Dec. 8, 1931. R. E. ACKLEY 1,835,685

BOOKBINDING MACHINE

Filed June 10, 1929 5 Sheets-Sheet 1

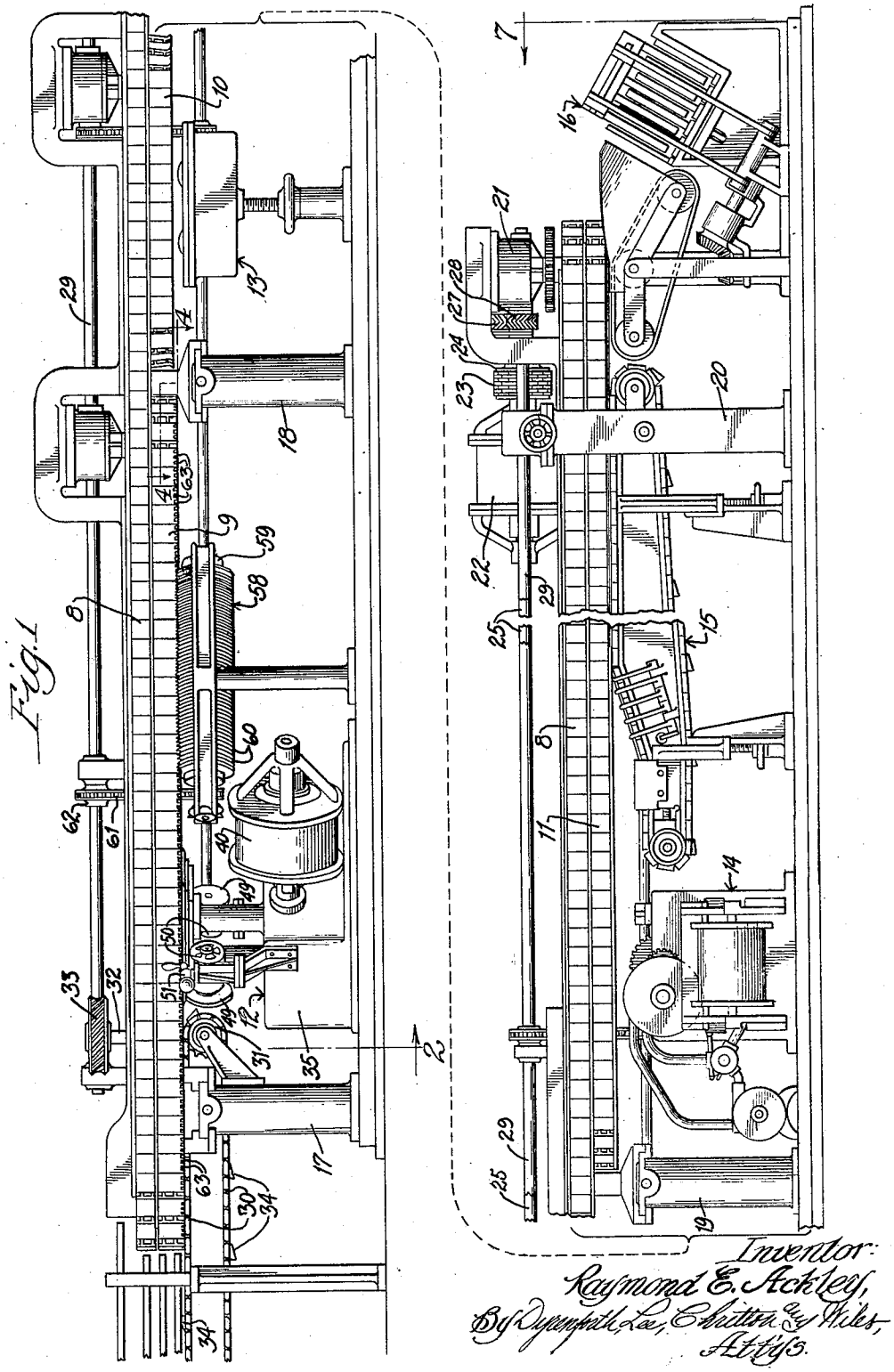


Fig. 1

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