate 88 is superposed in its position upon the knife or plate 80, one hole or port 90 of each row in said valve plate will register with a predetermined hole or port 85 in the corresponding row of holes in said knife 80, the holes 85 and 90 which are in register depending on the adjusted longitudinal position of the valve

plate 88 with respect to said knife. Two parallel straight sets of holes will be in communicating register extending along the knife 80 and valve plate 88, the distance between these sets depending upon the longitudinal position of said valve plate 88 with respect to said knife 80. The combined valve plate 88 and knife 80 are arranged underneath the path of the book clamps, in such position that the centerline between the two parallel sets or groups of registering holes 85 and 90 respectively will be directly below the centerline of the back of the book passing thereover, and the strip S cut off from the supply material S³ will be centered with respect to said book centerline. The strip material will therefore during the cutting off action be sucked inward or downward towards the suction head 83 and thus held to the valve plate 88 along two spaced parallel sets or groups of registering holes also centered with respect to the longitudinal centerline of the severed section or strip S of material overlying the knife 80; and later will be blown upward towards the book back along said rows, after said strip section has been severed, to apply said strip section to said book back. The strip section will therefore be first firmly held suctionally in applying position before and after cutting, thus properly determining its position while being pneumatically impelled, by a puff of pressure air, against the book back, as Fig. 6 well shows.

It is desirable to be able to provide various combinations of perforations or ports in the knife and valve plates 80 and 88, e. g. for various widths of severed strip S, and to supplement the bodily adjustments of the applier for changes of book thickness. As so far described an adjustment of the cooperation of the ports or holes 85 in the knife plate and 90 in the valve plate is available by which the position of the valve plate longitudinally upon the knife plate determines the active or open port-pairs (one port 85 with one port 90) which are in service, the other being idle or closed, as already indicated.

Two groups of ports (86, 87 and 91, 92) are shown in each plate, each group comprising numerous transverse rows and these rows being at different angles to the centerline, as 45° for the knife plate and 90° for the valve plate; so that the longitudinal positioning of the latter in effect selects the active port-pair, namely, one of each transverse row, e. g. the longitudinally aligned far line thereof. When these ports in said line are so rendered active, the three nearer lines of ports are idle, but by shifting endwise the valve plate any one of the four longitudinal lines of ports can be rendered active.

Therefore, in any of the adjustable positions of the plates there will be only a single selected longitudinal line of active or open ports in each of the two port groups 86 and 87 or 91 and 92. To change this selection is like transversely shifting the active holes of each plate, thus altering the effective centerline of the two lines of active ports relatively to the centerline of each plate; and thus obviating a difficult transverse bodily adjustment of the plates or of the pneumatic chamber to bring the pneumatic strip-handling means to a position wherein the pneumatic action is balanced or symmetrical with relation to the severed strip itself. In other words, when the strip is pneumatically held, or is blown across to the book, this action should be symmetrical to the sucking or blowing action; and the described adjustment as between plates

80 and 88 permits this, with approximate but sufficient accuracy.

Means facilitating the described adjustment are shown. The knife plate 80 has a selective series of threaded holes 92, at least at each end, these being at least four in number and in longitudinal line. Complementarily the valve plate has at each location at least one hole 93. When each hole 93 is registered with a selected one of the holes 92, one of the four settings is produced, and a stud or screw can be passed through 93 into 92, to fix the adjustment; or any other attaching or clamping means can be used for the purpose.

The head 83 (Figs. 3, 4, 7, 11) has pneumatic communications by which its chamber is connected to sources of air pressure and suction. The suction source is connected after a portion of the strip material S³ has been fed from the spool S¹ to position over the knife 80, and it is thereby maintained in this position while said knife and associated parts are moving upwardly toward the book during a cycle of operation to be described and while the strip material is being sheared off to form the individual strip or super S. The head 83 disconnected from the suction and promptly connected to the source of pressure after the cutting-off operation and while the individual strip S is very near to the book back, thereby to impel pneumatically said strip into registered position against the book back. The general manner in which and the valve means by which these alternate suction and pressure connections to the head chamber are effected form per se no part of the present invention and may be accomplished in one or another of the ways previously known e. g. as indicated in some of the prior art patents referred to.

The second shearing knife 82, being preferably the one which is movable with respect to the other knife 80, is supported on a shiftable block or slide 95 (Figs. 4, 7, 11) which is movable along the outer face of the suction and pressure head 83 and presenting a table 96, over which the strip material S³ is intended to advance in its passage towards the severing device 62, and a pair of bracket extensions 97 at each end having seats for the ends of the knife 82 a little above said table 96 to define a flat space or gap 98 between said knife and said table through which the strip material S³ is threaded and advances to overlie the knife 80. Studs 100 fixed into the bases of the bracket extensions 97 pass through elongated holes in the knife 82 to hold the knife in position while permitting it to be shifted for adjustments towards and away from the knife 80, and set screws 101 are provided in the back parts of these bracket extensions 97 to serve as means by which the knife 82 may be adjustably moved to allow for the proper setting of said knife 82, and to compensate for wear of said knife.

The strip feeding, cutting and applying unit described is cyclically operated to move the severed strip S upward towards the exposed back of the continuously traveling book being operated on and thence along in the same direction of travel as the books, and at substantially the same speed as the books while the strip is being pneumatically applied to the book; also thereafter to move the unit downward away from the book path after the strip has been applied, and rearward again in readiness for the next strip feeding, cutting and applying cycle in connec-

tion with the immediately succeeding book and strip.

The means for accomplishing this cyclic movement of the strip applying unit comprises the following illustrative elements. A pair of fixed brackets 110 (Figs. 1, 2, 3, 7, 10, 11) is shown of cylindrical form, being secured to the frame structure of the machine and each supporting a crank sleeve 111. The ends of this crank sleeve 111 carry bearings 112 for a crankshaft 113. At the outer end of each crankshaft 113 is the hub of a crank arm or web 114, at the free end of which is a crank pin 115. The suction and pressure head 83 has integral or otherwise rigid therewith two bearings 116 turning on the two crank pins 115.

Said twin crank arms 114 are of equal length and always parallel, and the two crankshafts 113 are parallel and at the same horizontal level, so that the resulting double crank actuating mechanism operates as a parallel motion device serving to move the strip feeding, cutting and applying unit around a circular path or orbit, while maintaining the different positions of each element of said unit in said orbit parallel to each other. In other words the head 83 and other members of the applying unit move circularly in pure translation, the strip supporting parts at the top of the orbit advancing with a component in the direction of book travel, being thus coordinated with the book travel at the time the strip is transferred from the applying unit to the traveling book. The knives 80 and 82, will therefore always remain horizontal or parallel to the book back, while the strip material S³ and the individual severed strip itself will travel in one cycle in a circular path upward and then forward with the book while remaining parallel to the book back. Therefore the strip will be moving tangent to the movement of said book at the moment of reaching the upper peak of the unit orbit, at which moment, and on the run, the severed strip S is being pneumatically impelled and transferred accurately by air blast towards and to the closely adjacent book back having approximately the same speed; whereafter the crank-carried parts, including a general carriage 75 and the operating parts carried thereby, will move ahead and downward from the book and retractingly to complete the strip feeding, cutting and applying cycle.

