A. BREDENBERG.

BOOK BINDING OR COVERING MACHINE.

APPLICATION FILED SEPT. 14, 1916.

1,248,252.

Patented Nov. 27, 1917.

11 SHEETS—SHEET 1.

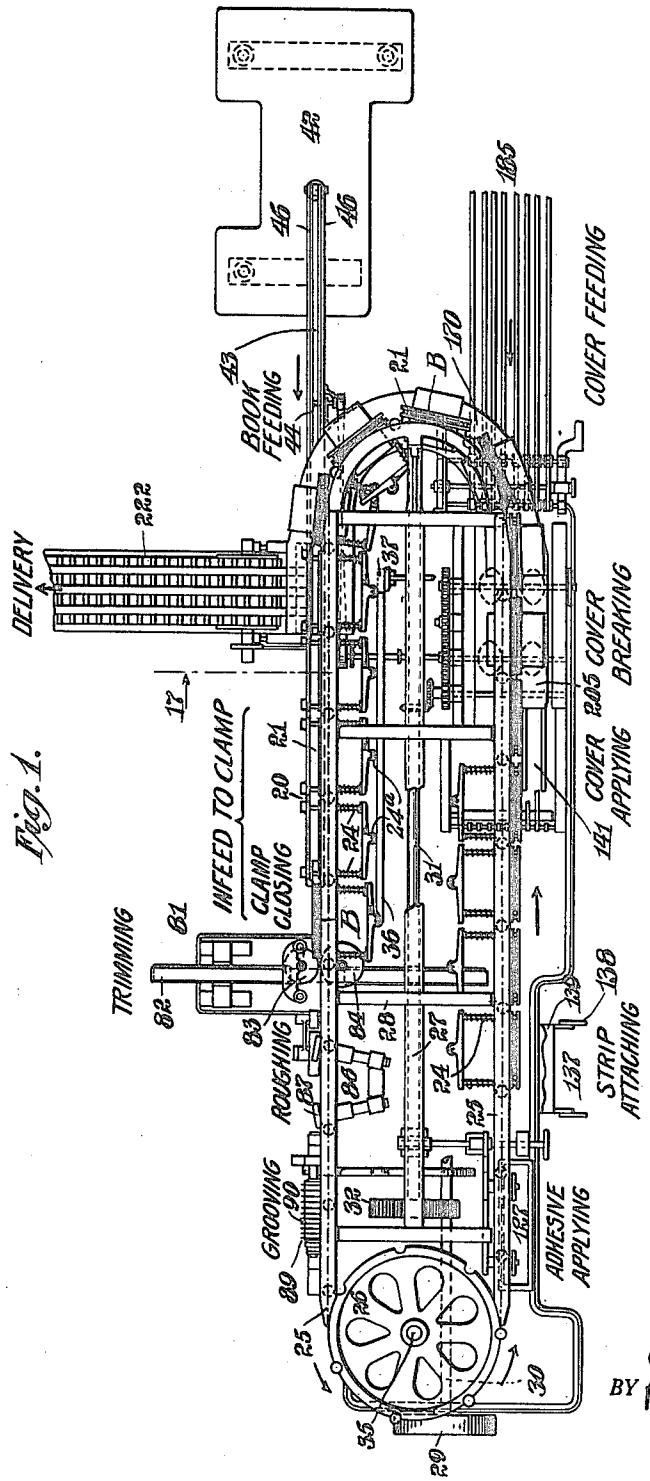


Fig. 1.

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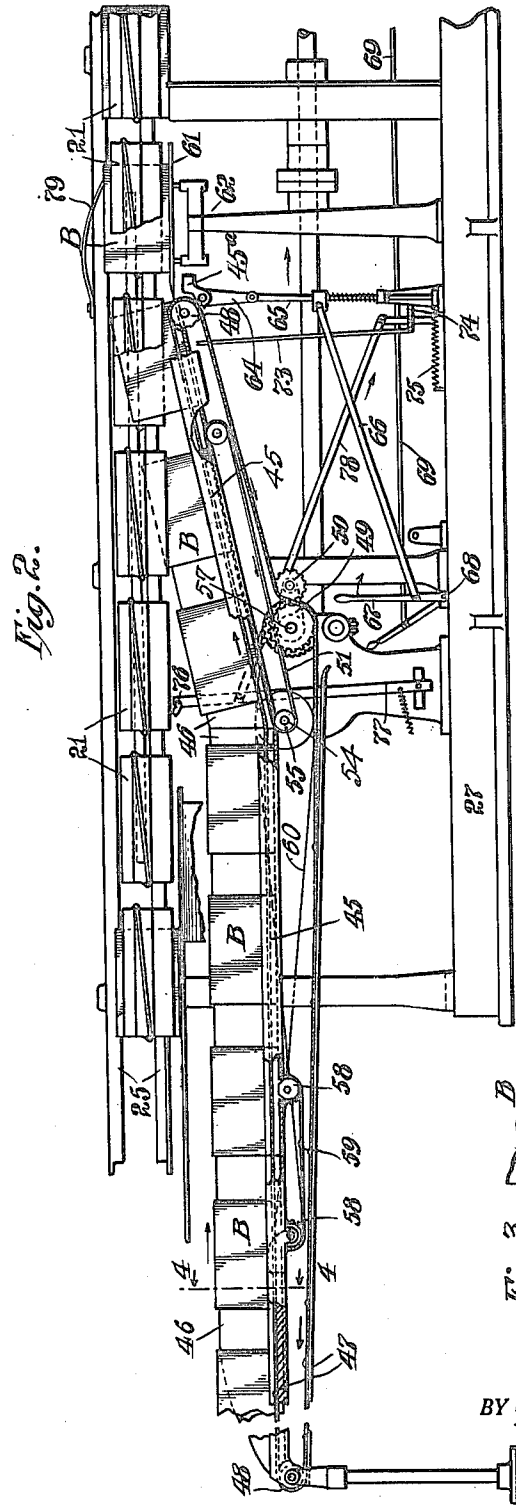


Fig. 2.

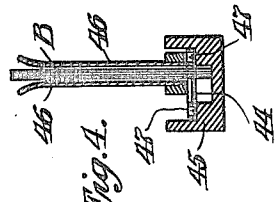


Fig. 4.

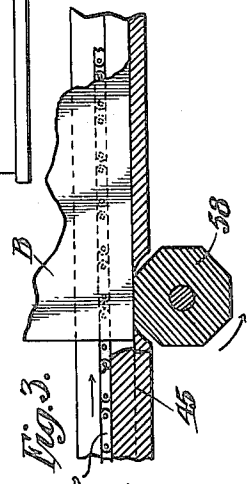


Fig. 3.

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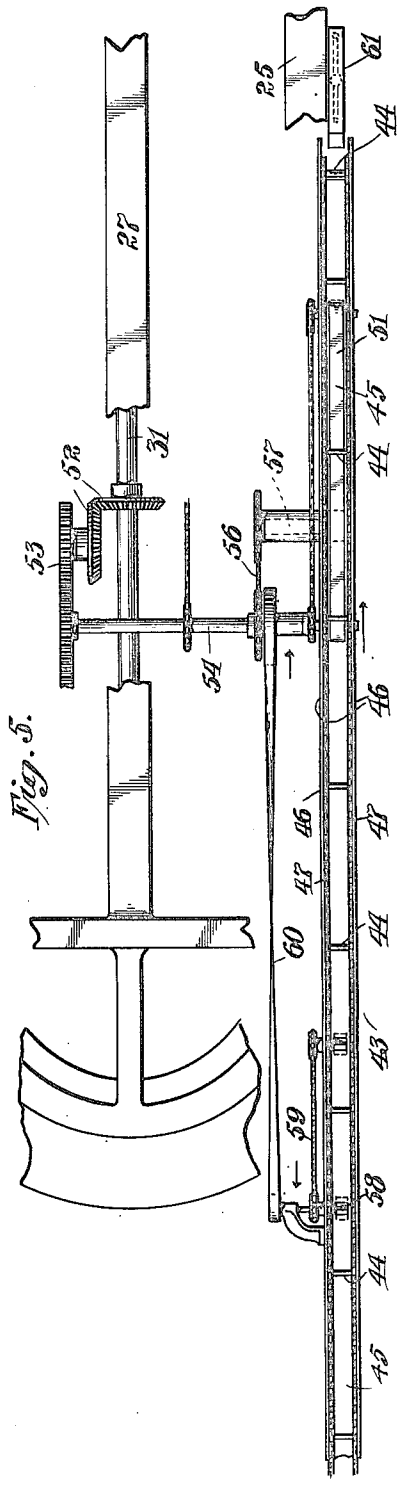


Fig. 5.

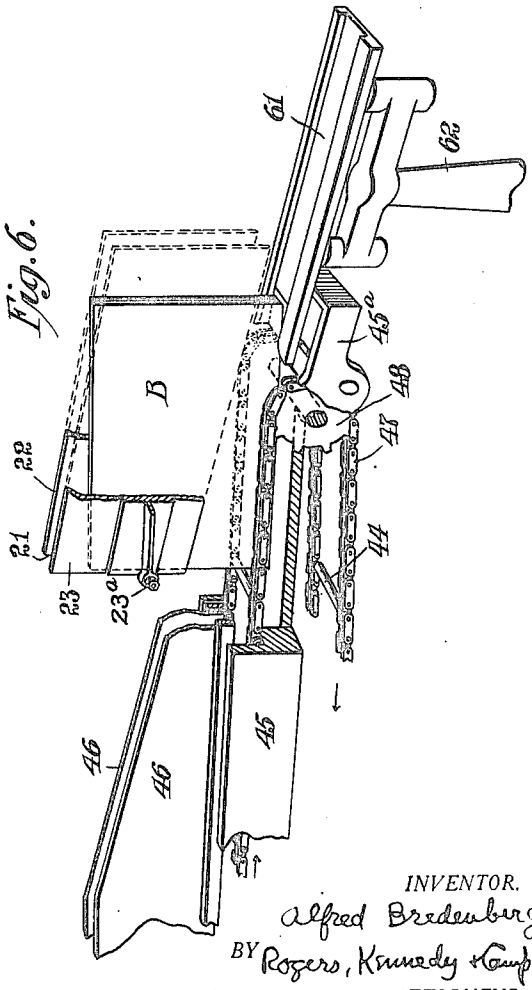


Fig. 6.

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11 SHEETS—SHEET 4.

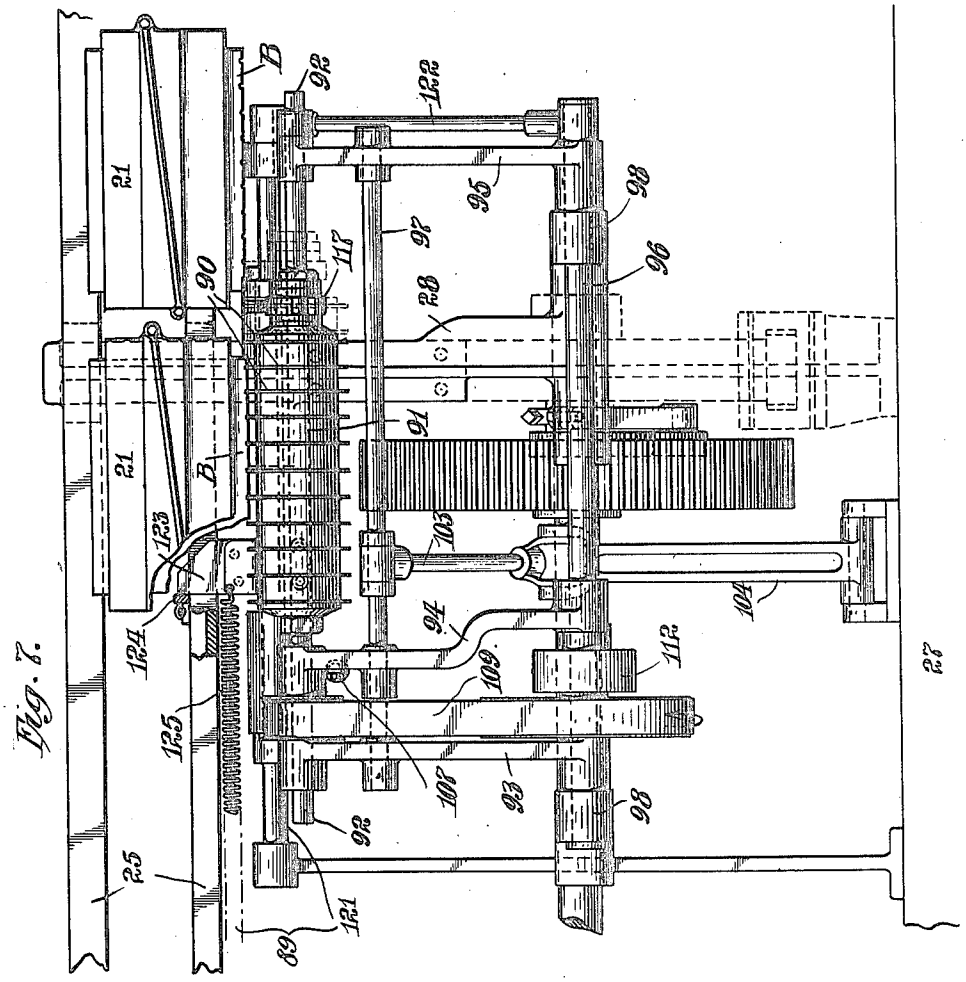


Fig. 7.

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BOOK BINDING OR COVERING MACHINE.