BOOKBINDING MACHINE

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Fig. 2

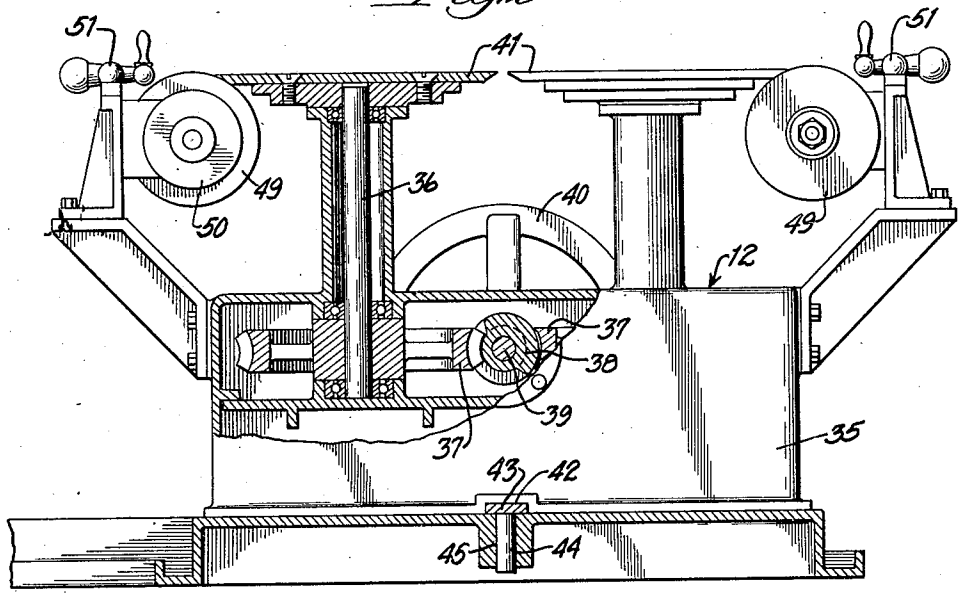
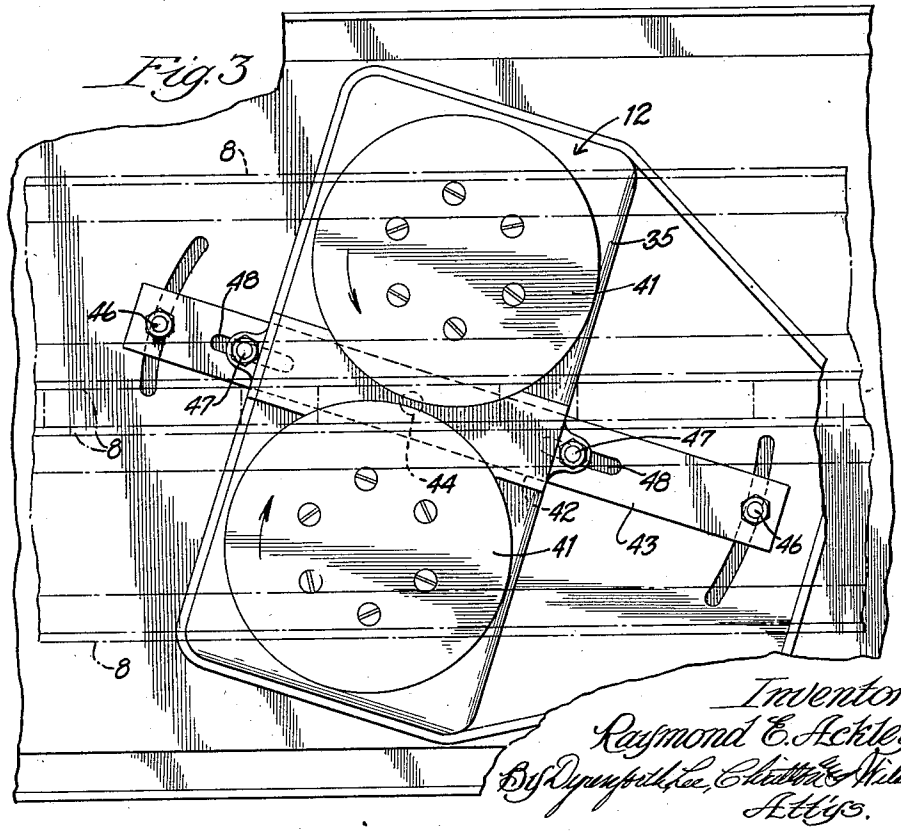