The pneumatic head 83 is a main part of the bodily shiftable parts which constitute the applicator unit, and this head and other parts movable with it may be considered collectively as the "carriage," 75, of this unit, partaking of the double-crank-induced orbital motion which is utilized in the placing of each strip upon its book. Other parts of the applicator carriage, in the nature of frame parts, comprise the side frame walls 50, 50, and any cross-braces and spacing rods therebetween, these frames or walls being rigidly attached to the chambered head casting 83; and these and other carriage parts giving support to various elements including some already described. The parallel crank motion of the carriage is primarily to put the strip and the strip holding plates 80 and 88 through the circular motions of advance and retraction and elevation and lowering which, with the pneumatic holding and propelling actions, form an important feature of the present invention.

The carriage-operating crankshafts 113 are driven continuously in unison from the longi-

tudinal main cam or drive shaft 40 through a gear train comprising a bevel gear 120 (Fig. 1) on said drive shaft meshing with a bevel gear 121 on a countershaft 122 supported in bearings in frame standards 39. A spur gear 123 on this countershaft 122 meshes with a gear 124 (Figs. 1, 2) on a shaft 125 supported in bearings in frame standards 39. This shaft 125 carries a pinion 126 meshing on opposite sides thereof with two similar pinions 127 secured to the crankshafts 113 respectively, to drive said two crankshafts continuously in the same rotary direction for the purposes already set forth.

The strip feeding, cutting and applying unit may be adjustably shifted frontwardly or rearwardly with respect to the book clamps to compensate for variations of book thickness. For that purpose, the crank sleeves 111 have rack teeth 130 (Figs. 1, 3, 7, 10) meshing with respective pinions 131 coupled together by an adjusting shaft 132 supported in suitable bearings. One projecting end of this adjusting shaft 132 is formed with a squared or shaped head 133 to receive a suitable hand crank. By turning this adjusting shaft 132, the strip feeding unit may be moved transversely of the direction of travel of the books, so that the center line of the two opposed sets of strip impelling air holes in the knife 80 can be adjusted to rest directly underneath the center line of the books being operated upon, whatever the widths of the book backs.

Since the crankshaft pinions 127 are axially adjustable frontwardly and backwardly, i. e. transversely of the direction of book travel, as a result of the described adjustment of the strip feeding unit, the center gear 126 driving said pinions is shown of considerable width, while as seen in Fig. 1, said pinions 127 are comparatively narrow, to maintain continuous mesh between said center gear and said pinions, notwithstanding that said unit is movable adjustably in and out, as described.

For actuating the knife 82 up and down with respect to the knife 80, for the strip severing action, the slide or stock 95 carrying said knife 82 has secured to its ends between the side frames 50, racks 140 (Fig. 11), each presenting rack teeth along its exposed outer edge. A segmental or oscillating pinion or gear 142 (Figs. 3, 11) at each end of the strip-feeding unit, the same extending through a slot 143 in the corresponding side frame 50 and meshing with the corresponding rack 140, is secured to one end of a shaft 144 which rocks in a bearing 145 on said side frame. The other end of each shaft 144 carries one end of an arm 146, the other end of which mounts a roll 147. Through these rolls and the rockshaft the rack and pinion devices are operated, to lower knife 82 for severing the strip and to raise it to initial position.

A knife depressor device or trip for engaging the two rolls 147, as the strip feeding unit approaches the limit of its upward movement, and for moving thereby said rolls downward, comprises a pair of parallel rods 150 (Figs. 1, 3, 7, 11) supported in slide bearings 151 and carrying at their outer or front ends a bar 152. A depressor shoe 153, shown in the form of an angle, is adjustably mounted (Fig. 11) on the bar 152 by means of studs or screws 154 passing through elongated upright slots 155 in the vertical flange of said shoe angle 153 and threaded into said bar 152. Adjusting set screws 156, threaded into the bar 152 and impinging on to the horizontal flange of the shoe angle 153, serve when turned to move

the angle downward to a selected position depending on the proper timing for the strip cutting action, so that the strip S will be severed slightly before the suction in the chamber 83 is cut off and the air pressure substituted.

In the operation of the strip cutting device 62, as the carriage 75, with the strip feeding, cutting and applying unit thereon, is moving upward through the double-crank parallel-motion mechanism described, and as these reach the tangential high point of their circular movement, the follower rolls 147 engage the depressor shoe 153 and cause said rolls to move downward. This movement is transmitted to the segmental gears 142 through the arms 146 and causes the racks 140 meshing with said gears to be slid downward. This operation depresses the knife 82 and severs the strip stretch S³ where it extends across the cutting plane between the knives 80 and 82, thus leaving an individual strip or super on the perforated lower or relatively fixed knife plate 80. The knife 82 is then returned upward to its operative initial position by means of spring-loaded rods 160 (Figs. 1, 3, 7, 11) passing with sliding fit through respective guide brackets 161 secured to the side frames 50 and affixed at their upper ends to the stock or slide 95 carrying said upper knife 82.

The knife depressor rods 150 are adjustably movable horizontally endwise with the bodily transverse adjustment of the strip feeding unit. For that purpose, these depressor rods 150 have secured to them at their inner or back ends depending arms or symmetrical brackets 164 (Figs. 1, 2), each of these carrying a pair of spaced plates 165 flanking the corresponding crankshaft pinion 127; so that upon the adjusting shift of the strip feeding unit through the turning of the adjusting shaft 132, as previously described, the resulting axial shift of the crankshaft pinions 127, active through 164 causes corresponding endwise movement of the depressor rods 150. This serves to maintain the knife depressor shoe 153 always in a position directly above the rolls 147 irrespective of the sideways adjustments of the strip feeding unit.

The lower feed roll 60 is operated to feed cyclically the strip material S³ for the successive books as long as a book occupies each clamp as it comes to the strip feeding, cutting and applying station. When an empty clamp approaches, the gluing operation is prevented, and means will be below described to prevent feeding and severing of the strip material in the absence of a book. This means is controlled to skip a strip feeding cycle automatically in the absence of a book, which condition is detected at said station by a feeler mechanism. For operating the lower feed roll 60 in the manner described, it is secured to a shaft 170 (Figs. 3, 4, 10) suitably journaled in bearings in the side frames 50 of the carriage 75. At one end of the shaft 170 outside of the adjacent side frame 50 is a one directional clutch 171 of any suitable construction, used to permit advance feed but prevent back feed of the strip material.