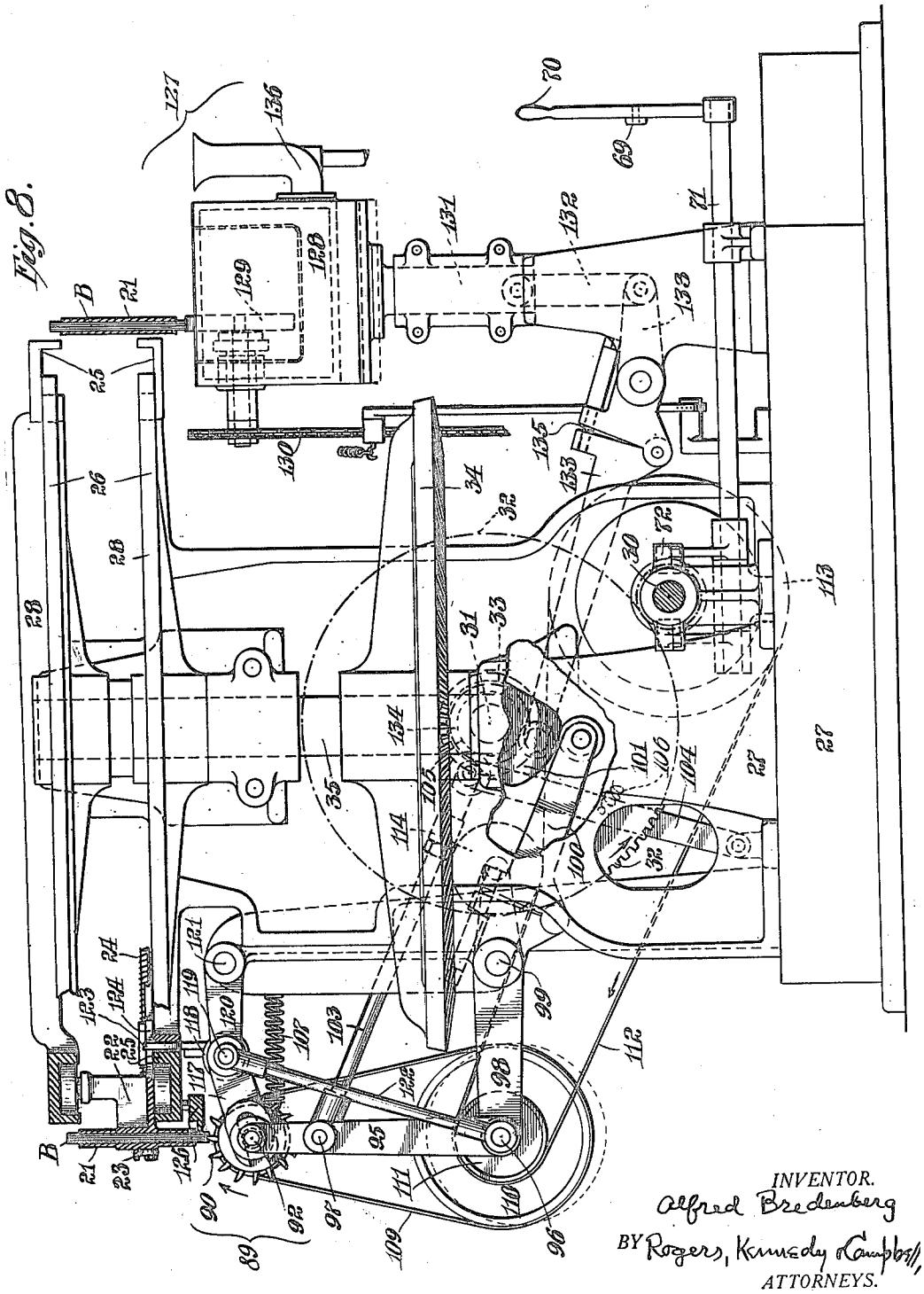
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11 SHEETS—SHEET 5.

Fig. 8.



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11 SHEETS—SHEET 6.

Fig. 9.

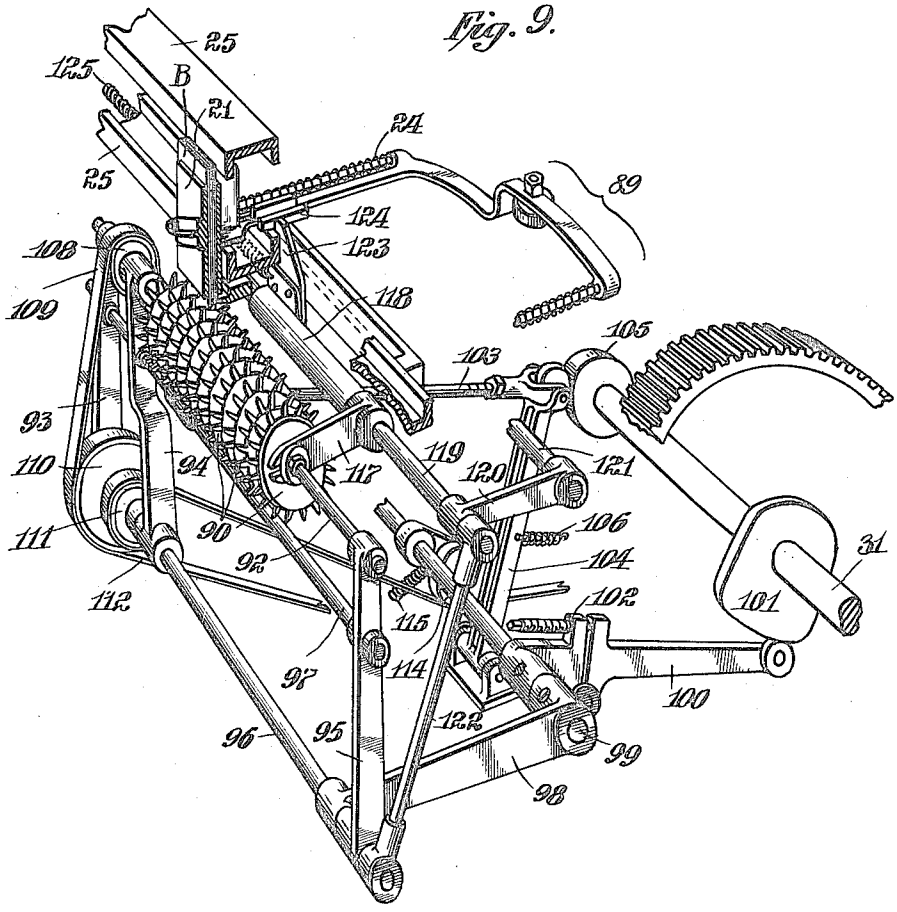
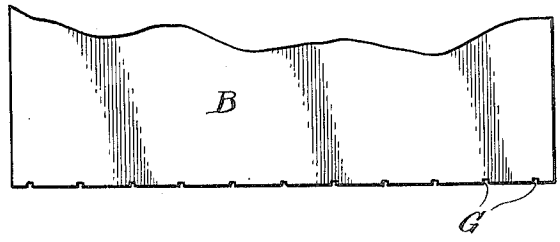


Fig. 10.



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BOOK BINDING OR COVERING MACHINE.

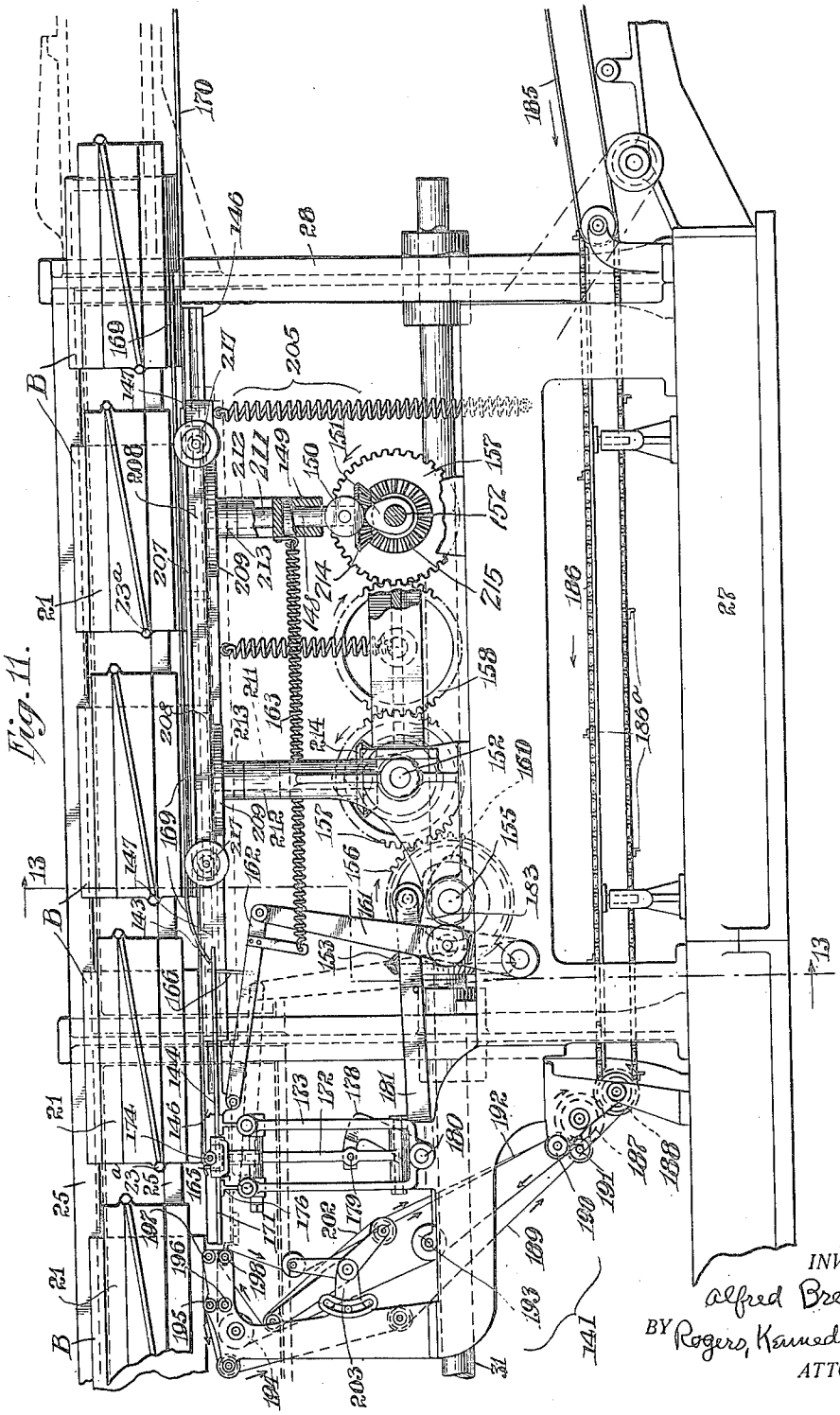
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11 SHEETS—SHEET 7.

Fig. 11.



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BOOK BINDING OR COVERING MACHINE.

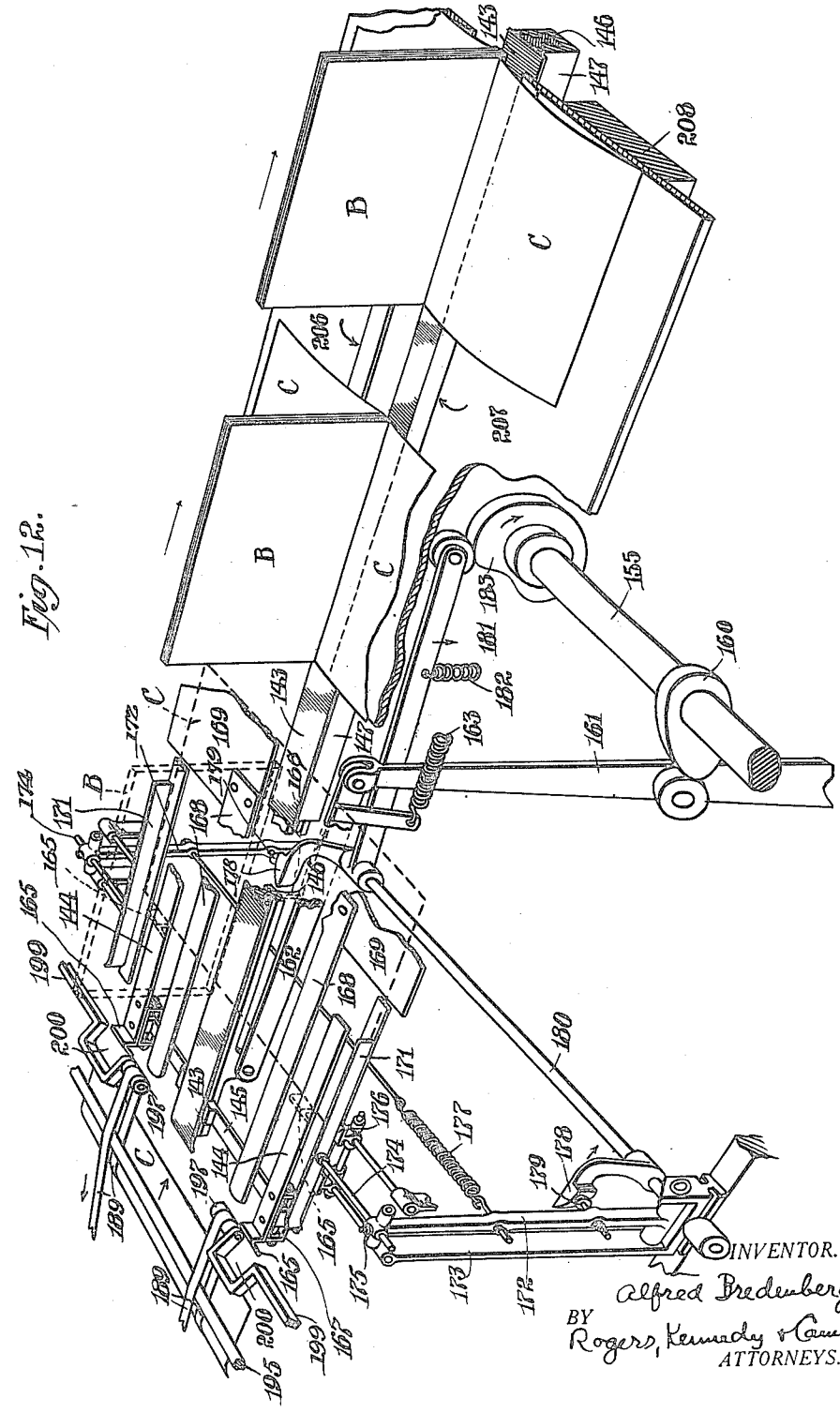
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11 SHEETS—SHEET 8.