Fig. 3



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BOOKBINDING MACHINE

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Fig. 5

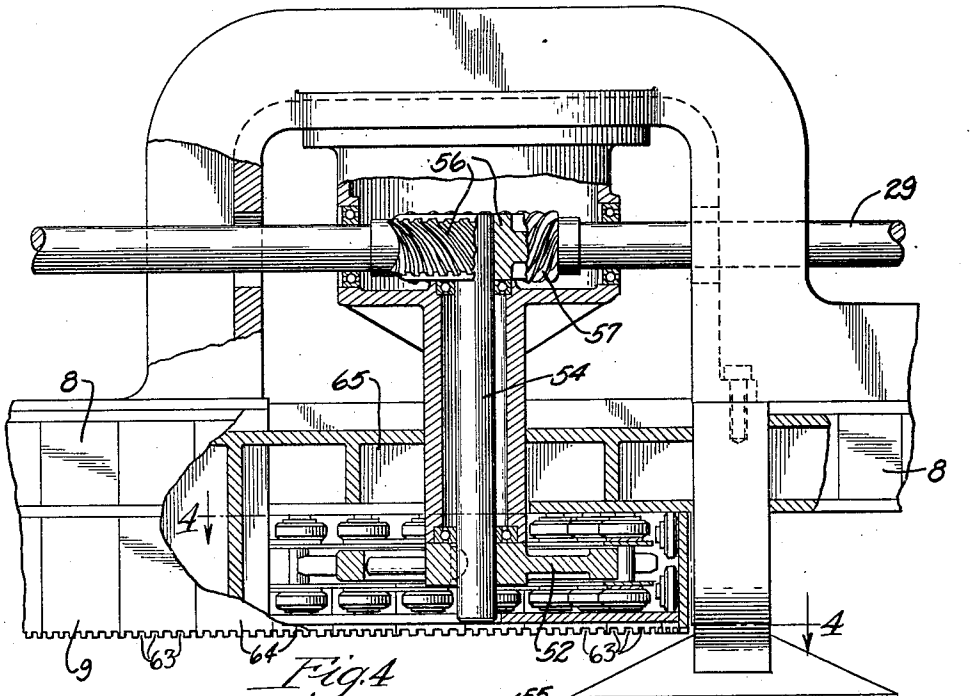
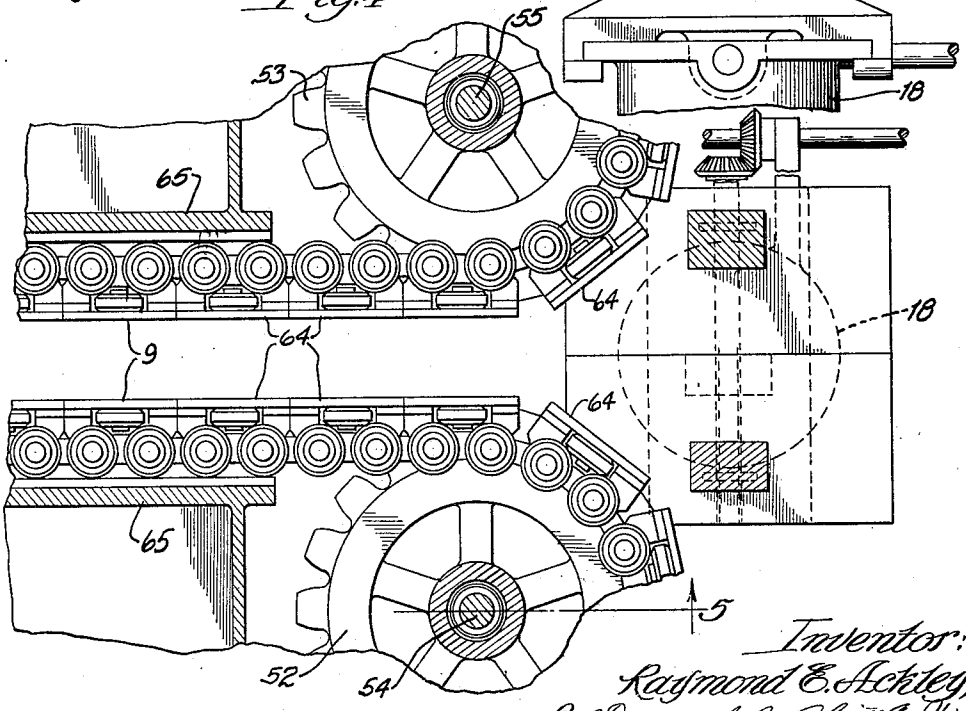