This upper clutch 171 is shown as comprising a clutch drive member 172 in the form of a drum loosely mounted on the shaft 170 for oscillatory rotation thereabout, and surrounding or housing a clutch driven member 173 keyed or otherwise made fast to said shaft, this being the shaft on which also the lower feed roll 60 is fast. This driven element 173 peripherally carries a series of tapered recesses or cam slots 174, each containing

a ball or roller 175. These rollers or some of them, are adapted to be wedged, with an aiding spring 176 if desirable, between the clutch elements 172 and 173 when the loose clutch drive

element 172 is being turned counterclockwise (Figs. 3 and 4), and to drive thereby the feed roll shaft 170, and consequently the lower feed roll, in strip feeding direction. The driven lower feed roll 60 cooperates with the upper roll 61 in the driving action, and the upper roll 61 functioning also to press the material against the periphery roll 60. These clutch rollers 175 are adapted to fall into inactive position when the clutch drive element 172 of the one-way clutch 171 is rotated in clockwise direction (Fig. 3) to interrupt transmission to the driven clutch element 173, thus terminating each strip feed action.

The clutch drive element 172 is rotatably oscillated continuously and loosely upon the lower feed roll shaft 170 as long as there is a book in each clamp at the strip applying station. The mechanism shown for oscillating this clutch drive element 172 comprises a first spiral gear 180 (Figs. 3, 4, 7, 10) secured fast to an extension of one of the crank pins 115 and meshing with it a complementary second spiral gear 181 supported on a low clutch shaft 182 for rotation therewith. This shaft 182 is journaled in bearings in the side frames 50, and it is connected to the spiral gear 181 through a second or lower clutch 183, being a one-revolution clutch, well below the upper or one-direction clutch 171. Between the shaft 182 of the lower clutch and the drive element 172 of the upper clutch 171 is a feed connection shown in the form of an arm, rod or link 184. As the crankshaft 113, rigidly carrying the spiral gear 180, rotates continuously, this spiral gear also rotates continuously about its axis, while remaining in mesh with the support portion of the gear 181 secured to the driving part of the clutch 183. This causes the spiral gear 181 and in turn the driving part of the clutch 183 to rotate continuously.

The clutch 183 is of the one revolution type and is operatively closed or engaged when a book is present in the clamp at the strip feeding, cutting and applying station, and is disengaged when the absence of the book in the clamp is detected at this station. This clutch 183 is shown of the Hilliard type, which is well known and which, therefore, need not be described or shown in greater detail, and which comprises an outer driving sleeve 190 (Fig. 10) that is loose on the clutch shaft 182 for rotation thereabout and is secured to the spiral gear 181 to be directly driven therefrom continuously, and comprises an inner driven hub (not shown) keyed or otherwise affixed to the shaft 182. In such a clutch 183 there are rollers (not shown) which are held in position in a cage (not shown) between a race in the outer driving clutch part or sleeve 190 and a cam (not shown) on the periphery of the inner driven clutch part or hub, thus to furnish the driving contact between said parts. The clutch rollers are moved into or out of driving contact by action of the cage which is controlled by a trip plate 191 connected with the cage through a leverage and carrying a trip pin 192. A collar 193 keyed or otherwise affixed to the clutch driven shaft 182 pivotally carries the trip plate 191, with a spring 194 placed between said collar and said trip plate that normally urges said trip plate into position about its pivotal support with respect to said collar to move the clutch rollers through the cage into driving contact between

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the outer and inner clutch parts. A trip lever 196 (Figs. 3, 4, 10) pivotally mounted at 197 upon one of the side frames 50 is supported in position for its hook or latch 198 to contact the lower clutch trip pin 192 when the clutch 183 is to be disengaged. While the trip lever 196, or its hook end 198, is out of contact with the clutch trip pin 192, the clutch 183 is engaged and the clutch shaft 182 is being continuously driven through said clutch 183. When the trip lever 196 is dropped into engagement with the clutch trip pin 192 in response to the detection of the absence of a book in the clamp at the strip applying station, as will be more fully described, the driven shaft 182 of clutch 183 continues to rotate, but through a very small angle only sufficient to release the clutch 183. During this period, the trip plate 191 swings or turns on its pivot support relatively to the collar 193, rotating thereby the cage with respect to the inner clutch part of 183 and forcing the clutch rollers out of driving contact. The clutch 183 remains in released position as long as the trip lever 196 or its latch 198 is in contact with and holds the trip pin 192. When the lever 196 is withdrawn again, the spring between the trip plate 191 and the shaft collar 193 snaps said trip plate again into driving position and the clutch 183 picks up the load without any slip or lag or shock.

The clutch 183 is of the one-revolution type, so that the disengagement of said clutch is effected in one predetermined position of the feed roll 60, as is also the re-engagement thereof. This action by the lower clutch 183 stops the oscillation of the upper clutch drive shaft 170. This determines the stopped position of the feed roll 60, namely, is its position just before the strip material S³ forward edge has been moved beyond the knife 82 towards and above the knife 80. The upper clutch thus acts to suspend for the period of one revolution or cycle the strip feeding operations.

The transmission from the driven part 191 of the lower clutch 183 to the driving part 172 of the upper clutch 171 includes the upright feed arm or link 184 (Figs. 3, 4, 5). The upper end of this link or arm 184 rotatively embraces a pin or pivot 200 mounted on a plate 201 rigidly secured to the end wall of the drive clutch loose drive element 172 of the upper clutch 171.

The lower end of the feed arm or link 184 is connected to the driven shaft 182 of the lower clutch 183 by means of a crank mechanism or device adjustable to vary its throw. This adjustable mechanism comprises a crank 210, Fig. 5, secured to the shaft 182 and having a guide-way 211 for a block 212 carrying a crank pin 213 rotatively engaged by the lower end of the feed link 184. A radial screw 214 journaled in a bearing plate 215 secured to one end of the crank 210, and threaded into the block 212 serves to adjust the radius and throw of the crank pin 213.

As the lower clutch shaft 182 is continuously driven in one direction through the engaged lower clutch 183, the driving part 172 of the upper clutch 171, connected to the feed roll 60, is oscillated to and fro in an arc. During the counter-clockwise rotative throw and phase of the driving part 172 of the upper clutch 171 (Fig. 4), the feed roll 60 is driven in the same counter-clockwise feed direction, and the strip material S³ is thereby fed toward the left in Fig. 4 and therefore towards the perforated supported knife 80. During the return or clockwise rotation or swing of the driving part 172 of the upper clutch

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171, coinciding with the strip cutting phase, this clutch, being unidirectional, is released from the drive, so that the feed rolls and strip remain stationary, thus preventing backfeed.

To prevent overrun of the lower feed roll 60, both when it is stopped regularly during each cycle, and as well upon the detection of the absence of a book in the clamp at the strip feeding station, brakes or other retarding devices are employed. As an example, the driven shaft 182 of the lower clutch 183 carries a brake drum 220 (Figs. 3, 10) around which, to an ample extent, as partially, is wound a flexible brake member or band 221, shown in the form of a leather belt or strap having its ends anchored at 222 and 223 to one of the side frames 50 and tensioned by a spring 224. The upper clutch feed roll shaft 170 similarly carries a brake drum 225 around which is partially wound a spring-pressed brake band 226 likewise anchored at its ends 227 and 228 to one of the side frames 50.

For sensing or detecting the absence of a book from any clamp, at the strip feeding station, or approaching it, there is provided an operating control member 230 (Figs. 1, 12, 13) which for example is mounted on a transverse fixed bracket 231 secured to a fixed longitudinal plate 232 which is adjustably connected to the top of a frame piece 233 by means of elongated slot-and-stud connections 234, thus to adjust the proper position of the control member 230. This control member has a spring-pressed push button, tappet, plunger or other mechanical contact 235 operated by a feeler or detector means so that the absence of the book prevents feed.