Fig. 12.



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11 SHEETS—SHEET 9.

Fig. 14.

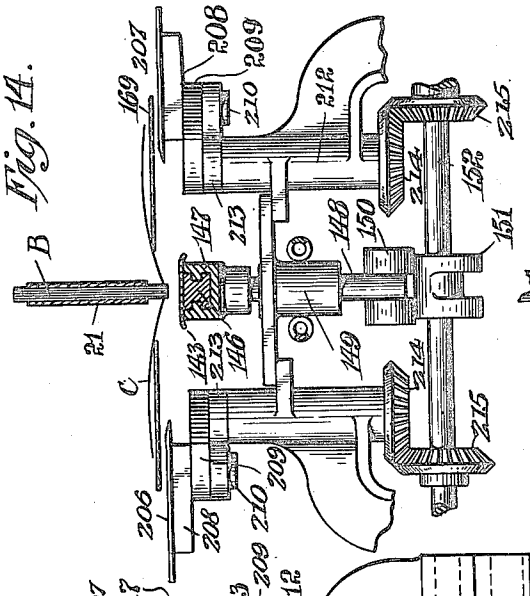


Fig. 15.

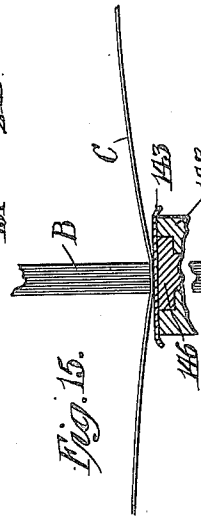


Fig. 16.

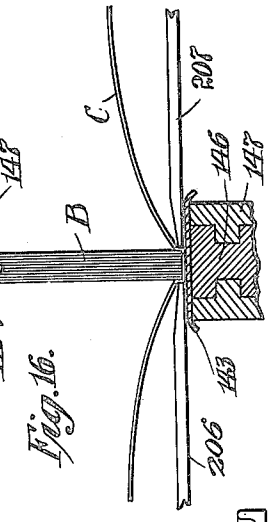
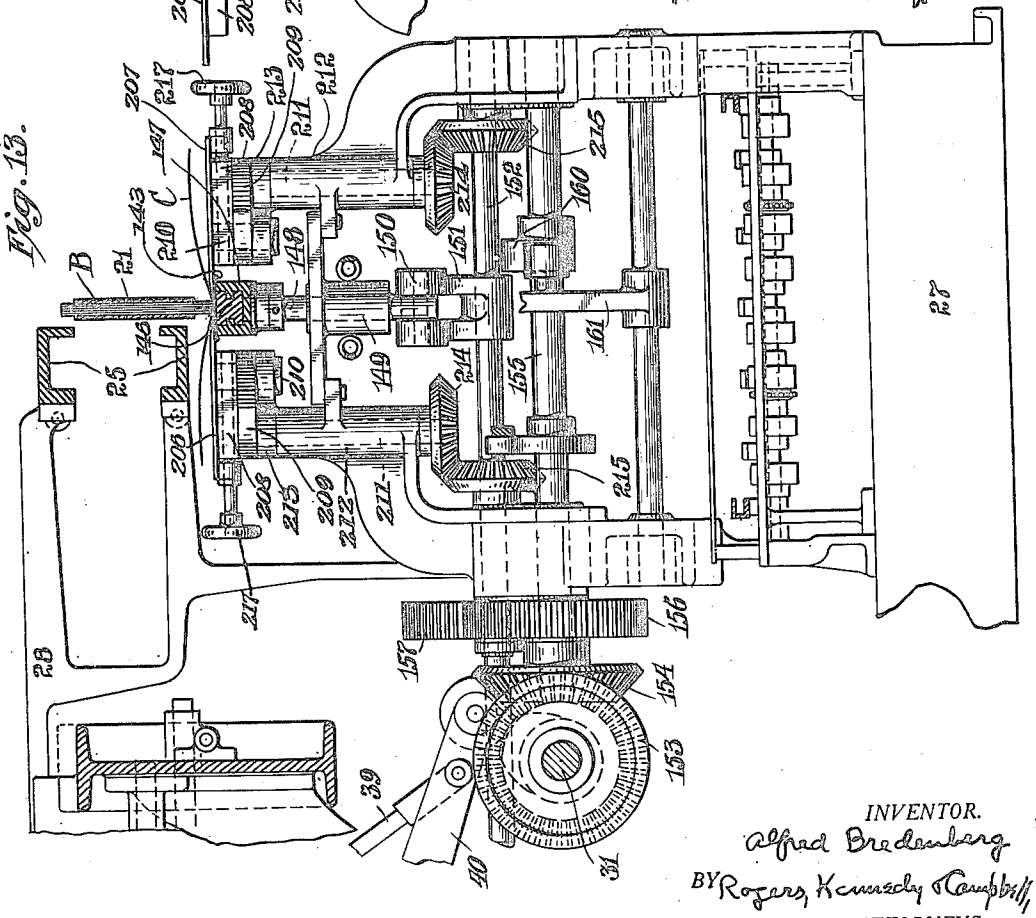


Fig. 13.



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11 SHEETS—SHEET 10.

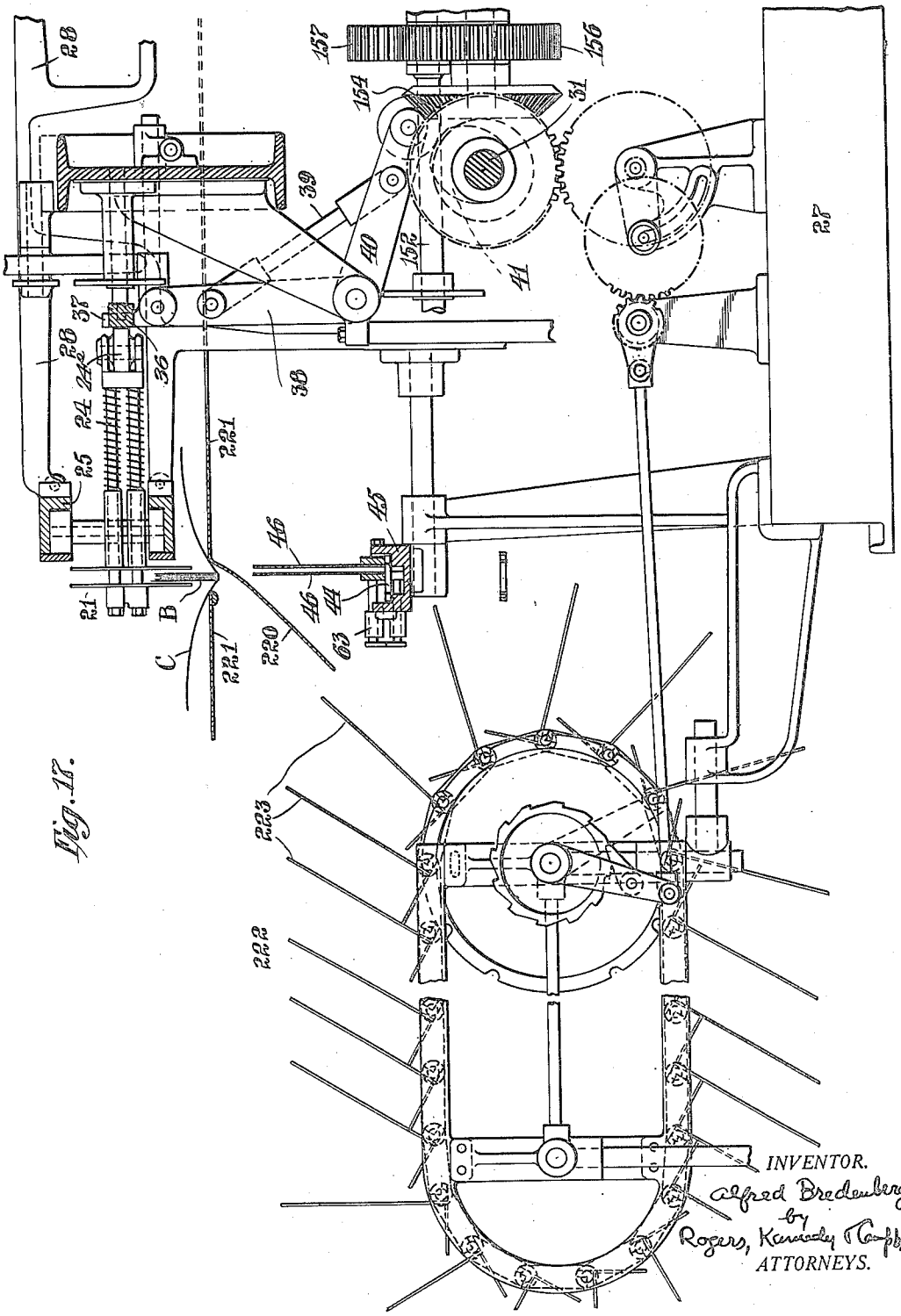


Fig. 17.

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11 SHEETS—SHEET 11.

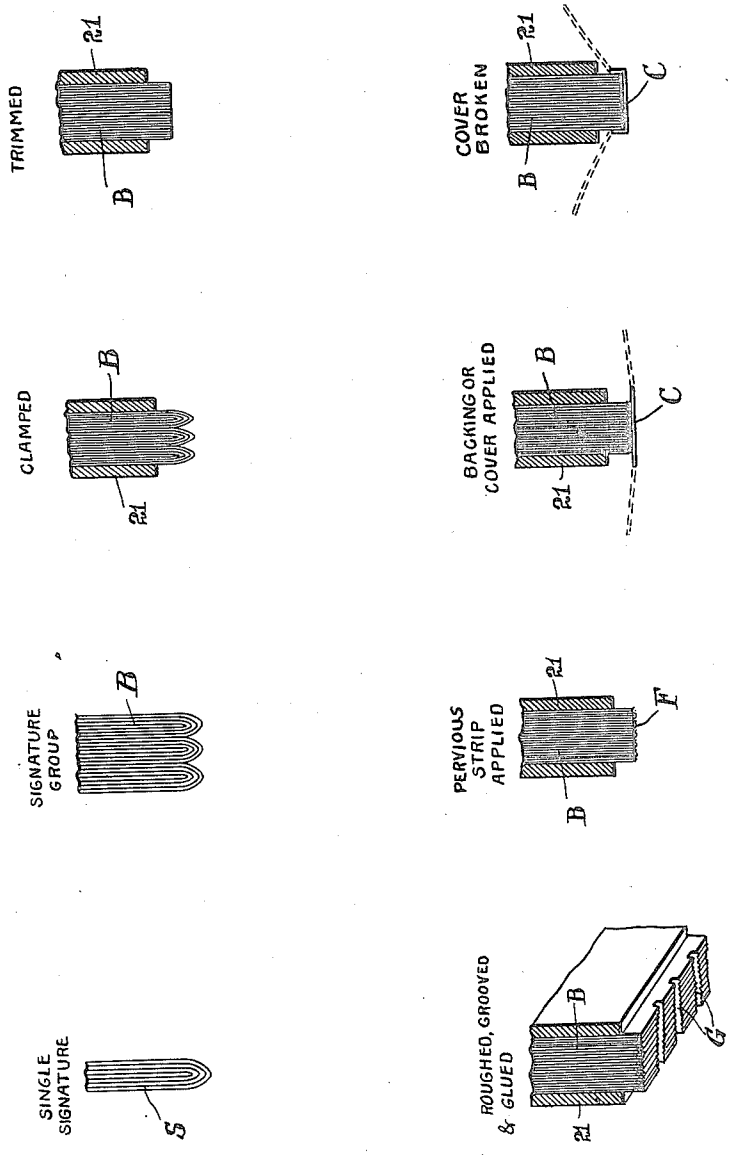


Fig. 10.

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BY Rogers, Kennedy & Campbell

ATTORNEYS.

UNITED STATES PATENT OFFICE.

ALFRED BREDENBERG, OF CHAMPLAIN, NEW YORK, ASSIGNOR OF ONE-HALF TO THE SHERIDAN IRON WORKS, A CORPORATION OF NEW YORK, AND ONE-HALF TO T. W. & C. B. SHERIDAN COMPANY, A CORPORATION OF NEW YORK.

BOOK BINDING OR COVERING MACHINE.

1,248,252. Specification of Letters Patent. Patented Nov. 27, 1917.

Application filed September 14, 1916. Serial No. 120,133.

To all whom it may concern:

Be it known that I, ALFRED BREDENBERG, a citizen of the United States, residing at Champlain, in the county of Clinton and State of New York, have invented certain new and useful Improvements in Book Binding or Covering Machines, of which the following is a specification.