Fig. 4



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BOOKBINDING MACHINE

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Fig. 6

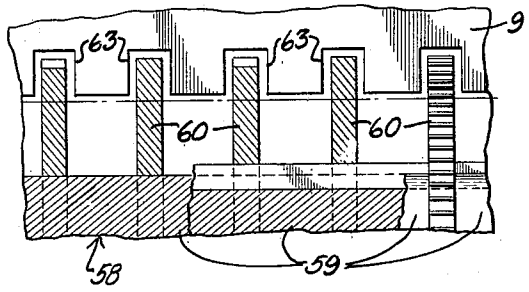
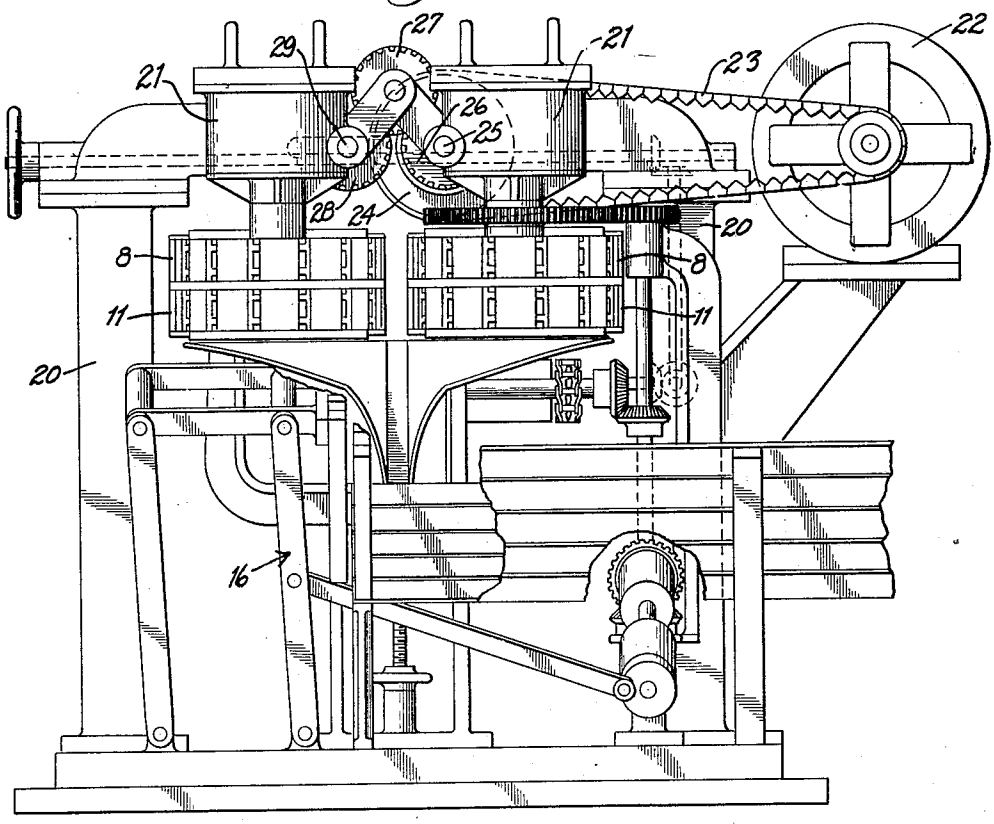


Fig. 7



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BOOKBINDING MACHINE

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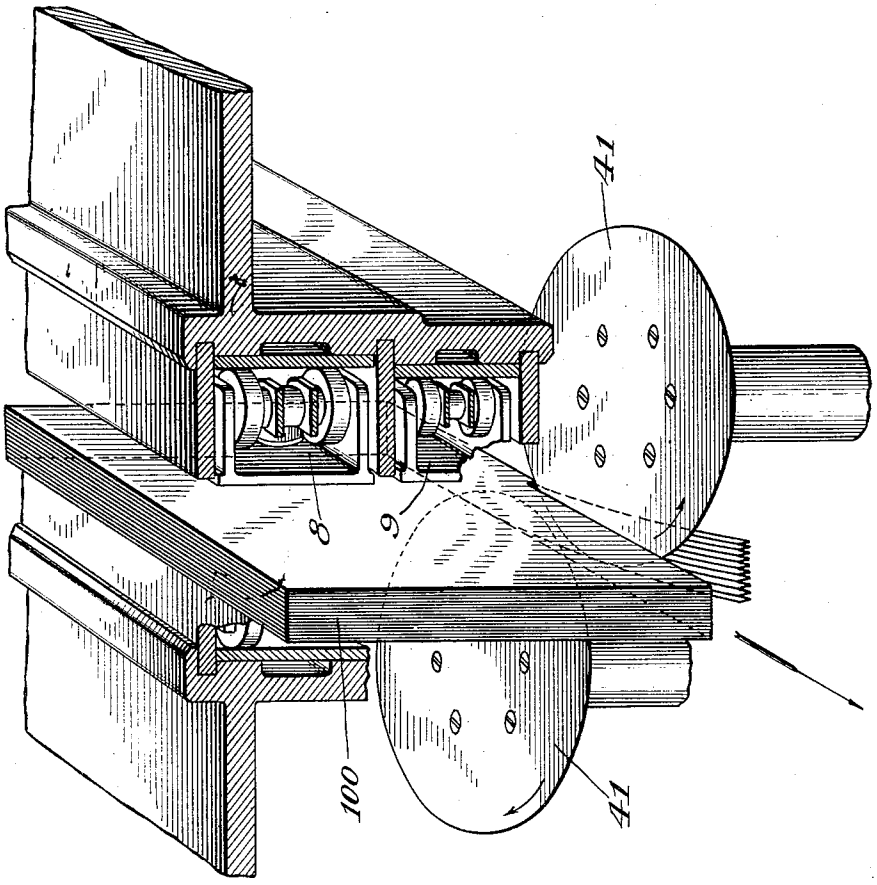