The feeler mechanism is actuated from the clamp or its rolling contact 27 and is shown in the form of a parallel motion mechanism comprising a longitudinal fixed bar or bracket 237 connected to the plate 232 by transverse brackets 238 on which is mounted the feeler element, finger or bar 240 parallel to said fixed bar 237 and to the book travel path, and connected to the bar or feeler 240 by means of a pair of substantially parallel links 241 and 242 of substantially equal length. The link 241 has a mechanical contact or shoe 243 shown in the form of an angle piece connected to the link, this being adapted to engage the complementary contact consisting of the push button, tappet or plunger 235 of the control member 230 thus to displace and force the latter inwardly against the resistance of an internal restoring spring (not shown) which retains the contact of shoe 243 on said plunger 235 during normal operations. The feeler which operates the strip feed control may do so through any sort of connections, such as mechanical combined with pneumatic, as illustrated or by hydraulic or electromagnetic devices.

The feeler mechanism, which is normally inoperative and maintained in that position, represented by the rectangular relationship shown in Fig. 12, by means of a resilient thrust means, shown as a spring-loaded rod 244 having one end pivotally connected to the link 241 and the other end slidable in a slide bearing 245 pivotally mounted on the fixed bar 237. A spring 246 on the rod 244 acts at one end against a collar 247 on said rod and at its other end against the slide bearing 245 to urge the feeler mechanism to its normal rectangular shape or position shown in Fig. 12. Another collar or stop-piece 248, on said rod, in its abutting engagement with the slide bearing 245 acts as a limiting stop for the rod 244.

In normal operating position, when the clamps traveling past the feeler mechanism described are all occupied by books, the follower rollers 27 carried by the book clamps are located in retracted position so that the rolling contact clears the feeler bar 240, as in Fig. 12, so that the feeler mechanism remains in the rectangular or normal position of Fig. 12, and so that the tappet, button or plunger 235 of the control member 230 remains in its inwardly thrust position held by the shoe 243 on the link 241 as shown. The strong spring 246 overcomes the controlling spring, thus to retain the Fig. 12 position.

In the absence of a book in a clamp, Fig. 13, the outer or front clamp plate 22 is free to move inward along with the clamp rods 23 by the action of the clamp-closing springs 24, so that the follower roller 27 on the clamp under consideration will take a location inwardly from its normal position, as shown in Fig. 13. Under these conditions, the roller 27 on this clamp, being shifted inward due to the empty clamp, will engage and make contact against the feeler bar 240, as the clamp advances into the strip feeding station, and will move this feeler bar endwise with the traveling clamp. This will cause links 241, 242 to swing, and the link 241 will swing away from the control member 230, releasing the depressed button 235. This link will continue to remain in this displaced position, during the time the roller 27 rides along the length of the feeler bar 240. The control member 230 will thereby be released, becoming active under the action of its internal restoring spring. The described feeler-caused release of the control member 230 sets into operation a mechanism which acts in the way already described to lower the trip lever 196 of the lower clutch 183, thus shifting it into position to engage the trip pin 192 of that clutch, and to disengage thereby said clutch, so that the operation of the upper clutch and of the feed roll 60 is interrupted.

It should be noted that the feeler bar 240 is advantageously of such length, see Fig. 12, as to span two rollers 27 of consecutive clamps, so that a series of successive empty clamps will operate to maintain the feeler bar continuously in displaced position and the control member 230 thus continuously closed, to prevent strip feed, thus minimizing wear of the entire train of parts from the bar 240 to the feed rolls 60, 61.

The trip lever actuating mechanism may take any suitable form adapted to effect the down and up swinging of the lever. In the specific form shown, this mechanism comprises an upright pneumatic cylinder 250 (Fig. 3) which with its piston provides a motor device, adapted to actuate the trip. Specifically the device may be a depending cylinder of the so-called Schroder type, supported above by a mount 251 on one of the side frames 50 of the strip applying unit or carriage 75. The cylinder has a piston with a depending piston rod 252 whose lower end is connected, preferably directly, to the trip lever 196. The lifting and lowering piston movements are controlled by the control member 230 so that the feed of strip material is controlled by the train which includes the cooperating clutches. For the purposes stated the controller constitutes a pneumatic valve, having an inlet connection 253 as a tubular passage from an air pressure source or vessel, and an outlet connection 254 connected to the bottom of the cylinder 250, that is, below the piston. A spring 255 acts on the piston rod 252 to urge it downward into position to shift

the trip lever 196 into trip pin engaging position. When a book is missing the feeler 240 acts on the controller or valve to uncouple and vent its connections 253, 254 thereby to allow the clutches and feed rolls to become inoperative, and vice versa.

During the normal operating conditions shown in Fig. 12, the valve 230 which may be of the "Ross" pilot type is opened by the shoe 243 on the link 241 of the feeler mechanism and air under pressure is delivered to the cylinder 250 through the air connection 253 and 254, so that the piston in said cylinder is raised and the trip lever 196 is raised out of disengaging contact with the trip pin 192 of the lower clutch 183. When the absence of the books in the clamps is sensed at the strip feeding station as shown in Fig. 13, the control valve 230 is released and this shuts off pressurized air to the cylinder 250 and opens the air connection 254 to the atmosphere. This operation causes the piston to move downward under the action of the spring 255 and the trip lever 196 to move downward into position to engage the trip pin 192 when it reaches the catch end of said lever and to interrupt thereby the feed of the strip material S³.

Instead of pneumatic means described for operating the trip lever 196, other well known forms of electrical, mechanical or hydraulic devices may be employed for the purpose. For example, the cylinder 250 can be replaced by a solenoid and the control member 230 may take the form of a spring-pressed microswitch in the circuit of said solenoid.

Operation

Although the operation of the strip-applying mechanism has been hereinabove largely explained it may be summarized as follows.

As the successive books are moved by the conveyor clamps horizontally advancingly along their travel path, they are subjected to successive operations, including some or all of the following trimming, roughing and gluing; the books so prepared being then carried successively into the field of action of the strip apply mechanism, including feeding, severing and placing each strip on its book; thereafter applying to each book a cover, and breaking the cover. The strip unit mechanism is carried on the supporting carriage 75, which moves in translation around a curved orbit in a vertical plane, below the book, thus to carry the perforated support and the strip thereon upwardly, and advancingly with the corresponding book but closely below it and, after air pressure transfer from support to book, the carriage shifts downwardly and back to original position for continuous repetition.