This invention is an improved book binding or covering machine. The components or "signatures" which are to make up the finished pamphlet or other book are supposed to have been "gathered" or grouped in proper arrangement. The loose "signature group" may be united or bound together in the machine hereof, and the resulting book may then have a cover applied. If the book has been previously bound, this machine may be in part employed to merely cover the same.

The general plan of this machine is that each of the successive signature groups, which, for convenience, may be termed "books", is caused to travel or advance along a designated path through the machine while clamped or held firmly compacted, and during its travel is operated upon by various mechanisms for performing the individual steps in the binding or covering process. Examples of machines of this type are shown in my prior patents Lovell and Bredenberg 476,208 and Bredenberg 1,073,324.

I herein show, as in my said prior patents, the "flexible" system of binding. The books, held upright, are advanced horizontally and edgewise, and subjected to operations including those of trimming the back edges and applying adhesive and a backing. The signatures ordinarily used in making magazines are "multifold", produced by folding the paper for example three times, forming four folds and sixteen pages. The trimming removes the back folds, so that the glue may permeate to every sheet, giving a book that will open out flatly in a manner impossible with wire staple binding. The present machine also resembles my prior patents in that each book, held in spring closed clamps having facewise openable clamp parts, is conveyed at the first side of the machine to a trimming mechanism and a roughening mechanism, and around the end of the machine to the other side, where it travels to a gluing mechanism, a mechanism for applying a fibrous backing strip over the glue and mechanisms for applying an impervious outer backing, which may be the pamphlet cover, and pressing and folding or breaking the cover about the sides of the book.

Unlike my prior patents wherein the roughing and gluing operations, but not all of the other operations, proceed while the book is traveling, I herein prefer to follow the well-known plan of having the several mechanisms operable during travel, thus avoiding the delay of the temporary stoppages otherwise necessary. The ordinary mode of providing for operation during travel is to cause each mechanism, while acting on the book, to partake of the advancing motion; and I do this in some cases by giving the mechanism a rotary motion tangent to the book as with the glue rollers of my prior patents, or the Lewis Patent No. 551,776, or the staple applying mechanism of the Crowell Patent No. 510,841, and in other cases by a reciprocation along the line of travel as with the Lewis cover applying table or the staple applying mechanism of Juengst's Patent No. 846,923, thus avoiding the need of intermittently bringing the books to rest, and permitting the books to be conveyed uninterruptedly from the infeed to the delivery, as is exemplied in the Lewis patent.

The main objects of the present invention are the general improvement of the efficiency and running qualities of the machine and the particular improvement of the means for feeding the successive books into the clamps, the mechanism for trimming the backs of the signature groups, the mechanism for applying a pervious strip, the mechanism for applying a cover to the book, the mechanism for breaking or bending the cover into place, and the discharge or delivery mechanism.

Another object, in a binding machine, is to combine with the other mechanisms a

mechanism which operates upon the book prior to the application of glue for producing a plurality of shallow cross-cuts or grooves at the back of the book to facilitate the entrance of the adhesive and improve the security of the binding.

Other and more detailed objects and advantages of the present invention will be elucidated in the hereinafter following description or will be apparent to those skilled in the art.

To the attainment of the above referred to objects the present invention consists in the novel bookbinding and covering mechanisms, combinations, arrangements, devices, details and other features herein described, illustrated or claimed.

Certain of the individual mechanisms are not herein claimed *per se;* the particular book trimming mechanism is made the subject of claim in my co-pending application Serial No. 48,959, filed September 4th, 1915, and the particular pervious-strip applying mechanism is made the subject of claim in my co-pending application, Serial No. 108,894, filed July 13th, 1916.

In the accompanying drawings forming a part hereof, Figure 1 is a general plan view of a bookbinding and covering apparatus embodying the present invention, with many well-known parts and many details omitted for simplicity.

Figs. 2 to 6 illustrate in detail the mechanism for feeding the successive books into the clamps. Fig. 2 is a rear elevation. Fig. 3, like Fig. 2, is a rear elevation showing in detail, however, only certain parts which are indicated near the left end of Fig. 2. Fig. 4 is a section taken on the plane 4—4 of Fig. 2. Fig. 5 is a plan of some of the parts shown in Fig. 2 indicating principally the book conveying belt and chain and their driving connections. Fig. 6 is a perspective showing the highest portion of the infeed conveyer with the book passing on to the leveling table prior to the closing of the clamp.

Figs. 7 to 10 illustrate in detail the mechanism for cross grooving the backs of the books. Fig. 7 is a rear elevation. Fig. 8 is a left elevation, showing also portions of the machine's driving mechanism and the gluing mechanism at the front. Fig. 9 is a skeleton view in perspective of the cross grooving mechanism. Fig. 10 shows a portion of a signature group after the cross grooving operation.

Figs. 11 to 16 illustrate in detail the mechanisms for applying the cover and breaking and pressing it into place. Fig. 11 is a front elevation. Fig. 12 is a partial or skeleton view in perspective. Fig. 13 is a left elevation partly in section on the plane 13—13 of Fig. 11. Fig. 14 is a view similar to Fig. 13 showing the parts in different positions. Fig. 15, on an enlarged scale, shows the relation of the book and cover to the cover presser. Fig. 16 is similar, showing also the cover breakers after acting on the book.

Fig. 17 is a left elevation partly in section on the plane 17—17 of Fig. 1, and showing the clamp opening, and the delivery mechanism.

Fig. 18 is in the nature of a diagram showing the several successive stages in the manufacture of a pamphlet.

It will be obvious to those skilled in the art that certain features of the present machine may be employed for the purpose of securing together single sheets of trimmed paper into the shape of pads, which may be considered a form of binding.

I will refer first to the general machine parts and the book carrier and driving connections and the like, and thereafter describe in proper order of operation the several individual mechanisms.

General machine parts.

The successive books B to be bound or covered are shown as carried in upright position and around a horizontal orbit by a carrier 20 consisting of an endless train of book clamps 21, each clamp consisting of an inner member 22 and a movable outer or presser member 23. The clamp members 22 are hinged together, the hinges forming articulations, so that the carrier is flexible, like a chain, permitting the books to be carried around the ends of the machine when passing from one side to the other.

Each clamp member 23 is shown fitted slidably to its complementary clamp member to permit relative separation and approach for discharging, receiving and clamping the books; and a powerful spring device 24 is provided for each clamp to hold it closed firmly upon the book unless or until the clamp is opened by some opposing mechanism. Associated with these parts is a roller 24^a, which may be moved outwardly to compress the springs and cause the opening of the clamp.

For guiding the carrier the hinges or fulcra between the clamps are extended in the form of studs engaging upper and lower clamp tracks or guides 25 which extend in any desired manner, for example, in two parallel stretches along the front and rear sides of the machine. The carrier is guided around one end of the machine by curved continuation of the tracks, and at the other end is guided by a pair of large horizontal sprocket wheels or spiders 26 which, as will be explained, serve also for the purpose of driving or advancing the carrier and thereby causing the travel of the books from mechanism to mechanism.

The general frame parts of the machine need no specific description other than to mention the base and longitudinal frame parts 27, above which are a series of transverse frame parts 28. The clamp tracks and various other parts are suitably supported from the frame parts in a manner analogous to my prior Patent No. 1,073,324. Indeed, all of the hereinabove described elements 20 to 28 are shown as substantially the same in principle and structure to my said prior patent.

The source of power from which the carrier and various mechanisms are driven may consist of a belt pulley 29 mounted on the prime shaft 30, journaled in the machine frame. A secondary shaft 31 is shown arranged parallel with the prime shaft and driven therefrom at a slower speed by a suitable gear train 32.

The book carrier 20 may be suitably driven from the shafts 30 or 31 at any desired practical speed, and with an intermittent motion, as in my prior patent, if that be desirable, for coöperating with any one or more of the mechanisms, or with a continuous motion at a uniform or non-uniform speed, as may be dictated by circumstances.

To give an uninterrupted uniform speed, the connections from the secondary shaft 31 to the large sprockets 26 may be as follows (see Fig. 8): On the shaft 31 is mounted a small bevel gear 33 engaging the large horizontal bevel gear 34 mounted on vertical shaft 35 which, at its upper end, carries the sprocket wheels 26 which, in their notches, are engaged by the hinges between the clamps of the carrier.

At the rear side of the machine in their proper order are arranged, first, the delivery, located at the point where each clamp opens to discharge the completed book; second, the infeed of the book or loose signature group into the open clamp, the infeed commencing with a table at which the books are placed by hand or mechanically in the infeeding mechanism which carries the books beneath the delivery and lifts them into the respective clamps, before arriving at the clamp closing position; third, the trimming mechanism by which the doubled edges of the signature groups are removed; fourth, the roughing mechanism by which the trimmed back edges are slightly abraded to facilitate the entrance of the glue; and fifth, a cross grooving mechanism by which, as explained, the binding or consolidating of the individual sheets by the adhesive is improved. At the near or front side of the machine are arranged, sixth, the mechanism for applying glue to the back of each advancing book; seventh, mechanism for attaching or applying a pervious strip over the glued back of the book for purposes already referred to; eighth, mechanism for attaching or applying the covers to the advancing books; and, ninth, mechanism for bending or breaking the covers around the sides of the books. The book then passes idly around the curved stretch at the end of the machine while the adhesive slightly hardens, until, just before reaching the infeeding position, the clamp is opened and the completed book discharged or delivered to a suitable receiving or stacking mechanism.

Infeeding mechanism.

Each clamp must open in order to receive the signature group or book and must thereafter close to clamp the book and convey it successively to the other mechanisms. I will, therefore, first describe a convenient means for opening and closing the clamps in harmony with the other operations of the machine.

I follow substantially the principles of my said prior Patent No. 1,073,324, by employing a clamp controlling actuator or rail 36 arranged longitudinally and coöperating with the clamp closing spring device 24 in such way as to force the clamp open against the spring and afterward permit the spring to close it. See Figs. 1 and 17. This rail, or at least a portion of it, is moved from the operating shafts of the machine. Thus, in Fig. 1, the extreme right end 37 of the rail is indicated in full and dotted lines as movable outward to press on the spring device 24 to open the clamp at the delivery position. The spring device, which is provided with a roller 24^a for this purpose, then travels along the entire length of the rail 36 until the new book has been properly positioned in the clamp, when the rail, by its termination or incline at its left end, permits the closing of the clamp.

As seen in Fig. 17 the rail portion 37 is carried at the top of an arm 38 which is fulcrumed at its lower end and is held by an adjustable brace 39 in rigid relation with a second arm 40, the end of which carries a roller engaging a cam 41 on shaft 31. The adjustment of the brace 39 determines the extent of opening movement of each clamp.

In the machine herein illustrated I follow the plan shown in my said Patent No. 1,073,324 of employing a table 42 at which the operatives may stand and by hand set the books one at a time into operative relation with the machine. Instead, however, of requiring the operative to place each signature group or book directly into each of the successive clamps, as in my said Patent No. 1,073,324, I prefer to locate the table slightly removed from the clamp position, as is done in the Lewis patent,

wherein an automatic pusher moved in time with the rest of the machine conducts each successive book from a table into proper position in the clamping and carrying means.

Thus, referring to Figs 1 to 6, a book conducting infeed device 43 is shown extending between the table 42 and the book carrier and comprising a series of pushers 44 moved in time with the rest of the machine.

It will be noticed that the commencement of the book infeeding devices and the table 42 are at a lower level than the series of clamps 21 constituting the book carrier 20. This is important for two reasons. Thus, as will be clear in Fig. 2, the books B are brought into the clamps 21 with a lifting movement, at a substantial incline, which is contrary to the Lewis arrangement of infeeding in the same direction as the horizontal book travel, and is of advantage because the very effective type of clamp 21 is permitted, in which the members relatively separate and approach by parallel motion, guided by transverse horizontal guides or rods, as in my prior Patent No. 1,073,324. The clamp guide rods each act as a gage for positioning the book relatively to the clamp before the closing of the latter. Another advantage is that the lower level of the book infeeding conveyer permits it to be located beneath the discharge or delivery of the machine. This is of additional importance because, as seen in Fig. 1, the delivery may be arranged at the same side as and adjacent to the point of infeed, thus utilizing the entire length of the orbit of book travel from the cover breaking mechanism around the right hand end of the machine to the delivery for permitting the setting and hardening of the adhesive.

The illustrated details of the infeeding mechanism will now be described. The conveyer frame or bar 45 extending from the table 42 first horizontally and then at an upward incline is grooved at its upper side, as more clearly seen in Figs. 4 and 17, the groove being formed with interior shoulders on which run the pushers 44. The extreme right end of the conveyer is formed as at 45[a], Figs. 2 and 6. Each book B is placed vertically between the fixed but adjustable vertical side guards or guide-plates 46, and the bottom of the book rests in the bottom of the groove in the conveyer frame 45, as seen in Fig. 4. The pushers 44 are spaced apart at intervals corresponding with the traveling clamps 21, and the pushers are connected to and advanced by sprocket chains 47, 47, located on the shoulders within the grooved interior of the conveyer frame.

It will be noticed that the sheet metal side plates 46 are slightly flared at their upper ends, and at the entrance or beginning of the book travel are curved so as to facilitate the operatives setting the books between the plates and in front of the respective pushers 44. The pushers advanced by the chains 47 carry the books horizontally along the conveyer frame 45 and thence upwardly into the clamps 21.

The chains 47 are seen to pass around guiding wheels or sprockets 48 and a driving sprocket 49 with which coöperates a sprocket pinion 50 for adjusting the tightness of the chains.

In order to assist the starting of each book up the inclined part of the conveyer frame and minimize the danger of disturbance to the book I sometimes arrange a supporting belt 51 at a portion of the conveyer so that the book at this point is not only pushed forward by the pushers 44, but rests upon an advancing surface.