Fig. 8.

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UNITED STATES PATENT OFFICE

RAYMOND E. ACKLEY, OF CHICAGO, ILLINOIS, ASSIGNOR TO R. R. DONNELLEY & SONS COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

BOOKBINDING MACHINE

Application filed June 10, 1929. Serial No. 369,861.

This invention relates to book-binding machines employing as elements thereof a mechanism for trimming the backs of assembled signatures fed thereto and a mechanism for transversely sawing or grooving the backs for the better reception of the glue which is applied to the cut edges of the books; the present invention being disclosed in my application for United States Letters Patent Serial No. 194,645 filed May 27, 1927, and upon which United States Letters Patent No. 1,704,454 were granted March 5, 1929.

One of my objects is to provide improved means for trimming the edges of the grouped signatures and causing the back edges of such signatures to present a plane surface disposed at right angles to the faces of the sheets and preferably without producing any discoloration or other impairment of the sheets and without producing any objectionable accumulations on the cutting mechanism.

Another object is to provide a novel, simple and effective machine for transversely sawing or grooving the backs of the grouped signatures; and other objects as will be manifest from the following description.

Referring to the accompanying drawings:

Figure 1 is a view in side elevation of a book-binding machine embodying my improvements.

Figure 2 is an enlarged view in elevation on line 2 of Fig. 1 of the rotary trimming mechanism forming a part of the machine this view showing certain parts broken away.

Figure 3 is a top plan view of the mechanism shown in Fig. 2.

Figure 4 is a partial, enlarged, horizontal sectional view, the section being taken at the lines 4—4 on Figs. 1 and 5 and viewed in the direction of the respective arrows.

Figure 5 is a broken view in sectional elevation taken on the line 5 of Fig. 4 and viewed in the direction of the arrow.

Figure 6 is a partial, enlarged view in side elevation and section showing the saw for forming grooves in the back of the book.

Figure 7 is an enlarged view in end elevation of the machine as viewed on the line 7 of Fig. 1; and

Figure 8, a fragmentary perspective sectional view of the machine.

The particular illustrated machine comprises a conveyor 8, formed of a pair of endless chains arranged side by side, and preferably extending throughout the length of the machine and which grips the upper portions of a book, represented at 100, and which is fed to it at one end and retains this same grip upon the book until it is discharged at the opposite end. This leaves the lower, or unsupported, end of the book free to be grasped by other conveyors represented at 9, 10, and 11 arranged in series lengthwise of the machine directly below the conveyor 8 and which assist in performing various operations upon the book.

In the machine shown the conveyor 9 holds the lower edge of the book firm while it is being trimmed by trimming mechanism represented at 12 and constituting an embodiment of my invention, and also while a transverse notch or groove is produced therein by means of a rotary saw device also embodying my invention.

The conveyor 10 operates to "fan" the lower portion, or back edge, of the book to one side so as to expose overlapping edges of the sheets to gluing mechanism represented at 13 as described and shown in my said application.

The conveyor 11 is provided for holding the lower portion of the back again in a flat position while a "super" is applied thereto by mechanism 14 as described and shown in my said application; the conveyor 11 also holding the lower portion of the book while a cover is applied to the back of the book and firmly pressed thereagainst by means of mechanism represented at 15 and described and shown in my said application, following the operation of which the book passes out through the chute at the end of the machine to cross-feeding mechanism 16.

The two endless elements comprising the long conveyor 8 are carried by a suitable frame supported on the standards 17, 18, 19 and 20, and are driven by means of worm gear drives 21 at the tail end of the conveyor which are substantially like the one

shown in Fig. 5 which, together with a similar drive, drive the conveyor 9 and which is hereinafter explained in detail.