As the main or cam shaft 40 (Fig. 1) is rotating continuously, the pair of crankshafts 113 (Figs. 7, 10, 11) designed to give the carriage its orbital motion, are also rotating continuously, and their rotation is used to cause the strip feeding, cutting-off and applying means, including the supply spool S¹, the feed rolls 60 and 61 and the severing device 62, to move as a unit, based on carriage 75, and around the orbit thereof by means of the double-crank parallel motion, which remains parallel to itself along the vertical curvilinear or circular orbit. In this orbit, as explained, the entire strip mechanism moves upwardly and forwardly and towards the backs of the traveling books, so that when said mechanism reaches the peak or top level of its upward movement, in close proximity to said book edges,

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as shown in Figs. 3 and 7, it travels momentarily in a direction parallel to and at the same speed as the clamps and books. The entire mechanism then continues forwardly while swinging downwardly from this peak position and then rearwardly and downwardly to the lowermost position shown in full lines in Fig. 1. The entire mechanism then completes its return movement by moving from this lowermost position of Fig. 1 rearwardly and upwardly.

As a book in a clamp, with glue applied to its preferably trimmed edges, reaches a strip applying station, the clamp roller 27, clearing the feeler bar 240 as shown in Fig. 12, will permit the control valve 230 to be operated under the action of its released internal spring, so that air under pressure is being delivered by the connection 254 to the pneumatic cylinder 250 (Fig. 3). The trip lever 196, under the action of the resulting air pressure in the cylinder, is held in its raised inactive position (not shown). The lower feed clutch 183 (Fig. 4) is therefore engaged and operative, and as the double crank parallel motion operates to move the entire mechanism orbitally as described, the output shaft 182 of said clutch 183 is rotated continuously through the spiral gears 180 and 181 by reason of the orbital movement of the entire strip mechanism. This causes the strip feed lower roll 60 to be driven intermittently counterclockwise (Fig. 4) in strip feeding direction from the output lower clutch shaft 182, through the intermediate feed bar 184 and through the one directional upper clutch 171. This in turn causes the upper feed roll 61 to turn intermittently through the intermeshing gears 70 and 71 (Fig. 10). Each feeding movement of the feed rolls 60 and 61 advances the strip material S³ from the spool S¹ through a predetermined distance, corresponding to the desired width of the individual strip S, usually somewhat greater than the book back width; and so causes the end margin of the strip material S³ to be laid each time over the perforated valve plate or pneumatic support 88 (Fig. 4), overlying the knife 80.

The feeding of the strip material begins after the previous strip has been cut off and applied to the book, and may occur even while the entire mechanism is being moved in its orbit downward away from the line of travel of the book edge; but the feed should not commence for a given strip until after the corresponding clamp has passed the detection point for missing books. While the entire strip mechanism on carriage 75 is being moved in its orbit upward and forward toward the strip transfer or peak position, the oscillating feed arm or link 184 is moving downward but this clockwise oscillating movement is not transmitted to the feed roll 60 because of the one-directional character of the clutch 171 connected to said feed roll, so that no feeding takes place during this phase. To retain the strip material S³ on the knife 80 in its registered position against displacement while it is being moved upward, the head 83 supporting said knife is maintained under suction, supplied from a conventional suction tank and valve through air pipe 84 to the pneumatic chamber in head 83; to be reversed by means of a pressure tank and valve, all conventional and timed with the strip operations.

As the entire mechanism approaches the upper limit of its orbital movement, with substantially tangential motion for a moment, the rollers 147 engaging the knife depressor shoe 153 cause the segmental gears 142 (Fig. 11) through their mesh

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engagement with the racks 140 to depress the knife 82. This shears off the strip S upon the knife 80 and as the entire mechanism completes the rising phase of its orbital movement, the suction in the head 83 pulls against and holds onto the severed strip against displacement.

As the entire mechanism reaches the peak of its upward movement and while the severed strip S is in close proximity to but out of contact with the book back, the suction is automatically vented while the air pressure is automatically turned on within the head 83 at exactly the correct point of time, this causing the strip to be impelled upward by the puff of air in register upon the book back for attachment to the glued back. The orbital movement of the carriage 75 and entire mechanism thereon and the movement of the books are so correlated that the strip applying operation is effected at the instant that the strip reaches proper registry with the book back to which it is to be applied. The book with the strip applied thereto continues its operation, while the entire mechanism completes its cycle in the manner described. As shown, the radius of the crank pins 115 is such that at the uppermost or tangent part of the orbital path the forward speed of the carriage and strip holder is substantially identical with the book travel speed; thus minimizing error in making the strip transfer across the short gap from holder to book.

If the clamp entering the strip applying station has no book therein, then the feeler bar 240, sensing this condition (Fig. 13) causes the control member 230 to be closed thereby to shut off air pressure to the cylinder 250 (Fig. 3). This causes the latch or trip lever 196 to be lowered into active position, so that when the trip pin 192 reaches the catch or hook in said lever, the clutch 183 controlling the operation of the feed roll 60 will become disengaged, as shown in Figs. 3 and 4. Since the clutch 183 is a one revolution clutch, this disengagement can take place only at a predetermined phase, i. e. before the strip material has been fed on to the knife 80 or plate 88 thereabove. This disengagement of the clutch 183 will interrupt the feeding of the strip material S³, leaving it inoperative until a clamp containing a book reaches the strip applying station, or the detecting position.

The glue applying mechanism which precedes the strip applicator is not shown. However, depending on its type, it must be understood that glue mechanism can be controlled by a feeler mechanism similar to that shown in Figs. 12 and 13 for controlling the strip applying operation to prevent thereby the glue from being applied undesirably to parts of the machine when no book is present in the clamp at the glue applying station. No special control is necessary when the book back is glued, for example, merely by traveling in contact over a glue roll which at its lower part dips into a glue vessel, as shown in Fig. 5 of said prior Patent No. 1,073,324. In referring to glue herein it is intended to include other suitable adhesives, applicable in hot or cold condition, such as tough, quick-setting compositions, of plastic character.

The described invention may be expressed as follows in respect to an important combination feature. The subject is a book binding machine of the kind having a driven train of book clamps adapted to hold and advance along a given travel path a procession of books with their backs exposed downwardly, with continuous travel along the route of a series of operating units or mech-

anisms. In combination therewith and following a glue applying means or step there is a strip applying mechanism or unit operative to place pervious strips or supers upon the glued backs of the successive books, which is done without contact of the glue with the mechanism. And the mechanism has a strip support adapted initially to hold each strip in position parallel to the book back, to be released later to place the strip upon the book. Combined with these elements is a bodily shiftable or floating carriage supporting said mechanism in the region below and adjacent to the path of book travel. The carriage so characterized is provided with guiding and driving connections, as the parallel cranks, to shift bodily, with a motion of translation, said carriage and mechanism in a way to follow, with one round of shift per cycle or book, an upright closed curvilinear or substantially circular orbit so located, and followed by the carriage in such direction, that at the tangent high point or apex of its orbit the strip holding support is closely below and parallel to the book back position while at the same time it is tangentially shifting advancingly in coordination with book travel, by which plan highly accurate timing and positioning are assured. For the placing or transfer of each strip to its book the invention provides pneumatic means which extends to and is operable upon said carriage, with timing and pressure discharge to operate in each cycle while the strip is at its high point in register with the book, to deliver an air puff or discharge upwardly to impel the strip across the narrow gap from its support to the glued back of the book.