For transmitting power to drive the chains 47 and belt 51 I show a pair of bevel gears 52 between the secondary power shaft 31 and a pair of gears 53, the last of which is on a transverse shaft 54 carrying at its extremity a pulley 55 on which the belt 51 runs. A sprocket chain 56 and sprocket wheels communicate the rotation to a short transverse shaft 57 which, at its extremity, carries the driving sprocket 49. The parts thus all move in harmony at the same speed and in unison with the book clamp movements.

The successive books, then, are stood upright by hand at the table 42 and set between side plates 46 so that one of the cross pins or pushers 44 will come up behind the book and cause it to slide along the conveyer frame 45.

As the book travels along a horizontal part of the infeed it is preferably subject to the action of a pair of rotating polygonal rollers 58 which deliver a quick succession of light blows at the back edges of the signatures so as to jog them into alinement if they have not already been properly arranged. The two rolls will be suitably journaled at their ends and will rotate in unison by reason of a sprocket chain 59 which, as seen in Fig. 5, is actuated by a belt 60 extending between suitable pulleys on one of the roller shafts and the shaft 54. As seen in Fig. 3, the conveyer bar 45 is cut away so that the angles of the jogging rollers extend into the path of the books.

Each book then continues to travel horizontally until reaching the inclined portion of the infeeding conveyer, when its starts up the incline assisted by the traveling belt 51. It will be understood that the outermost guiding plate 46 is omitted from Fig. 2 to better show the books and mechanism.

The two side plates 46 form a vertical book groove which is substantially in alinement with the space between the outer and

inner plates of the open clamp 21. The groove between the side plates, however, is narrower than the clamp space so that the book will rise without hindrance from the former to the latter.

The upper portions of the guide plates are cut off horizontally beneath the level of the clamps, as seen in Fig. 6, so as to avoid conflict. It will be understood that in Fig. 6 the conveyer frame and chains are shown horizontally for convenience only, since these are in reality inclined upwardly as seen in Fig. 2.

By the described arrangement, as each book reaches the upper part of the infeeding conveyer it commences to enter cornerwise in the open book clamp above it so that as the book receives diminishing guidance from the side plates 46 it receives increasing guidance by the separated clamp members 22, 23.

As each book arrives at the top of the incline and while still being pushed forwardly under the influence of the cross pin or pusher 44, it comes to a point above a stationary leveling table 61 adjustably secured at the top of a stationary bracket 62. See Figs. 2 and 6. Fig. 2 shows one book about to move over the table and another book resting flatly on the table. Fig. 6 shows a book that has been pushed partly upon the table. At this stage the book is at an inclined position and it remains so until it has been pushed so far over the leveling table that gravity causes it to straighten out, as shown in Fig. 2.

When the rear edge of the book has arrived at the leveling table, the pusher 44 ceases to act upon it, it passing downward around the sprocket wheel. At this stage in the operations the book preferably comes momentarily to rest, standing upright on the leveling table and supported vertically by the open clamp members. This result is effected by timing the sprocket chains which carry the pushers 44 so that each book will be slightly in advance of its clamp. A belt such as 51 may be used to accelerate the book for the same purpose. However, after the book has been leveled on the plate 61 and the pusher has ceased driving it, the rear clamp guide rod 23^a meets the rear edge of the book, serving to "head up" or aline the signatures, and serving as a gage to properly determine the longitudinal position of the book in the clamp, while the leveling table 61 serves to gage its vertical position. Jogging rollers such as 58 may be provided under the leveling table, to finally insure the complete alinement of the signatures.

The clamp guide rod 23^a now pushes the book forward with the clamp for a short distance until the automatic closing of the clamp, as before described, causes the book to be firmly grasped between the clamp members, which occurs before the book has passed beyond the position in which it is supported on the leveling table.

Various adjuncts and accessories in connection with the infeed may be advantageously employed. Thus as shown in Fig. 17, the width of the groove or space between the guide plates 46, 46, may be adjusted by screw device 63 to suit different thicknesses of books.

A toggle device 64, 65 may be tripped or broken to the right in Fig. 2 by link 66 and handle 67 for swinging downwardly the inclined portion of the infeeding conveyer frame 45; and this action may be accompanied by stoppage of the machine through a rock shaft 68 connected by arm and rod 69 to a handle 70, see Fig. 8, which is secured on a cross-shaft 71 through which it throws the unclutching device 72. Further, by arranging a rod 73 to be actuated when a book is jammed at the infeed, for example, by an easily movable false bottom in the conveyer frame, this rod, through a device 74 may unlatch the lower toggle arm 65 so that a spring 75 will break the toggle, thus dropping the infeeding frame and stopping the machine. Further a feeling device 76 is shown located to be struck by a book that has failed to discharge from the clamp, this feeler operating through a lever 77, link 78 and latch device 74 to drop the infeeding conveyer and stop the machine, thus preventing damage.

I also preferably employ an accessory contrivance controlled by the presence or absence of a book in the clamp after leaving the conveyer. Occasionally a book may not be placed in the conveyer and a clamp may be left empty. A suitable feeler to detect this condition may be operated by some part of the clamp when closed, for convenience, by the roller 24^a, which takes different positions according to whether the clamp is opened or closed. Such feeler may be utilized by mechanical connections of an obvious nature to prevent the cover applying mechanism farther along in the machine from supplying a cover corresponding to the empty clamp. This safety contrivance, however, is not made the subject of claim herein.

There has thus been described, in combination with the traveling book carrier, for clamping in an upright position and advancing in a horizontal direction each book to be operated upon, a book infeeding mechanism, which like that of the Lewis patent, operates automatically in time with the carrier travel, and serves for entering the books into engagement with the carrier; but differing from the prior art in that the infeeding movement is not in the same direction as the advancing movement of the carrier, but at a substantial angle to the direction of carrier

travel, namely, with a steadily rising and advancing incline. Since the infeeding mechanism operates in time with the carrier travel, the two coöperate irrespective of the nature of the movement, whether continuous, uniform or varying speed, or intermittent.

The described infeeding mechanism may be advantangeously employed either for books that have already been bound and which require only to be glued and covered in the clamp, or for handling loose signature groups that require to be bound while in the clamp, for example, by trimming, gluing, and backing; in which latter case the book infeeding conveyer may, of course, be united with the delivery of a signature gatherer such as that shown in my Patent No. 1,177,600, in order to obviate hand transfer of the books, or, a gravity or hopper device of a well known kind may be used, the books being placed in quantities in the device and being automatically dropped or thrust one at a time into the infeeding conveyer. Such an infeeding hopper is shown in Pachter Patent 1,033,265 of July 23, 1912.

The operation of the jogging devices may be further explained as follows: The octagon rollers 58 are turned rapidly giving slight vertical blows which aline the signatures vertically. The jogging rollers turn in the direction of the arrows so that they are constantly tending to force the signatures to the left against the pushers 44, thus helping to "head up" the signatures or aline them horizontally. The travel of the loose signatures up the incline tends also to head them up against the pushers. The dropping of the signatures flatwise on the leveling table again tends to aline them vertically, and this action may be assisted by a hold-down spring 79, Fig. 2. Finally the clamp pin 23^a impacts against the signatures, thus insuring their horizontal alinement before the clamp closes. These various jogging expedients are very important on account of the essential necessity of proper heading up and alinement of the loose signatures or sheets prior to the clamping of the books in the carrier, since any lack of alinement will result in a defective book.

Trimming mechanism.

The trimming off of the doubled edges or folds of the loose signatures may conveniently be the first step in binding by the flexible method and in Fig. 1 is shown in plan view an effective trimming mechanism 81 adapted for this purpose, the complete details of which may be ascertained by reference to my aforesaid co-pending application Serial No. 48,959. The signature groups which are held upright in the clamps have their folded edges protruding downwardly and the trimming mechanism 81 is shown beneath the path of book travel. Instead of using a shearing mechanism, as in my prior patents, which would have to be reciprocated to conform with a continuous book travel, I prefer a mechanism which operates progressively, and for this purpose have shown a blade 82 which is arranged transversely to the path of the book travel and is so actuated, without changing its position in the machine, as to cut and trim off the back edges of the book. The blade 82 is shown as an endless band knife passing around large pulleys and caused to travel constantly at a high rate of speed. The forward travel of the book is thus utilized to produce the necessary relative feed so that the knife will progressively trim the book from the forward to the rear end. Suitable confining means 83, 84 of a rotary nature are shown for maintaining the book and blade in proper relation. The mechanism may be driven from the power shafts 30 or 31 or from an independent source. While the trimming mechanism may operate irrespective of the mode of advance of the book, it will be observed that a steady uniform book speed more effectively coöperates with the blade than would an intermittent or substantially variable speed.

Roughing mechanism.

In order to roughen and abrade the trimmed back edge of the signature group to facilitate the gluing, a roughing mechanism 86 may be employed of the nature generally indicated in Fig. 1, in which one or more toothed wheels 87 are constantly and rapidly turned in such position as to abrade or roughen the book. The motion of the roughing wheels being continuous, their action is independent of the mode of advance of the book, whether continuous or intermittent. In other words, like the trimming mechanism the roughing mechanism operates while the book is traveling.

The mechanism is the same as in my prior patent No. 1,073,324 in which also the roughing is performed while the book is traveling; and said patent may be referred to for available details of structure, which, for convenience, are omitted herefrom, since the details *per se* form no part of the present invention.

Cross grooving mechanism.

I believe it to be new in a machine of the present sort to provide in combination with the other mechanisms, such as the book carrier, the trimming mechanism, and the gluing mechanism, a cross grooving mechanism which automatically produces transversely extending grooves at the back edge of the book after the trimming and prior to the gluing, so as to facilitate the glue permeat-

ing between the individual sheets to afford a more secure binding.

The grooving mechanism 89, which is seen in general plan in Fig. 1, is best seen in detail in Figs. 7, 8 and 9, and a portion of the resulting book or signature group B is indicated in Fig. 10. The grooves G are seen to be shallow, and may be about $\frac{1}{16}$ inch in depth.

Generally speaking, the mechanism comprises a suitable number of cutting tools, which may be termed saws, operated to move at high speed, for example, by using the circular type of saw attached to a fast rotating spindle. The entire device is operated to lift or move toward the book, and, by arranging for a brief advancing movement of the device, it may be caused to operate while the book is traveling.

Thus, referring to the drawings, there are seen a plurality of circular saws 90 mounted, for convenience, on a cylindrical member 91, which rotates with the spindle 92.

To permit the bodily lifting and falling of the device the spindle is shown mounted horizontally and longitudinally in a frame consisting of upright arms 93, 94, 95, all connected at their lower ends to a lower brace rod 96, and being additionally connected by an upper brace rod 97. By lifting and dropping the frame 93—97 the grooving saws can be brought up into operative contact with the back of the book and restored to inoperative position.

To lift and drop the frame a pair of rearwardly extending rock arms 98 extend from the lower brace rod 96 to a longitudinal rock shaft 99, which has no movement except of rotation. The rock shaft and rock arms are rocked at the proper times by means of a cam arm 100, fast with the rock shaft and having its extremity or stud engaging a rotary cam 101 on the power shaft 31. The cam arm 100 has an adjusting device 102 by which the extent of rising movement of the cross grooving device may be predetermined.

The rock arms 98 lift and drop the spindle carrying frame, and I employ means for controlling the position of the frame as it rises and falls. Thus, it may be desirable to swing the frame laterally, so as to cause the saws to move across the face of a wide book. For a narrow book, however, a simple vertical rising and falling movement of the frame is sufficient, and the frame-controlling rod 103, therefore, serves in the disclosed embodiment as a steadying means. This rod extends rearwardly to where it is pivoted to the upper end of a swinging cam arm 104, a roller being provided at the pivot, which roller is engaged by a cam 105 on the power shaft 31. A spring 106 may be applied to the arm 104 to hold the roller against the cam, which is shaped to control the upper part of the frame so that the saws will be lifted substantially vertically against the book. The spindle frame may be pressed inwardly by strong spring 107 extending from the spindle frame to a fixed frame part of the machine.

The described devices provide for the movement of the grooving device to and from operative position. I will now describe means for maintaining the grooving device in motion, that is, for rotating the circular saws at the appropriate speed.

A belt pulley 108 is splined or otherwise secured on the spindle 92 near its left end, being shown located between the bearing sleeves at the top of the frame arms 93 and 94. A belt 109 extends from the pulley 108 to a pulley 110 loose on the frame rod 96. Turning with the pulley 110 is a smaller pulley 111, connected by a belt 112 with a driving pulley 113 mounted on the prime shaft 30. A shiftable pulley 114 is shown bearing on the belt 112 for taking up the slack, and a spring 115 to maintain yielding pressure is shown.

By these connections, or any other suitable connections, the cross grooving circular saws are maintained in a state of rapid rotation, so that, when brought into contact with the book, the desired grooves will be cut. After each grooving operation the grooving device, the frame, etc., may return to inoperative position by gravity, as permitted by the contour of the cam 101.

In order that the advancing travel of the book may not interfere with the grooving operation, I have provided means permitting the device to operate while the book is traveling. For this purpose the spindle 92 is arranged to slide longitudinally in the bearing collars at the upper ends of the frame arms 93, 94 and 95, the pulley 108 being splined to the spindle, as before stated. My plan for advancing the grooving device is to arrange that the book itself, or the clamp which carries the book, shall push the grooving device in the direction of travel while the cuts are being made, the parts being returned each time to normal position, for example, by springs.