The several conveyors are driven by means of a motor 22 (Fig. 7) which has a belt 23 which drives a pulley 24 on a shaft 25 carried in suitable bearings on the main frame and which extend substantially the full length of the machine as shown in Fig. 1 and drives various parts of the mechanism. A gear 26 on the shaft 25 drives an idler 27 which, in turn, drives a gear 28 on a shaft 29 which likewise extends substantially the full length of the machine. The gears 26 and 28 are of the same size so that the shafts 25 and 29 are driven in the same direction and at the same rotative speed.

Books are fed to the machine by means of a conveyor belt 30 which passes over a sprocket 31 driven by means of gears (not shown) from a shaft 32 which has a worm wheel 33 driven by a worm on the shaft 29. The belt 30 is provided with a series of lugs 34 which feed the book to the conveyor 8 in definite timed relation thereto so that the books are always in step with the several mechanisms of the book-binding machine, particularly the "super" feeding mechanism 14 and the cover feeding mechanism 15.

The trimming mechanism represented at 12 and shown particularly in Figs. 2 and 3 comprises a frame 35 having journalled therein two vertical shafts 36 (one only of which is shown) and each having a worm wheel 37 both of which are driven by means of a worm 38 on the shaft 39 of a motor 40.

The two shafts 36 carry at their upper ends rotary knives 41 which are spaced a short distance apart, the cutting edges of these two knives lying in the same horizontal plane and beneath the path of the books which is shown by dotted lines in Fig. 3. These two knives are set at an angle to the path of the books so that the cutting edges of the two knives overlap on the path of the books as shown in Fig. 3.

The frame 35 contains a longitudinally extending groove 42 in which a bar 43 is slidable, this bar having a central pin 44 which is pivotaly mounted in an opening 45 in the base as shown in Figs. 2 and 3. The angular position of the bar 43 is fixed by bolts 46 and the position of the frame 35 with respect to the bar 43 is fixed by bolts 47 extending into slots 48 in the bar 43.

The knives 41 are driven at such a speed as to produce a differential between the speed of movement of the cutting portions of the knives and the speed of movement of the books to effect a shearing action and preferably to cause the cutting edges to travel in the general direction taken by the books but at a faster or slower rate. Furthermore, it is preferred that the speed differential referred to be approximately 3 to 1.

By directly opposing the cutting edges of the knives 41 whereby they operate from opposite sides of the book, the tendency of the knives to force the sheets away from them and thus in deflected condition, which in the case of the use of a single knife would cause the back of the book to extend otherwise than at right angles to the side of the book, is substantially equalized. Furthermore, by so positioning the knives 41 that they overlap the path of movement of the book as shown in Fig. 3, the cutting of all of the sheets of the book is ensured and a better and more uniform cut is effected.

The above-referred-to differential between the speed of movement of the book and the cutting edge of the knife is highly desirable, as it overcomes objections incident to the operation of machines wherein the differential is high.

The high differential movement causes the sheets adjacent the portions thereof being cut, to become discolored because of the heat developed by the friction between the knives and the sheets and, furthermore, produces smoke, requiring the use of ventilating systems for withdrawing it, and produces accumulations of brown, hard, scale on the knife which is difficult to remove, but which must be removed to cause the knife to continue to properly function. Where the differential provided for is as in the case of my machine as above set forth, all of these objections are avoided without creating any other objectionable condition.

In the machine shown grinders 49 are placed at the sides of the knives 41 and slightly below the level of the latter so that these grinders may be fed under the knives, these grinders being driven in any suitable manner as by means of electric motors 50. Each of the grinding units referred to, as a whole, may be raised and lowered by means of a feed screw 51 so that the grinders may be lowered when not in use and raised for the purpose of sharpening the knives.

It will be understood that the book, upon entering the machine, is engaged near its upper part by the upper conveyor 8 hereinafter described in detail, and that this conveyor maintains a firm grip on the book throughout its travel on the machine.

The lower belt 9 comprises two endless chain elements arranged side by side and passing around chain sprockets at opposite ends thereof, these sprockets at the right-hand end of the belt 9 in Figs. 1, 4 and 5 being represented at 52 and 53 and shown as keyed to vertical shafts 54 and 55. The shafts 54 and 55 are each provided at its upper end with a worm wheel the worm wheel on the shaft 54 being represented at 56, these worm wheels meshing, respectively, with worms secured to the shafts 29 and 25, the worm on shaft 29 being represented at 57. This same drive is

used for driving each of the pressure belt conveyors 8, 9, 10 and 11, so that all of these conveyors are driven at the same speed.