While the invention has been described with particular reference to a specific embodiment, it is to be understood that it is not to be limited thereto, but is to be construed broadly and restricted solely by the scope of the appended claims.

What is claimed is:

1. In a book binding machine of the kind having a driven train of book clamps adapted to hold and to advance along a given travel path a procession of books with their backs exposed downwardly, with continuous book travel along the line of a series of successive operating mechanisms, and in combination therewith and following the glue applying position in the machine a strip applying mechanism adapted to place gluepervious strips upon the glued backs of the successive books and having a strip support element adapted to hold each strip in position parallel to the book back; said mechanism including a floating carriage carrying said strip support and located in the region below the adjacent path of book travel; carriage guiding and driving connections adapted and timed with a translatory motion to shift said carriage and strip support in a way to follow, with each round of shift per book cycle, an upright closed curvilinear orbit so disposed and in such orbital direction that at the orbital high point the strip support is closely below and parallel to the book back position while tangentially shifting advancingly at a speed coordinated with the book travel; and pneumatic means extending and connected to said strip support and having timing and pressure means to discharge air in each cycle while the strip and support are at the orbital high point and the strip is in register with the book, thereby to deliver an air puff upwardly to impel the strip across the narrow gap from its support to the glued back of the book.

2. A strip applying mechanism as in claim 1 and wherein the closed curvilinear orbit of shifting motion of carriage and strip support is provided by connections from the power source including a pair of equal and parallel cranks, upon and between which extends the carriage thereby, to maintain the strip and its holder level throughout the traversing of the circular orbit.

3. A strip applying mechanism as in claim 1 and wherein the pneumatic means comprises a perforated plate at the strip support and also a suction connection to the plate initially to hold the strip upon the support, and timed means to apply holding suction until released ahead of the pressure puff and transfer of strip to book.

4. A strip applying mechanism as in claim 1 and wherein the strip support is perforated for applying suction and then pressure to the strip, with ports to control the same, and means for adjusting the strip support and feed to the book.

5. A strip applying mechanism as in claim 1 and wherein there is a strip material supply means for wide material fed transversely to position on the support, together with strip material feed means, and means for severing each strip after its measured feed to the strip support beneath the book path.

6. A strip applying mechanism as in claim 1 and wherein there is strip material feed means comprising upper and lower feed rolls adapted cooperatively to squeeze and advance the material for each cycle, with a one-way clutch to operate the feed rolls, the said clutch having means to oscillate its driving member thereby to produce intermittent feed; a one-revolution clutch connected to actuate said oscillating means of the one-way clutch, a settable latch means adapted when set to block the action of the one revolution clutch, and means controlled by the detection of the absence of a book from a given clamp to set said latch thereby to prevent feed of strip material to said clamp.

7. A book binding machine of the general continuous travel type, with the books advancing edgewise and with backs downward, the same including a strip applying mechanism having a strip support and a shiftable carriage on which said support is mounted, having a strip applying unit comprising a support for strips fed thereto below the book travel path; means for shifting the carriage and unit around an orbit with translatory motion to maintain the strip support level, the orbit being such that when the level support is at its peak of motion it is traveling closely below and in coincidence with the back of the corresponding book; and means associated with the support for causing registered transfer of the strip to the adhesive book back while the two are advancing in unison but out of contact, said transfer means comprising a timed air valve connection for delivering pressure air to the support to impel the strip across in register upon the book back.

8. In a bookbinding machine, means for clamping and supporting each book to be bound, with its back exposed downwardly for application thereto of a back strip, and means for advancing the books continuously along a horizontal path of travel; a support for supporting the back strip in opposition to the exposed back of the advancing book; means for moving said strip support cyclically around a closed curved path first towards the book back until it comes into close proximity to the book back and then away from the book back and also back and forth

along said path of travel; and pneumatic means for transferring the strip by air puff on to said back while said strip support is in close proximity to said book back and is advancing along said path at the speed of book travel.

9. In a bookbinding machine, means for clamping each book to be bound with its back exposed for application thereto of a back strip and for advancing the book continuously along a book path of travel extending substantially parallel to said back; a strip support arranged in opposition to the exposed back of the advancing book and substantially parallel thereto, a parallel motion mechanism for guiding and moving said strip support cyclically around a circular orbit substantially in the plane of said book travel path while maintaining the strip supported thereon substantially parallel to the book back, said orbit of the support in one phase being in close proximity to said book back and moving in a direction parallel to said path, and pneumatic means for impelling the strip from said support on to said book back while said strip support is in close proximity to said book edges and moving in said direction parallel to said path.

10. In a bookbinding machine, means for continuously advancing each book along a travel path with its back exposed and adhesively coated for application of a back strip thereto, a strip support, a double crank parallel motion device for moving said strip holder continuously in a curvilinear orbit carrying said holder cyclically towards and away from said advancing book back and back and forth along said path, and air pressure means operable when said strip holding device reaches about the limit of its cyclic movement towards said book back for transferring the strip thereon on to said book back.

11. In a bookbinding machine, means for supporting a book to be bound with its back exposed for application of a back strip thereto and for advancing the book continuously along a travel path, means for supplying a web of strip material, means for cutting off sections of the strip material cyclically to form separate back strips, means for cyclically feeding said strip material from said supply to said cutting-off means, a support for supporting the cut-off strip in opposition to the exposed back of the advancing book, and means including a carriage carrying and cyclically moving said cutting off means, said material supplying means, said strip material feeding means and said strip support as a unit, around a curved orbit thereby to move said strip support towards said exposed back to permit application thereto by impelling action upon the supported strip in each cycle.

12. In a bookbinding machine, means for continuously advancing a book along a travel path with its back exposed and adhesively coated for application of a back strip thereto, strip severing means, means for supporting a reel of strip material, means for feeding said strip material from said reel to said severing means, a support for supporting the severed back strip in position facing the exposed back of the advancing book, a double-crank parallel-motion mechanism for carrying and moving said severing means, said reel supporting means, said feeding means and said strip support continuously as a unit in a circular orbit, thereby carrying said support cyclically towards and away from said advancing book back and back and forth along said path course, and means operable when said strip sup-

port reaches about the limit of its cyclic movement towards said book back for transferring the strip thereon on to said book back.

13. In a bookbinding machine, means for advancing a book continuously along a travel path with its back exposed and precoated adhesively for the application of a back strip thereto; cyclic means including cutting knives for severing the strip material into successive individual back strips comprising a pair of relatively movable knives, cyclic means for feeding strip material to said severing means, a strip support for supporting each severed strip in position opposite to the exposed edges of the advancing book, cyclic means for moving said strip support around a curved closed orbit thereby carrying said support and strip cyclically towards and away from said advancing book back and back and forth along said course, means movable cyclically with said strip support in said orbit for moving said knives relatively to each other for severing action, and a stationary trip member located in the path of a part of said knife moving means for operating said knife moving means.