At a convenient point on the spindle 92, the latter is engaged by a slotted arm 117. Relative lateral movement is permitted by the slot, but relative longitudinal movement is prevented by suitable collars on the spindle, as shown. The arm 117 may be moved longitudinally by a slide 118, which is shown in the form of a sleeve surrounding a guide rod 119. The rod 119 is adapted to move up and down in unison with the rising and falling movements of the grooving device, and for this purpose is swung by rock arms 120 from a fixed axle or fulcrum 121. To raise and lower the guide rod 119, a link 122 is shown extending from the lower brace rod 96 of the spindle frame to the

guide rod 119. Thus, the slide or sleeve 118 is caused to rise and fall in unison with the grooving device, while the slot in the arm 117 gives relative free play transversely.

By moving the slide 118 at the proper time and in harmony with the advancing movement of the book, the circular saws are at the same time caused to advance with the book for the purpose mentioned. To this end the slide 118 is shown as provided with an upstanding contact piece 123, adapted to be engaged by a contact 124 on the book clamp device 24. This engagement takes place only when the grooving device has been lifted. The contacts are timed so that the actual commencement of grooving occurs simultaneously with or subsequently to the clamp contact 124 coming into engagement with the slide contact 123. It will be understood that the moment the contact 124 strikes the contact 123, the circular saws move bodily forward with the book during the grooving.

The extent of forward motion may be quite small, as the rapidly rotating saws cut very quickly, and the dotted lines in Fig. 7 give an indication of a suitable extent of forward movement. It will be further understood that the forward movement ceases when the grooving device is lowered by the control arm 101. For returning the parts to normal position, a spring 125 attached to the contact 123 will suffice.

To resist the pressure created by the operation of the circular saws, an abutment 126 is arranged to bear against the inner side of the downwardly protruding book.

Gluing mechanism.

Herein is shown at 127 a gluing mechanism of generally well known characteristics. This is indicated in the general plan view, Fig. 1, and is shown also in Fig. 8. Within the usual glue vessel 128 is a movable device, namely, the rotating roller 129 arranged in the vessel for conveying adhesive to the book B above it. The roller is partly immersed, and its upper portion is arranged to progressively apply to the book the glue lifted by its rotation from the vessel. The roller may be automatically driven, as usual, for example, by a sprocket chain 130, so that the upper periphery of the roll advances in unison with the book. The chain is shown provided with a tightening device.

By this well-known arrangement the gluing mechanism operates during the travel of the book, and its operation is independent of whether the book be advanced intermittently or continuously.

Since glue is usually employed, the vessel may be heated in the usual way to melt the adhesive.

I also adopt the well known plan of causing the gluing device to lift and drop, so that it may be moved toward each book near the front end thereof and withdrawn near the rear end of each book. Instead, however, of shifting the glue roller within and relatively to the vessel, I mount the roller in the vessel in the manner of my prior Patent 1,073,324, Fig. 5, capable only of rotary movement, and I bodily lift and drop the entire gluing mechanism, vessel, roller and all. Thus, the vessel 128 is shown mounted at the top of a vertical stem 131, which is slidable in a suitable sleeve and is connected by a link 132 to a cam lever 133, which is fulcrumed near the link and has a long arm extending to cam 134 on the power shaft 31. An adjusting device 135 determines the extent of elevation of the gluing mechanism, and gravity lowers the same and maintains the cam and follower in engagement.

The contour and the timing of the cam 134 are such that the gluing mechanism is lifted as the front corner of each book comes above the glue roller, and is dropped as the rear corner passes over the glue roller. Thus, the spreading of glue is minimized, and the adhesive may be confined so as not to extend to the extreme corners of the book.

If desired, a safety contrivance may be employed of a suitable nature, which will prevent the rise of the gluing mechanism or the application of glue to the book in case no book cover has been fed corresponding to the book, a cover detecting device of a usual sort being available for this obvious purpose.

A portion 136 of the glue heating means is indicated.

Strip attaching mechanism.

I prefer, as in my prior patent, to employ mechanism 137 for attaching to the glued back of the book a piece of pervious material, which may be termed a pervious strip, this consisting, for example, of a suitable length of crash or other woven or fibrous or analogous material, which may be laid over the adhesive so as to assist generally in consolidating the back edges of the signatures, which become firmly attached to each other and to the pervious strip. The adhesive permeates the strip and permits the subsequent attachment of a suitable impervious strip, such as a piece of paper, which may be a portion of the cover to be applied to the book. In this way the pervious strip assists both in the binding and covering operations.

The drawings show a spool holding device 138, from which the supply of material passes over a feed plate 139 to devices which cut off the proper width of strip, and then lift it into proximity with the book and

impel it by a puff of air against the book at a time when the latter is exactly above the strip. The action, therefore, is independent of the nature of the travel of the book, whether steady, variable, or intermittent. The further details of the mechanism may be ascertained by reference to my aforesaid co-pending application Serial No. 108,894.

Cover applying mechanism.

I prefer to apply or place the cover against the glued back of the book, as in my said prior Patent No. 1,073,324 by means of a cover supporting platen or table or platform, which, as each book comes adjacent to it, moves or rises toward the book B so as to bring the cover C in contact therewith. Instead of the mere lifting and dropping movement to the platen, it may additionally have an advancing movement in the direction of book travel, as in the Lewis patent, so that the application of the cover is independent of the nature of the travel of the book, whether steady, variable, or intermittent.

The cover-applying platen or table hereof is lifted to the book and moves forwardly, subsequently moving down and back to the original position. Instead of maintaining a quantity of covers on the platen or table, as in said two prior patents, in connection with the devices for gradually raising the level in order that the successive covers may come into proper position, I prefer the well-known equivalent arrangement of feeding covers from an exterior source one at a time to the platen; for example see Bredenberg Patent No. 1,179,892, April 18, 1916.

The cover applying platen hereof, which is best shown in Fig. 12, comprises a central longitudinal plate 143 beneath the path of the books, and outlying plates or wings 144 connected by cross pieces 145 to the central plate; so that the platen is a built-up skeleton structure. The wings are shown slightly lower than the central member.

The plate 143 is secured at the upper side of a longitudinal slide 146. These parts are broken away in Fig. 12. The slide is adapted to reciprocate longitudinally, as stated, and for this purpose is suitably fitted to a longitudinal guide 147.

It should be noted that the slide and platen extend well beyond the guide 147 at the left, and at the right the guide and platen extend beneath the cover breaking positions of the book. The platen, therefore, constitutes not merely a cover applier at its left end, but a presser at its middle and right end, it being three units long so that each book is operated upon three times by the platen or presser 143.

To produce the rising and falling movement of the platen in order to carry each cover to the book, the guide 147 is arranged to rise and fall, as best seen in Figs. 13 and 14, in which, respectively, the guide, slide and platen are in their upper and lower positions.

Extending downwardly from the guide 147 at two convenient points are vertical guide rods 148 slidable in fixed bearings 149 and having cam rolls 150 at their lower ends. The cam rolls 150 rest upon cams 151 mounted on transverse shafts 152 driven from the power shaft 31 so as to elevate and drop the platen in harmony with the book travel. The connections may consist of a bevel gear 153 on the shaft 31 engaging a similar gear 154 on a cross shaft 155 which is also provided with a gear 156 engaging a gear 157 on one of the cross shafts 152, an idle gear 158 serving to communicate the motion to the gear 157 on the other cross shaft 152, as seen in Figs. 11 and 13.

The cam 151 is of such contour and timing as to lift the cover applying platen 143 when the book is above the platen so as to properly place the cover on the book.

To give the cover applier an advancing movement analogous to the Lewis Patent to facilitate the accuracy of the cover applying operation, the platen 143 and the slide 146 beneath it may be caused to move longitudinally in the rising and falling guide 147 by any suitable mechanism; for example, a cam 160, mounted, for convenience, on the cross shaft 155, is arranged to act on the follower or roller of an upright cam lever 161 which, at its upper end, as seen in Figs. 11 and 12, is connected by a link 162 with a boss at the under side of the slide 146. In order to hold the lever up to the cam 160, the lever and link may be constantly pulled toward the right by a spring 163.

The contour and timing of the cam 160 are such as to cause the cover applying platen to move bodily in the direction of the book travel at the time the cover is applied to the book, the cam serving to return the parts leftward after the other cam 151 has lowered the platen beneath the level of the book. The total to-and-fro movement may be six inches or so.

It is necessary that the covers shall accurately take their proper position on the members 143, 144 of the platen in order that the covers may register properly with the book. For this purpose shoulders or hooks 165 are provided at the rear end or side of the platen. These hooks are located on the platen wing members 144 so as not to have any conflict with the traveling books. It will be understood that the covers are carried forwardly by the hooks 165 as the platen rises and advances, and, to prevent the covers becoming forwardly displaced on the platen, a light spring or wire device 166 may be arranged upon the link 162 up-

standing in the path of the covers but capable of yielding to permit the covers to pass forwardly with the books after attachment.

The position of the covers on the platen may be regulated by adjusting longitudinally the members 144 carrying the hooks 165, and devices 167 on the cross bar 145 are shown for this purpose.

Fixed plates or bars 168, seen in Fig. 12, but not seen in Fig. 11, may be arranged in conjunction with the cover applying mechanism to assist in supporting the outlying flaps of the cover between the plates 143 and 144. As each book carries its cover forwardly from the applying mechanism the wings or flaps of the cover at each side are caused to ride up over a curved supporting plate 169, to which plate 168 is secured. A curved continuation 170 of the plates 169 extends around the end of the machine, see Figs. 1 and 11.

Fig. 12 shows in full lines the cover applying mechanism lowered and retracted, ready to receive a cover, rise and advance. No cover is shown in the applying position. However, the hooks 165 and the cover C are shown in dotted lines in Fig. 12 in their advanced position. Fig. 11 also shows them raised and advanced, and in dotted lines lowered and retracted.

It is desirable that the covers shall be centered on the platen before being applied to the books so as to insure the book being centrally placed with respect to the cover. For this purpose a pair of opposite centering members or plates 171 are shown, these being symmetrically arranged and supported at the top of lateral swinging upright arms 172. Each arm 172 is pivoted within the lower end of a rigid upright frame 173. Each centering member 171 is adjustable on its carrying arm by means of a rod 174 which may be secured in its desired adjustment by set screw 175. The centering plates slide in their transverse movements over small plates 176 supported from the frame 173.

By this arrangement the arms 172 may be moved toward and from each other, and, if this motion is symmetrically performed, the centering plates 171 will symmetrically approach the covers from opposite sides and accurately center them with respect to the platen and book.

To secure such symmetrical movements, the following devices may be used. A spring 177 is shown tending to cause the mutual approach of the centering plates, and, opposing the spring, are a pair of symmetrically arranged wedges or cams 178 adapted to be oscillated in unison so as to act upon studs or followers 179 adjustably secured near the lower ends of the respective arms 172. The two cams or wedges 178 are both mounted on a rock shaft 180 extending transversely from side to side.

In order to automatically rock the shaft 180 and thereby cause the cams 178 to symmetrically operate the centering plates, I show a longitudinally extending cam arm 181 pulled downwardly by spring 182 so as to maintain its cam stud 179 in contact with cam 183 mounted on the cross shaft 155. The contour and timing of the cam 183 is such that the wedge cams 178 operate to permit the centering plates to approach into contact with the covers and thus center the covers and to immediately retract or separate them.

It will be understood that the several described adjusting devices enable the centering plates to be set in predetermined positions according to the size of the book covers. Symmetrical adjustments may be simultaneously made by changing the relation of the adjusting shaft 180, for example, to the cam arm 181.

I may maintain in some cases on the cover applier 143, 144 a small number or stack of covers and employ the sheet feeding mechanism, to be described, for replenishing the stack of covers. By this arrangement there is no danger of the metal parts of the applier coming into contact with the glue on the book in case the sheet feeding mechanism fails to supply a cover; and any depletion of the stack of covers in this way may be offset by the addition of covers to the stack when a book clamp comes along empty.

In order to supply covers one at a time to the platen 143—144, any convenient sheet feeding mechanism may be employed. These mechanisms have been long well known for feeding sheets singly to the platens of printing presses and for analogous purposes, and such mechanisms are on the market and can be purchased and connected up by sheet feeding tapes to convey the sheets in any direction and to any given position or platen in a variety of well known ways.

For example, I may use the "Cross" feeding mechanism which contains devices that deliver sheets of paper one at a time, for example, the covers of books. See F. L. Cross Patents Nos. 637,324 of November 21, 1899; 690,702 of January 7, 1902; 812,260 of February 13, 1906 and 887,314 of May 12, 1908. As this feeding machine is well known I do not herein describe nor illustrate it further than to indicate in Fig. 11 the delivery tape 185. This is an endless tape passing around suitable driven rollers, and the advance of the successively fed covers is indicated herein as continued by an endless chain 186 which may be provided with stops or pushers 186ª at suitably placed intervals. The sheet feeding machine and

the chains 186 may be located wherever convenient, for example as shown, or the covers could be fed from different directions, for example, from the side as in my prior Patent No. 1,179,892. The chain extends horizontally to a convenient point where the feed may again be taken up by tapes arranged to advance the successive covers and to place them one at a time upon the cover applying platen. I will not describe in detail the travel of all the tapes shown in Fig. 11, but will explain the path of travel of each cover with reference to the pulleys or rollers around which the tapes pass in connection with arrows indicating the direction of movement of the tapes themselves.

Each cover passing from the chain 186 enters between rollers 187 and 188 becoming engaged at the same time by a traveling tape 189. The cover next passes between rollers 190 and 191 and becomes engaged by an overlying tape 192. The advancing cover is thus held between overlying and underlying tapes. It then passes around an idle guide roller 193, thence around roll 194, thence between rolls 195, 196, and finally between rolls 197, 198, the tapes then separating and returning by convenient routes to the starting point.