The chain element of each conveyor 8, 9, 10 and 11, at one side of the longitudinal axis of the machine, together with their operating shaft 29, are adjustable crosswise of the machine for adapting them to operate on books of different thicknesses as shown and described in my hereinabove-referred to application.

The rotary saw device hereinbefore referred to and represented generally at 58 comprises primarily a drum 59, shown in Fig. 6, on which is mounted a spiral saw 60, the drum being driven by means of a chain 61 running over a sprocket 62 on the shaft 29.

This spiral saw is so timed that the feed of the saw is the same as that of the conveyors 8 and 9. The plates of the conveyor 9 are provided at their bottom edges with notches 63 (Fig. 6) which are so spaced with respect to the spiral cutters 60 that the latter rotate into registration with these notches. These notched plates thus support the lower edge of the book while the cutter 59 is forming slots therein and these plates also support the lower edge of the book very firmly while the book is passing over the rotary knives 41. To ensure an even cut in the notches formed in the bottom edge of the book the spiral cutter 60 is set at an angle to the path of the books so that no matter what the thickness of the book which is passing through the machine, the cutter will travel entirely across it thereby ensuring the production of notches of uniform depth throughout the width of the book.

The endless chains of the various conveyors referred to are formed of links pivotally connected together by means of pins, at which links the chains engage the sprockets with which they cooperate as hereinbefore described. These chains also comprise a series of pivoted links disposed at the outer surfaces of the chains and between which the books are clamped by the pressure exerted by these plates for advancing the books by the conveyors, the chains, between the sprockets at the ends thereof, cooperating with backing members disposed at the inner sides of the chain to permit of the proper clamping of the book.

The arrangement of parts just described is illustrated and described in detail in my above-mentioned application and therefore detailed illustration and description herein appears to be unnecessary. It may be stated, however, that the above-referred-to pivoted links at the outer faces of the chains of the conveyor 9 are illustrated at 64 and the stationary backing members for the chains, at 65, the chains forming the other conveyors referred to, as also the backing members therefor, being of this same construction, it being understood, however, that the outer links of the conveyor 10, and corresponding with the links 64 of the conveyor 9 are laterally deflected in the same direction to cause the sheets of the book at its lower edge portion to become "fanned" before reaching the gluing mechanism 13 while moving in engagement with the peripheries of the gluing rollers, as more specifically described in the above-referred-to application.

While I have illustrated and described a particular embodiment of my invention, I do not wish to be understood as intending to limit it thereto, as the same may be variously modified and altered without departing from the spirit of my invention.

What I claim as new, and desire to secure by Letters Patent, is:

1. In a bookbinding machine, the combination of means for advancing a book, and means for trimming an edge of the book comprising cutter elements located at opposite sides of the edge to be trimmed so that each cutter operates as a cutting support for the other thereof.

2. In a bookbinding machine, the combination of means for advancing a book, and means for trimming an edge of the book comprising rotary cutter disks located at opposite sides of the edge to be trimmed so that each cutter operates as a cutting support for the other thereof, and means for rotating said disks.

3. In a bookbinding machine, the combination of means for advancing a book, and means for trimming an edge of the book comprising rotary cutter disks located at opposite sides of the edge to be trimmed and each extending tangentially to a line at a slight acute angle to the line of travel of the book, and means for rotating said disks.

4. In a bookbinding machine, the combination of means for advancing a book, and means for trimming an edge of the book comprising rotary cutter disks located at opposite sides of the edge to be trimmed and so disposed as to produce overlapping cuts, and means for rotating said disks.

5. In a bookbinding machine, the combination of means for advancing a book, and means for trimming an edge of the book comprising rotary cutter disks located at opposite sides of the edge to be trimmed and each extending inwardly beyond the median line of said edge to produce overlapping cuts, and means for rotating said disks.

6. In a bookbinding machine, the combination of means for advancing a book, and means for trimming an edge of the book comprising rotary cutter disks at opposite sides of the edge to be trimmed and disposed closely adjacent to each other in the same plane one in advance of the other, and means for rotating said disks.

7. In a bookbinding machine in which it is

desirable to support the books close to the edge while being trimmed and farther from such edge in other portions of their travel, a pair of spaced pressure-belts running substantially the length of the machine and adapted to grip a portion of the sides of each book for supporting the same, a second pair of pressure-belts of less length than said first-referred to belts, adapted to grip the other portion of the sides of said book, and a pair of spaced disk cutters adjacent said second pair of pressure-belts for trimming said books.