14. In a bookbinding machine, means for advancing a book continuously along a travel path with its back exposed downwardly and adhesively coated for reception of a back strip applied thereto, cutting means for cutting-off strip material into individual back strips, the same comprising a pair of relatively movable knives, means for feeding strip material to said cutting means, a strip support for supporting each severed back strip in position opposite to and facing the exposed back of the advancing book, means for moving said strip support in a closed curvilinear orbit thereby carrying said strip and support cyclically towards and away from the back of said advancing book and back and forth along said course, means movable cyclically with said strip support in said orbit for moving said knives relatively to each other for cutting-off action and for return action, and comprising a rack rigid with one of said knives, a gear meshing with said rack, and a member rigid with said gear for rotating said gear when said member engages a stationary trip to move said last-mentioned knife with respect to the other knife in strip cutting direction, spring means for returning said last-mentioned knife, and the aforesaid stationary trip in the path of said gear rotating member for operating said latter member as said strip support is moving upwardly toward the book.

15. In a bookbinding machine, means for advancing a book continuously along a travel path with its back exposed and adhesively coated for application of a back strip thereto, a strip cutting-off device, means for feeding strip material to said strip cutting device, a support for supporting the cut strip in opposition to the exposed back of the advancing book, means for moving said strip support cyclically in a curved orbit towards and away from the edges of the advancing book and back and forth along said path, pneumatic means for transferring the cut strip from said strip support on to said book back during each cycle of movement of said strip supporting means, and means operable from a part of said means which moves said strip support for operating said feeding means.

16. In a bookbinding machine, means for advancing a book continuously along a book-travel path with its back exposed and adhesively coated for application of a back strip thereto, a strip cutting device, means for feeding strip mate-

rial to said strip cutting device, a support for supporting the cut strip in a position opposite to the exposed edges of the advancing book, a double-crank parallel-motion mechanism for moving said strip support, said strip cutting device and said feeding means as a unit continuously in a circular orbit carrying said strip support cyclically towards and away from said advancing book edges and back and forth along said course, means for transferring a cut strip from said strip support on to said book back during each cycle of movement of said strip supporting means, said parallel motion mechanism comprising a crankshaft, a crank arm rigid with said crankshaft and a crankpin rigid with said crank arm, and a transmission train between said crankshaft and said feeding means for operating said feeding means and comprising a gear secured to said crankpin and movable therewith about the axis of the crankshaft, and a gear in mesh with said first mentioned gear and supported on an axis fixed with respect to said unit.

17. In a bookbinding machine, means for continuously advancing a book along a book-travel path with its back exposed downwardly and adhesively coated for application of a back strip thereto, a strip severing device, means for feeding strip material to said severing device and comprising a cooperating pair of feed rolls, a one-directional clutch having its power output connected to one of said feed rolls, means for rotatably oscillating the power input member of said clutch, said clutch being directionally arranged to rotate said roll in a direction to feed said strip material towards said severing device during one rotary stroke of said clutch input member and to cause said roll to remain stationary during the return rotary stroke of said input member, whereby said feed roll is driven intermittently, and means for causing the cut strip to be propelled to said book back.

18. In a bookbinding machine, means for continuously advancing a book along a book-travel path with its back exposed and adhesively coated for application of a binder strip thereto, a strip cutting-off device, means for feeding strip material to said cutting device comprising a pair of feed rolls, and means for driving one of said feed rolls intermittently comprising a feed roll shaft, and a clutch having its power output member connected to said feed roll shaft, a crankshaft, a crank on said crankshaft and a feed link pivotally connected between said crank and the power input member of said clutch, to oscillate said clutch input, said clutch being of the one-directional type to oscillate said feed roll only in a direction to feed the strip material towards said strip cutting device, and means for applying the cut strips to said book back; together with a floating carriage carrying as a unit said strip feeding and cutting means and a strip support, and the unit being mounted to follow an orbital path in presenting the strip to the book, said strip applying means comprising air pressure means to impel each strip to its book back.

19. In a bookbinding machine, the combination as described in claim 18, said crank feed link being adjustable in length to vary the throw of said clutch input to vary the length of strip material fed during each cycle.

20. In a bookbinding machine, a strip feeding, cutting and applying mechanism located at a book-travel station, comprising a cyclic strip cutting-off device, cyclic means for feeding the uncut

strip material to said cutting device, cyclic means for applying the strip to the back of a book after it has been cut, a series of clamp devices for holding successive books and advancing them continuously through said station in succession with their backs exposed downwardly, a support for the cut strip and means for moving the support and strip through an upright orbit and for impelling the strip upwardly to the book back while the support is moving in coincidence with the book; a feeler mechanism for sensing the absence of a book in a book holding clamp device as it approaches said station, and means responsive to the operation of said feeler mechanism for interrupting said strip feeding means until a succeeding book clamp device bearing a book approaches said station.

21. In a bookbinding machine, with book conveying means disposed along a travel path, means at an operating station comprising a mechanism for operating upon a book passing through said station, said conveying means comprising a series of articulated clamps for holding books respectively and advancing them continuously through said station in succession, a first contact roll member carried by each of said clamps, taking different positions when the clamps are loaded or empty, a control member for said operating mechanism, a feeler mechanism for sensing the absence of a book in a clamp as it approaches said station, with a second contact member, constituting a feeler bar along which said first contact member is adapted to travel, said feeler bar being in position to be free of said first contact roll member when the clamp contains a book and in position to be engaged by the first contact member and to be moved and displaced thereby when the clamp is locking a book, and means responsive to the actuation of said feeler bar by an engaging follower member for actuating said control member into position to interrupt the operation of said operating means.

22. In a bookbinding machine, a strip feeding, cutting and applying mechanism located at a clamp-travel station, comprising a strip cutting device, means for feeding strip material to said cutting device, means for applying the strip to the back of a book after it has been cut, a series of articulated clamps for holding books in series and advancing them along a travel path and through said station in succession with their backs exposed, a movable clamp contact member carried by each of said clamps and taking an abnormal position when the clamp is empty, a control member for said feeding means, a feeler mechanism for sensing the absence of a book in a clamp as it approaches said station and having a feeler bar along which said clamp contact member is adapted to travel, said feeler bar being mounted in position to be free of said contact member when the clamp contains a book and to be engaged by the contact member and to be moved thereby when the clamp is locking a book, and means responsive to the actuation of said feeler bar for actuating said control member into position to interrupt the operation of said strip feeding means when said feeler bar is moved by said clamp contact member, and into position to permit said strip feeding means to operate when said feeler bar is freed of the clamp contact member.

23. In a bookbinding machine, a strip feeding, cutting and applying mechanism located at a clamp-travel station and comprising a strip cutting device, means for feeding strip material to

said cutting device, means for applying the strip to the edges of a book after it has been cut, a series of articulated clamps for holding books in series and advancing them along a travel path and through said station in succession with their backs exposed, a detector contact member carried by each of said clamps, a control member for said feeding device, a feeler mechanism for sensing the absence of a book in a clamp as it approaches said station and including a feeler bar along which said contact member is adapted to travel, a pair of substantially parallel links supporting said feeler bar for movement substantially parallel to itself, one of said links having means engaging said control member and actuating it into position to permit the operation of said feeding means, and spring means normally urging said feeler mechanism into position to cause said link means to engage said control member when said feeler bar is free from engagement with said follower member, to permit thereby operation of said feeding means; said feeler bar being in position to be free of said contact member when the clamp contains a book and in position to be engaged by the contact member when the clamp is empty, said feeder bar when engaged by said contact member being actuated into position to cause said link means to move out of engagement with said control member and to release thereby said control member, whereby interruption is caused in the operation of said feeding means when the book is missing.