As each cover is thrust forwardly disengaging the rolls 197, 198, it drops upon the platen and is thereafter taken charge of by the platen and lifted into contact with the book, while being advanced as already explained.

The perspective view, Fig. 12, shows a cover C passing forwardly beneath the overlying rollers 195 and 197 and the tapes 189; this view omitting the underlying tapes and rollers for clearness.

The supports for the several tape rollers need not be described excepting to call attention that the support 199 for the rolls 197 is cut away or so shaped as to afford a recess 200 at each side for accommodating the shoulders or hooks 165 of the platen.

The parts are so timed that the hooks 165 in their retracting movement enter the recesses 200 and while in that position the sheet feeding tapes deposit the cover on the platen with the rear edge of the cover in front of the hooks. The cover is, therefore, always securely placed on the platen and is engaged longitudinally by the hooks 165 in connection with the resilient positioning wire 166 contacting the front edge of the cover.

The overlying tapes 192 may be supplemented by another set of overlying tapes 202 which do not pass completely to the point at which the tapes deliver the sheet to the platen.

A tape tightening device 203 may be employed capable either of tightening all the tapes simultaneously, or separately tightening the individual tapes by suitable adjustment.

The chain 186 may travel more slowly than the tapes, so that each cover is accelerated and drawn from the chain as the tapes engage it.

Cover breaking mechanism.

As in my prior Patent No. 1,073,324, the cover breaking mechanism 205 hereof comprises opposite jaws 206 and 207 which are moved toward each other to strike and bend or break the covers, thus folding them snugly around the sides of the book. In order to operate the breaking mechanism so that it will engage the book while the book is traveling, I prefer to employ in part the principles disclosed in the cover breaking mechanism of Figs. 35 to 37 of prior L. and B. Patent No. 476,208, wherein the jaws are not reciprocated longitudinally but are guided by rotary carrying devices to move in a circuitous path which touches the path of the book. By this well-known contrivance the operation of the cover-breaking mechanism is independent of the mode of travel of the book, whether intermittent, continuous, or otherwise. As in the old patent it acts while the book travels.

The cover breaking jaws 206, 207 hereof are specifically given a purely horizontal motion of the rotary kind so that during each rotation thereof the jaws are brought tangentially against the book and cover. In using the words tangent or tangential in respect to the movement of the cover breaker jaw, we mean that each portion of the jaw face is caused to move in a path tangent to the side of the book or the path of the book travel. The pressure is of short duration but of extreme force, as the circular motion gives a force equivalent to and an action analogous to that of a toggle joint; and the jaws are elongated over two units in length so that each book is twice subjected to the breaking pressure.

Each jaw 206 consists of a comparatively thin plate arranged under the stationary plates or wings 169 previously mentioned, but which latter are omitted from Fig. 12 for clearness. Each breaker jaw is mounted at the top side of a heavy longitudinal bar 208.

As before stated the jaw is horizontal and also its motion is purely horizontal and in a circular path, this giving great simplicity and strength of action. The fittings may be as follows:

Beneath the bar 208 near each end is a circular or elliptical plate 209 which gives support to the bar and permits relative sliding. The bar is connected to each of the two circular plates by a short vertical cen-

tral stud 210. The stud 210 is in effect a crank and it moves circularly in a horizontal path about a vertical actuating shaft 211 journaled in vertical bearings 212.

Each vertical shaft 211 above its journal is provided with a collar 213, the shaft passing through the collar and engaging the plate 209.

By this arrangement as the shaft 211 rotates the circular plate and the stud shaft 210 are caused to travel around and around. This is true of the plates and studs at both ends of both of the breaker jaws, so that the two jaws move harmoniously in horizontal circular paths, tangent to the path of the book, delivering in each inward movement a brief but powerful pressure which is in the nature of a blow against the sides of the book. Figs. 12 and 14 show the breaker jaws at their position farthest from the book; Fig. 13 shows them contacting the book.

The four upright shafts 211 may be driven by bevel gears 214 at their lower ends engaging corresponding gears 215 on the cross shaft 152.

Any desired adjusting devices may be employed, for example, the adjusting handles 217 which may be operated by screw adjustment to initially set the breaker jaws toward or from each other and in proper relation to the book.

The book having had its cover twice struck by the breaking jaws passes, after the jaws have disengaged it, around to the delivery position at the other side, the glue setting *en route*.

Delivery mechanism.

For delivering the completed books from the machine I prefer the general plan indicated in my prior patent 1,073,324, Fig. 7, wherein, when each clamp has reached the delivery point, it is opened, permitting the book to drop by gravity upon a plate or guide, which conducts it to the receiving point or table, as desired.

It will be noted that the operation of this device is independent of the mode of travel of the book, whether continuous or intermittent. I have already hereinabove described the mechanism for automatically opening the clamp at the delivery point, and, as seen in Fig. 17, this has the effect of releasing the book, which thereupon drops upon the inclined plate 220, while the side plates 221 cause the sides of the cover to fold toward the book, so that the latter, sliding off the plate 220, is in closed condition.

Instead of a mere table or a stacking device, I may employ a delivery conveyer 222, which I will briefly but not fully describe, as the same will be made the subject of separate letters patent. A series of movable partitions 223 are arranged to travel around an endless circuit, so as to successively bring a series of compartments to a receiving position beneath the delivery plate 220. The principle of the device is that each compartment, when supplied with a predetermined number, for example, a dozen, completed books, moves onward one unit, bringing the next compartment into position. Driving connections are indicated by which the power shaft 31 communicates the desired step-by-step motion to the delivery conveyer; and, by changing the gear ratio of the connections, the intermittent feed can be adjusted so that each compartment will receive any desired number of books. Thus, with thicker books, a smaller number can be delivered into each compartment. Operatives may stand at the outward end of the conveyer to receive the groups of books and stack, package or ship them as desired.

Conclusion.

The complete machine and its operation have now been described. The process is indicated in the diagrams in Fig. 18, which show consecutively the different stages in the assembling, binding and covering of a book. The signatures S are grouped into a book B, then placed in the clamp 21 then trimmed off at the bottom, then roughed, if desired cross-grooved, and supplied with adhesive, then backed with a pervious strip F and then backed with an impervious backing strip or cover C, which cover may, if desired, be broken or bent around the book before discharge.

In the preceding description I have used various terms such as horizontal, vertical, inner and outer, but it is obvious that for many purposes these terms may be considered as merely relative and employed for convenience or description rather than as limitations upon the principles of the invention.

It will thus be seen that I have described a machine of the kind referred to, constructed according to the principles and attaining the objects and advantages of the present improvement. Since many features including matters of arrangement, design, combination and detail may be variously modified without departing from the underlying principles, it is not intended to limit the invention to such features except in so far as set forth in the appended claims.

What is claimed is:

1. In a book binding or covering machine the combination of a plurality of successive mechanisms for performing the operations involved in binding or covering books, said mechanisms arranged along the path of travel of the books, and a traveling book-carrier for conducting a succession of books along horizontally to such successive mech-

anisms, said carrier comprising an endless train of upright book clamps, and each clamp comprising opposed members openable and closable facewise upon the book with a substantially parallel movement, automatic means for feeding successive books into the successive clamps with a movement at an incline to the carrier travel, and means for causing the closing of each clamp after receiving a book, maintaining it closed during the operations of said mechanisms upon the books and thereafter causing its opening to discharge the book prior to the clamp's return to the infeeding position.

2. In a book binding or covering machine the combination of a plurality of successive mechanisms for performing the operations involved in binding or covering books, said mechanisms arranged along the path of travel of the books, and a traveling book-carrier for conducting a succession of books along horizontally to such successive mechanisms, said carrier comprising an endless train of upright book clamps, and each clamp comprising opposed members openable and closable facewise upon the work with a substantially parallel movement, means for causing the closing of each clamp after receiving a book, maintaining it closed during the operations of said mechanisms upon the books and thereafter causing its opening to discharge the book prior to the clamp's return to the infeeding position, and automatic means for feeding successive books in a procession beneath the clamp discharging position and thence upwardly at a rising slant into the successive clamps before the closing of the latter.

3. In a book binding or covering machine the combination of a plurality of successive mechanisms for performing the operations involved in binding or covering books, said mechanisms arranged along the path of travel of the books, and a traveling book-carrier for conducting a succession of books along horizontally to such successive mechanisms, said carrier comprising an endless train of upright book clamps, and each clamp comprising facewise opposed members openable and closable with a substantially parallel movement, means for causing the closing of each clamp after receiving a book, maintaining it closed during the operations of said mechanisms and thereafter causing its opening to discharge the book prior to the clamp's return to the infeeding position, and an upwardly slanted book-infeeding conveyer for automatically introducing the successive books into the successive clamps before the closing of the latter.

4. In a book binding or covering machine the combination of a plurality of successive mechanisms for performing the operations involved in binding or covering books, said mechanisms arranged along the path of travel of the books, and a traveling book-carrier for conducting a succession of books along horizontally to such successive mechanisms, said carrier comprising an endless train of upright book clamps, and each clamp comprising facewise-opposed members openable and closable with a substantially parallel movement, means for causing the closing of each clamp after receiving a book, maintaining it closed during the operations of said mechanisms and thereafter causing its opening to discharge the book prior to the clamp's return to the infeeding position, an upwardly slanted book infeeding conveyer for automatically introducing the successive books cornerwise into the successive clamps and means for leveling each book after introduction into its clamp before the closing of the latter.

5. In a book binding or covering machine the combination of a plurality of successive mechanisms for performing the operations involved in binding or covering books, said mechanisms arranged along the path of travel of the books, and a traveling book-carrier for conducting a succession of books along horizontally to such successive mechanisms, said carrier comprising an endless train of upright book clamps, and each clamp comprising facewise-opposed members openable and closable with a substantially parallel movement, means for causing the closing of each clamp after receiving a book, maintaining it closed during the operations of said mechanisms and thereafter causing its opening to discharge the book prior to the clamp's return to the infeeding position, an upwardly-slanted book-infeeding conveyer for automatically introducing the successive books cornerwise into the successive clamps, and means for leveling each book after introduction into its clamp before the closing of the latter, consisting of a level table at the top of the conveyer on which each book is caused to rest edgewise and is leveled by gravity and is vertically positioned in the clamp.

6. In a book binding or covering machine the combination of a plurality of successive mechanisms for performing the operations involved in binding or covering books, said mechanisms arranged along the path of travel of the books, and a traveling book-carrier for conducting a succession of books along horizontally to such successive mechanisms, said carrier comprising an endless train of upright book clamps, automatic means for feeding successive books into the successive clamps with a movement at an incline to the carrier travel, means for causing the closing of each clamp after receiving a book, maintaining it closed during the operations of said mechanisms and thereafter causing its opening to discharge the book

prior to the clamp's return to the infeeding position, a table arranged to receive each infed book and adapted to level the unclamped book and position it vertically in the clamp, and each clamp having a member adapted to move the unclamped book along the table and position it longitudinally in the clamp, before the closing of the latter.

7. In a book binding or covering machine the combination of a plurality of successive mechanisms for performing the operations involved in binding or covering books, said mechanisms arranged along the path of travel of the books, and a traveling book-carrier for conducting a succession of books along horizontally to such successive mechanisms, said carrier comprising an endless train of upright book clamps, means for causing the closing of each clamp after receiving a book, maintaining it closed during the operations of said mechanisms and thereafter causing its opening to discharge the book prior to the clamp's return to the infeeding position, a book infeeding conveyer for automatically introducing the successive books into the successive clamps before the closing of the latter, and an automatic jogging device acting upon each book while advancing in said infeeding conveyer for alining the signatures or loose components of the books.

8. In a book binding or covering machine the combination of a plurality of successive mechanisms for performing the operations involved in binding or covering books, said mechanisms arranged along the path of travel of the books, and a traveling book-carrier for conducting a succession of books along horizontally to such successive mechanisms, said carrier comprising an endless train of upright book clamps, resilient clamp closing means, a member traveling with each clamp and movable relatively to the clamp travel for opening the clamp, a movable device actuated automatically to give said member a quick opening movement at the book discharge position, and a fixed device for maintaining the clamp open while traveling to the infeeding and clamp closing position.

9. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along horizontally to the successive mechanisms below mentioned, said carrier comprising an endless train of upright book clamps, each adapted to hold a book with the back edge of the latter protruding, drive means for advancing the carrier, automatic means for feeding successive books into the successive clamps with a movement at an incline to the carrier travel, automatic means for closing each clamp after receiving a book, maintaining it closed during its advancing travel and thereafter opening it to discharge the book, mechanism located adjacent the path of book travel for automatically trimming off the back of each clamped book, mechanism located farther along the path of book travel for thereafter automatically cutting a plurality of transversely-extending glue-receiving grooves at the trimmed back edge of each clamped book, mechanism located farther along the path of book travel for thereafter automatically applying adhesive to the trimmed back and cross grooves of each clamped book, mechanism located farther along the path of book travel for thereafter automatically applying a suitable cover over the adhesive covered back of each clamped book, and mechanism for thereafter automatically bending and breaking the cover sides against the book before discharge thereof from the clamp.

10. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along horizontally to the successive mechanisms below mentioned, said carrier comprising an endless train of upright book clamps, each adapted to hold a book with the back edge of the latter protruding, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically trimming off the back of each clamped book, mechanism located farther along the path of book travel for thereafter automatically cutting a plurality of transversely-extending glue-receiving grooves at the trimmed back edge of each clamped book, mechanism located farther along the path of book travel for thereafter automatically applying adhesive to the trimmed back and cross grooves of each clamped book, and mechanism located farther along the path of book travel for thereafter automatically applying a suitable strip, backing or cover over the adhesive covered back of each clamped book.

11. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along horizontally to the successive mechanisms below mentioned, said carrier comprising an endless train of upright book clamps, each adapted to hold a book with the back edge of the latter protruding, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically trimming off the back of each clamped book, mechanism located farther along the path of book travel for thereafter automatically cutting a plurality of transversely-extending glue-receiving grooves at the trimmed back edge of each clamped book, and mechanism located farther along the path of book travel for thereafter automatically applying adhesive to the trimmed back and cross grooves of each clamped book.

12. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along horizontally to the successive mechanisms below mentioned, said carrier comprising an endless train of upright book clamps, each adapted to hold a book with the back edge of the latter protruding, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically cutting a plurality of transversely-extending glue-receiving grooves at the trimmed back edge of each clamped book, mechanism located farther along the path of book travel for thereafter automatically applying adhesive to the trimmed back and cross grooves of each clamped book, and mechanism located farther along the path of book travel for thereafter automatically applying a suitable strip, backing or cover over the adhesive covered back of each clamped book.

13. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along horizontally to the successive mechanisms below mentioned, said carrier comprising an endless train of upright book clamps, each adapted to hold a book with the back edge of the latter protruding, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically cutting a plurality of transversely-extending glue-receiving grooves at the trimmed back edge of each clamped book, and mechanism located farther along the path of book travel for thereafter automatically applying adhesive to the trimmed back and cross grooves of each clamped book.

14. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along edgewise to the successive mechanisms below mentioned, with the back edge of the latter protruding, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically cutting a plurality of transversely-extending glue-receiving grooves at the back edge of each book, and mechanism located farther along the path of book travel for thereafter automatically applying adhesive to the trimmed back and cross grooves of each book.

15. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along edgewise to the successive mechanisms below mentioned with the back edge of the latter protruding, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically cutting a plurality of transversely-extending glue-receiving grooves at the back edge of each traveling book, the same comprising a plurality of rotary cutters, a rotating spindle carrying such cutters arranged longitudinally of the book travel, a spindle-carrying frame movable toward and from the book and means for causing the spindle to longitudinally advance in said frame during the cross-grooving of each book, and mechanism located farther along the path of book travel for thereafter automatically applying adhesive to the trimmed back and cross grooves of each book.

16. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along edgewise to the successive mechanisms below mentioned, with the back edge of the latter protruding, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically cutting a plurality of transversely-extending glue-receiving grooves at the back edge of each book, an adhesive vessel located farther along the path of book travel and movable bodily toward and from the book, a movable adhesive roller or device mounted in the vessel adapted to convey adhesive to the book, and automatic mechanism for moving the vessel and roller toward and from each book traveling past it, whereby adhesive is applied to the trimmed back and cross grooves of each book.

17. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along to the successive mechanisms below mentioned, said carrier comprising a train of clamping members adapted to hold the books upright with the back edges of the latter protruding downwardly, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically trimming off the back of each clamped book, mechanism located farther along the path of book travel for thereafter automatically applying adhesive to the trimmed back of each book, and mechanism located farther along the path of book travel for thereafter automatically applying a suitable backing or cover over the adhesive covered back of the book, comprising a platen adapted to hold the covers substantially flatwise and mounted for shifting bodily with the covers to and from the traveling book and for moving forwardly and reversely along the path of book travel, together with devices for feeding covers successively and depositing the same upon the platen in front of a positioning member coöperating with the platen, means for automatically actuating the platen to advance and lift in unison with the book travel to apply a cover thereon to the traveling book, and to return to the cover receiving position, and an advancing positioning-member for engaging and positioning the rear edges of the successive covers after their deposit upon the platen,

and during the advance of, and the application of the cover to the book.

18. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along to the successive mechanisms below mentioned, said carrier comprising a train of clamping members adapted to hold the books upright with the back edges of the latter protruding downwardly, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically applying adhesive to the trimmed back of each book, and mechanism located farther along the path of book travel for thereafter automatically applying a suitable backing or cover over the adhesive covered back of the book, comprising a platen adapted to hold the covers substantially flatwise and mounted for shifting bodily with the covers to and from the traveling book and for moving forwardly and reversely along the path of book travel, together with devices for feeding covers successively over the platen rear edge and depositing the same upon the platen in front of a positioning member coöperating with the platen, means for automatically actuating the platen to advance and lift in unison with the book travel to apply a cover thereon to the traveling book, and to return to the cover receiving position, and an advancing positioning-member arranged to underreach the cover feeding devices for engaging and positioning the rear edges of the successive covers after their deposit upon the platen, and during the advance of, and the application of the cover to the book.

19. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along to the successive mechanisms below mentioned, said carrier comprising a train of clamping members adapted to hold the books upright with the back edges of the latter protruding downwardly, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically applying adhesive to the trimmed back of each book, and mechanism located farther along the path of book travel for thereafter automatically applying a suitable backing or cover over the adhesive covered back of the book, comprising a platen adapted to hold the covers substantially flatwise and mounted for shifting bodily with the covers to and from the traveling book and for moving forwardly and reversely along the path of book travel, together with devices for feeding covers successively and depositing the same upon the platen in front of a positioning member coöperating with the platen, means for automatically actuating the platen to advance and lift in unison with the book travel to apply a cover thereon to the traveling book, and to return to the cover receiving position, and an advancing positioning-member for engaging and positioning the rear edges of the successive covers after their deposit upon the platen, and during the advance of, and the application of the cover to the book, and a light, yielding positioning device to engage and position the forward edges of the covers.

20. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along to the successive mechanisms below mentioned, said carrier comprising a train of clamping members adapted to hold the books upright with the back edges of the latter protruding downwardly, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically applying adhesive to the trimmed back of each book, and mechanism located farther along the path of book travel for thereafter automatically applying a suitable backing or cover over the adhesive covered back of the book, comprising a platen adapted to hold the covers substantially flatwise and mounted for shifting bodily with the covers to and from the traveling book and for moving forwardly and reversely along the path of book travel, together with devices for feeding covers successively and depositing the same upon the platen in front of a positioning member coöperating with the platen, means for automatically actuating the platen to advance and lift in unison with the book travel to apply a cover thereon to the traveling book, and to return to the cover receiving position, an advancing positioning-member for engaging and positioning the rear edges of the successive covers after their deposit upon the platen, and during the advance of, and the application of the cover to the book, and a cover centering device comprising opposed members symmetrically movable toward and from each other at opposite sides of the path of book travel for transversely adjusting the covers on the platen before lifting to the book, and means for automatically actuating said centering members to approach in unison after the deposit of the covers on the platen and to subsequently recede.

21. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along to the successive mechanisms below mentioned, said carrier comprising a train of clamping members adapted to hold the books upright with the back edges of the latter protruding downwardly, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically applying adhesive to the trimmed back of each book,

and mechanism located farther along the path of book travel for thereafter automatically applying a suitable backing or cover over the adhesive-covered back of the book, comprising a platen adapted to hold the covers substantially flatwise and mounted for shifting bodily with the covers to and from the traveling book and for moving forwardly and reversely along the path of book travel, together with devices for feeding covers successively and depositing the same upon the platen in front of a positioning member coöperating with the platen, means for automatically actuating the platen to advance and lift in unison with the book travel to apply a cover thereon to the traveling book, and to return to the cover receiving position, and an advancing positioning-member for engaging and positioning the rear edges of the successive covers after their deposit upon the platen, and during the advance of, and the application of the cover to the book, and a cover-centering device comprising opposed members symmetrically movable toward and from each other at opposite sides of the book travel for transversely adjusting the covers on the platen before lifting to the book, means for automatically actuating said centering members to approach in unison after the deposit of the covers on the platen and to subsequently recede, and means for symmetrically adjusting the range of movement of said members to agree with varying sizes of covers.

22. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along to the successive mechanisms below mentioned, said carrier comprising a train of clamping members adapted to hold the books upright with the back edges of the latter protruding downwardly, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically applying adhesive to the trimmed back of each book, comprising a glue tank with rotating roller therein and means for bodily lifting the tank and roller as each book comes above it and dropping them as the gluing of each book is completed, and mechanism located farther along the path of book travel for thereafter automatically applying a suitable backing or cover over the adhesive covered back of the book, comprising a platen adapted to hold the covers substantially flatwise and mounted for shifting bodily with the covers to and from the traveling book and for moving forwardly and reversely along the path of book travel, together with devices for feeding covers successively and depositing the same upon the platen in front of a positioning member coöperating with the platen, means for automatically actuating the platen to advance and lift in unison with the book travel to apply a cover thereon to the traveling book, and to return to the cover-receiving position, and an advancing positioning-member for engaging and positioning the rear edges of the successive covers after their deposit upon the platen and during the advance of, and the application of the cover to the book.

23. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along to the successive mechanisms below mentioned, said carrier comprising a train of clamping members adapted to hold the books upright with the back edges of the latter protruding downwardly, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically applying adhesive to the trimmed back of each book, and mechanism located farther along the path of book travel for thereafter automatically applying a suitable backing or cover over the adhesive-covered back of the book, comprising a platen adapted to hold the covers substantially flatwise and mounted for shifting bodily with the covers to and from the traveling book and for moving forwardly and reversely along the path of book travel, together with devices for feeding covers successively and depositing the same upon the platen in front of a positioning member cooperating with the platen, means for automatically actuating the platen to advance and lift in unison with the book travel to apply a cover thereon to the traveling book, and to return to the cover-receiving position, and an advancing positioning-member for engaging and positioning the rear edges of the successive covers after their deposit upon the platen, and during the advance of, and the application of the cover to the book; and mechanism for subsequently automatically bending and breaking each cover around the sides of its book.

24. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along to the successive mechanisms below mentioned, said carrier comprising a train of clamping members adapted to hold the books upright with the back edges of the latter protruding downwardly, drive means for advancing the carrier, mechanism located adjacent the path of book travel for automatically applying adhesive to the trimmed back of each book, and mechanism located farther along the path of book travel for thereafter automatically applying a suitable backing or cover over the adhesive covered back of the book, comprising a platen adapted to hold the covers substantially flatwise and mounted for shifting bodily with the covers to and from the traveling book

and for moving forwardly and reversely along the path of book travel, together with devices for feeding covers successively and depositing the same upon the platen in front of a positioning member coöperating with the platen, means for automatically actuating the platen to advance and lift in unison with the book-travel to apply a cover thereon to the traveling book, and to return to the cover-receiving position, and an advancing positioning-member for engaging and positioning the rear edges of the successive covers after their deposit upon the platen, and during the advance of and the application of the cover to the book; said platen having its central or book-pressing portion elongated sufficiently to give a subsequent pressure against each book, and mechanism for breaking each cover simultaneously with such subsequent pressure.

25. In a book binding or covering machine the combination of a traveling book-carrier for conducting a succession of books along to the successive mechanisms below mentioned, said carrier comprising clamping means adapted to hold the books with the back edges of the latter protruding, drive means for advancing the carrier, mechanism located adjacent the path of book travel for applying adhesive to the back of each book, mechanism located farther along the path of book travel for thereafter applying a cover over the adhesive covered book back, and mechanism for thereafter breaking the cover about each book, comprising a breaking jaw, and rotary jaw-carrying devices arranged to move the jaw so as to deliver a momentary but powerful cover-breaking blow.

26. In a book binding or covering machine the combination of a traveling carrier adapted to hold and advance a succession of books having attached covers, and mechanism for breaking the cover about each book, comprising a jaw arranged longitudinally at each side of the book, and rotary jaw-carrying means for moving the jaw to and from the book to deliver a brief blow against the book side.

27. In a book binding or covering machine the combination of a traveling carrier adapted to hold and advance a succession of books having attached covers, and mechanism for breaking the cover about each book, comprising a jaw arranged longitudinally at each side of the book, rotary jaw-carrying means for moving the jaw to and from the book to deliver a brief blow against the book side, and connections for rotating such rotary means in such direction that the jaw face during the moment of contact moves in the same direction with the book travel.

28. In a book binding or covering machine the combination of a traveling carrier adapted to hold and advance a succession of books having attached covers, and mechanism for breaking the cover about each book, comprising a plate-like jaw having its breaking face arranged longitudinally of the path of book travel, and jaw-actuating means constructed to cause the jaw to move to and from the book to deliver a brief powerful blow by a movement wherein each part of the jaw face takes a curved motion substantially tangent to the book side.

29. In a book binding or covering machine the combination of a traveling carrier adapted to hold and advance a succession of books having attached covers, and mechanism for breaking the cover about each book, comprising a plate-like jaw having its breaking face arranged longitudinally of the path of book travel, and jaw-actuating means constructed to cause the jaw to move to and from the book to deliver a brief powerful blow by a movement wherein each part of the jaw face takes a curved motion substantially tangent to the book side, comprising at least one rotary crank rotated in time with the book travel and means connecting said jaw to said crank.

30. In a book binding or covering machine the combination of a traveling carrier adapted to hold and advance a succession of books having attached covers, and mechanism for breaking the cover about each book, comprising a jaw arranged longitudinally at each side of the book, and rotary jaw-carrying means for guiding the jaw to move to and from the book to deliver a brief blow against the book side; such jaw being sufficiently longitudinally extended to subsequently deliver to each book a second similar blow.

31. In a book binding or covering machine the combination of a traveling carrier adapted to hold and advance a succession of books having attached covers, and mechanism for breaking the cover about each book, comprising a plate-like jaw having its breaking face arranged longitudinally of the book travel, and jaw-actuating means constructed to cause the jaw to move to and from the book to deliver a brief powerful blow by a movement wherein each part of the jaw face takes a curved motion substantially tangent to the book side; such jaw being sufficiently longitudinally extended to subsequently deliver to each book a second similar blow.

In testimony whereof, I have signed my name to this specification.

ALFRED BREDENBERG.