8. In a bookbinding machine in which it is desirable to support the books close to the edge while being trimmed and farther from such edge in other portions of their travel, a pair of spaced pressure-belts running substantially the length of the machine and adapted to grip a portion of the sides of each book for supporting the same, a second pair of pressure-belts of less length than said first-referred-to plates adapted to grip the other portion of the sides of said book closely adjacent the edge of the book, and a pair of spaced disk cutters adjacent said second pair of pressure-belts for trimming said books.

9. In a bookbinding machine, a pair of spaced pressure-belts running substantially the length of the machine and adapted to grip a portion of the sides of each book for supporting the same, a second pair of pressure-belts, adapted to grip the other portion of the sides of said book, a pair of spaced disk cutters for trimming the books, said cutters being disposed adjacent said second pair of pressure-belts and located at opposite sides of the edge to be trimmed so that each cutter operates as a cutting support for the other thereof, and means for driving the cutters.

10. In a bookbinding machine, a pair of spaced pressure-belts running substantially the length of the machine adapted to grip a portion of the sides of each book for supporting the same, a second pair of pressure-belts adapted to grip the other portion of the sides of said book, a pair of spaced disk cutters for trimming the books, said cutters being disposed adjacent said second pair of pressure-belts and located at opposite sides of the edge to be trimmed so that each cutter operates as a cutting support for the other thereof, and means for driving the cutters in the direction taken by said books but at a greater speed.

11. In a bookbinding machine, a pair of spaced pressure-belts running substantially the length of the machine and adapted to grip a portion of the sides of each book for supporting the same, a second pair of pressure-belts adapted to grip the other portion of the sides of said book, a pair of spaced disk cutters for trimming the books, said cutters being disposed adjacent said second pair of pressure-belts and located at opposite sides of the edge to be trimmed so that each cutter operates as a cutting support for the other thereof, and means for driving the cutters at a different circumferential speed from that of the book to produce a slicing action.

12. In combination, a rotary trimming mechanism having a pair of spaced disk knives having cutting edges lying in the same plane, means for carrying books over said knives, means for rotating said knives, and a swivel mounting for said trimming mechanism whereby the knives may be adjustably moved about a vertical axis to align the cutting edges to the path of said book.

13. In combination, a rotary trimming mechanism having a pair of spaced disk knives having cutting edges lying in the same plane, means for carrying books over said knives, means for rotating said knives, a swivel mounting for said trimming mechanism whereby the knives may be adjustably moved about a vertical axis to align the cutting edges to the path of said book, and means for slidably mounting said trimming mechanism on said swivel mounting.

14. In a bookbinding machine, the combination of means for advancing a book, and means for trimming an edge of the book comprising rotary cutting disks located at opposite sides of the edge to be trimmed and disposed in the same plane and one located in advance of the other, the cutting edge portion of each disk being beveled along one face thereof, said beveled portions extending on the same side of the plane of the cutting edges, and means for rotating said disks.

15. In a bookbinding machine, the combination of means for gripping and advancing a book, and means for trimming an edge of the book beyond said first-named means comprising rotary cutting disks located at opposite sides of the edge to be trimmed and disposed in the same plane and one located in advance of the other thereof, the cutting edge portions of each disk being beveled along one face thereof, said beveled portions extending on the sides of said cutting edge portions remote from said first-named means, and means for rotating said disks.

16. In a bookbinding machine, the combination of means for advancing a book, and means for trimming an edge of the book comprising adjustable cutter elements located at opposite sides of the edge of the book to be trimmed so that each cutter element operates as a cutting support for the other cutter element.

17. In a bookbinding machine, the combination of means for advancing a book, and means for trimming an edge of the book comprising cutter elements located at opposite sides of the edge to be trimmed so that each cutter element operates as a cutting support for the other cutter element, and means mounting said cutter elements for adjustment

on a line substantially transverse to the line of advance of the book.

18. In a bookbinding machine, the combination of means for advancing a book, and means for trimming an edge of the book comprising cutter elements located at opposite sides of the edge to be trimmed so that each cutter element operates as a cutting support for the other cutter element, and means mounting the cutter elements with fixed longitudinal spacing and for adjustment in a path substantially transverse to the line of advance of the book.

19. In combination, a rotary trimming mechanism having a pair of spaced disk knives having cutting edges, means for carrying books over said knives, means for rotating said knives, and mounting means for said trimming mechanism whereby the knives may be adjustably moved to align the cutting edges to the path of the book.

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