24. In a bookbinding machine, a strip feeding, cutting and applying mechanism located at a clamp-travel station and comprising a strip cutting device, means for feeding strip material to said cutting device and comprising a pair of feed rolls, and a drive train to one of said rolls including a clutch, and means for applying the strip to the back of a book after it has been cut, a train of clamp devices for conveying books in series and continuously advancing them through said station in succession with their backs exposed, a feeler mechanism for sensing the absence of a book in a book conveying clamp as it approaches said station, and means automatically responsive to the detection of the absence of a book in a book clamp device for disengaging said clutch to interrupt the operation of said feeding means.

25. In a bookbinding machine, a strip feeding, cutting and applying mechanism located at a clamp-travel station and comprising a strip cutting device, means for feeding strip material to said cutting device and comprising a pair of feed rolls, and a drive train to one of said rolls including a clutch, said clutch being of the type which can be disengaged at a position in its rotative cycle and having a rotary part with a trip the stopping of which disengages the clutch, a trip lever movable into and out of latch engagement with said trip, and means for applying the strip to the edges of a book after it has been cut, a series of clamp devices for conveying books and advancing them through said station in succession with their backs exposed, a feeler mechanism for sensing the absence of a book in a book clamping device as it reaches said station, and means automatically responsive to the actuation of said feeler mechanism into position to detect the absence of a book in the book supporting device for moving said trip lever into clutch engagement with said clutch trip to disengage said clutch and

thereby to interrupt the operation of said feeding means.

26. In a bookbinding machine, a strip feeding, cutting and applying mechanism located at a clamp-travel station and comprising a strip cutting device, means for feeding strip material to said cutting device and comprising a pair of feed rolls, and a drive to one of said rolls including a clutch, said clutch being of the type which can be disengaged at a position in its rotative cycle and having a rotary part with a trip the stopping of which disengages the clutch, a trip lever movable into and out of catch engagement with said trip, power means for controlling the movement of said trip lever, a control member for said power means, and means for applying the strip to the back of the book after it has been cut, a series of book clamp devices for conveying books and advancing them continuously through said station in succession with their backs exposed, and a feeler mechanism operating said control member and actuated automatically to sense the absence of a book in a book clamp device as it approaches said station, said feeler mechanism when sensing said absence causing said control mechanism to be actuated into position to cause said trip lever to move into catch engagement with said clutch trip to disengage said clutch and thereby to interrupt the operation of said feeding means.

27. In a bookbinding machine a train of clamps for holding and continuously advancing a series of books respectively in succession along a path of travel and through a given station with their backs exposed and adhesively coated for application of a binder strip thereto, a strip cutting device at said station, means for feeding strip material to said cutting device comprising a pair of feed rolls, a one-directional first clutch having its power output member connected to one of said rolls, a one-revolution second clutch, motion transmitting means connecting the power output member of said second clutch to the power input member of said first clutch to cause the power input member of said first clutch to oscillate, said first clutch being directionally arranged to rotate said roll in a direction to feed said strip towards said cutting device during one oscillatory stroke in each cycle of the input member of said first clutch and to cause said roll to remain stationary during the return stroke of said latter input member, whereby said feed roll is driven intermittently in feeding direction, means for driving the power input member of said second clutch continuously, feeler means for detecting the absence of a book in a clamp as it approaches said station, and means automatically operable when said feeler mechanism detects the absence of a book in a clamp device near said station, for disengaging said second clutch to interrupt the operation of said first clutch and feeding means.

28. In a bookbinding machine, a strip applying mechanism containing, in combination, means for supporting a book to be bound with its back exposed for application of a back strip thereto and for advancing it continuously along a longitudinal book-travel course, a strip support holding a strip facing the exposed back of the advancing book, means for moving said strip support cyclically along an upright orbit towards the book back until it reaches its closest proximity to the book back and then away from the book back and simultaneously also back and forth along said book-travel course, means for transferring the strip on to said back while said strip

support is in close proximity to said book back and is moving forward along said course, and means for adjustably moving said strip support transversely to said course and to the plane of said orbit to accommodate the mechanism to variations in the width of the book backs.

29. In a bookbinding machine, means for continuously advancing a book along a longitudinal travel-path with its back exposed and adhesively coated for application of a binder strip thereto, a strip supporting and applying device, an aligned pair of horizontal, transverse, driven crankshafts, a double-crank parallel-motion mechanism actuated by said shaft pair and having their crank pins interconnected, for moving said strip supporting and applying device in a circular upright orbit thereby to carry said strip supporting and applying device cyclically upward towards and then downward away from said advancing book back and also back and forth along said path, and means for adjustably moving said strip supporting device transversely to said path and to the plane of said orbit to accommodate the same for variations in the width of the books.

30. In a bookbinding machine, means for advancing continuously a book along a longitudinal travel path with its back edges exposed and adhesively pre-coated for application of a back strip thereto, a strip supporting and applying means, a double-crank parallel-motion mechanism for moving said strip supporting and applying means in a circular orbit carrying said strip supporting and applying device cyclically towards and away from said advancing back edges and back and forth along said path, said parallel motion mechanism comprising a pair of parallel crankshafts, and a pair of sleeves encircling said crankshafts respectively and supporting the bearings for said crankshafts, said sleeves having rack teeth extending therealong, and an adjusting shaft extending transversely of said sleeves and carrying a pair of gears in mesh with the rack teeth on said sleeves respectively to adjust said strip supporting and applying means parallelly to said crankshafts to accommodate the mechanism for variations in the width of the books.

31. In a bookbinding machine, a device for cutting a back strip and holding it for application to the back of a traveling book, comprising a pneumatic valve-controlled and chambered suction and pressure head, a knife plate on said head having numerous ports or holes in communication with the interior of said head, a valve plate slidable on said knife plate and having numerous cooperating air ports or holes, the holes in each of said two plates being arranged in two similar series on opposite sides of a longitudinal center line axis, the holes of each series in one plate being arranged in parallel rows extending at a substantial slanting angle to those in the other plate with respect to the longitudinal axis of said knife plate, while the holes of each series in the valve plate are arranged in parallel rows extending at a different angle with respect to the longitudinal axis of said valve plate; the holes in the two plates being arranged with the rows of holes in one plate crossing the rows of holes in the other plate, and with a hole in one row in one plate registering with a hole in the corresponding row of the other plate, whereby two sets of registering holes on opposite sides of the longitudinal axes of said respective plates will be provided, one of said two plates, being mounted for adjustment along its longitudinal axis with respect to the other plate thereby to vary adjustably the effective position of the general median line of the active holes of the entire system, so that the pneumatic suction holding and pressure impelling positions of the open holes can be adjusted into substantial symmetry with the adjusted position of a strip of any desired width to be applied to a book of any desired thickness.

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