United States Patent

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[54] CONTINUOUS ONE-STATION THREE-KNIFE BOOK TRIMMER

16 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **83/214,** 83/216, 83/282, 83/461, 83/519, 83/556, 83/564, 83/630, 83/925

[51] **Int. Cl.** **B26d 5/20**

[50] **Field of Search** ..... 83/282, 214, 216, 437, 461, 519, 556, 557, 564, 600, 630, 925(BT)

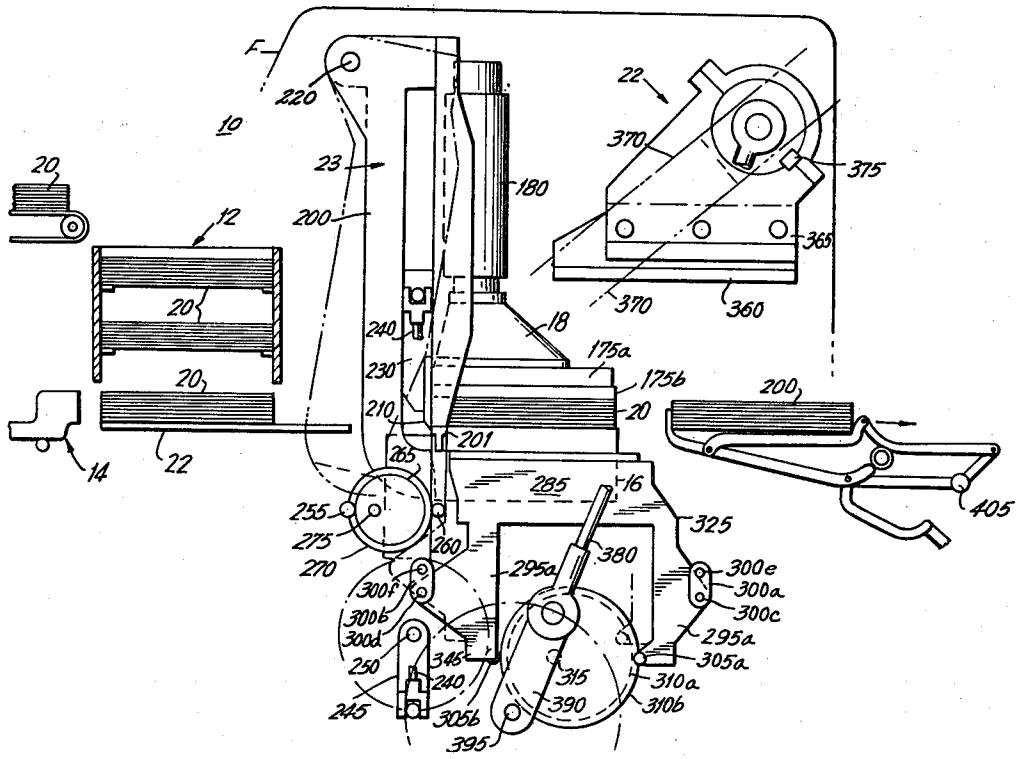
[56] **References Cited**

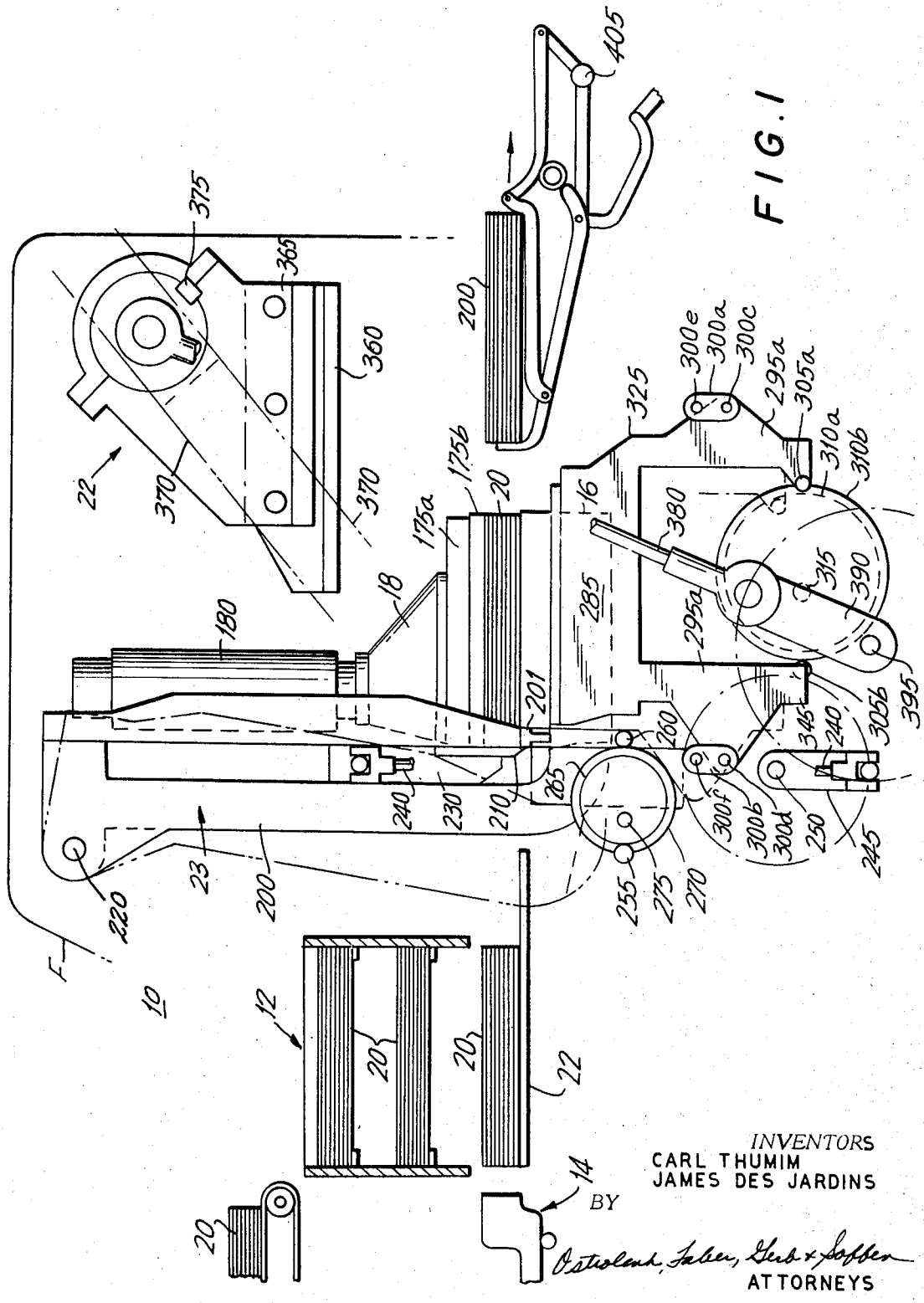
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ABSTRACT: A continuous book and magazine trimming machine arranged to cut the front edge and top and bottom edges of the material with guillotine type of action. High accuracy is maintained by performing all the cutting operations while the book remains in a single cutting position. To effectuate such single station cutting of three edges, the front knife and frame associated therewith are movable out of the path of movement of the side knife apparatus once the front edge has been trimmed.





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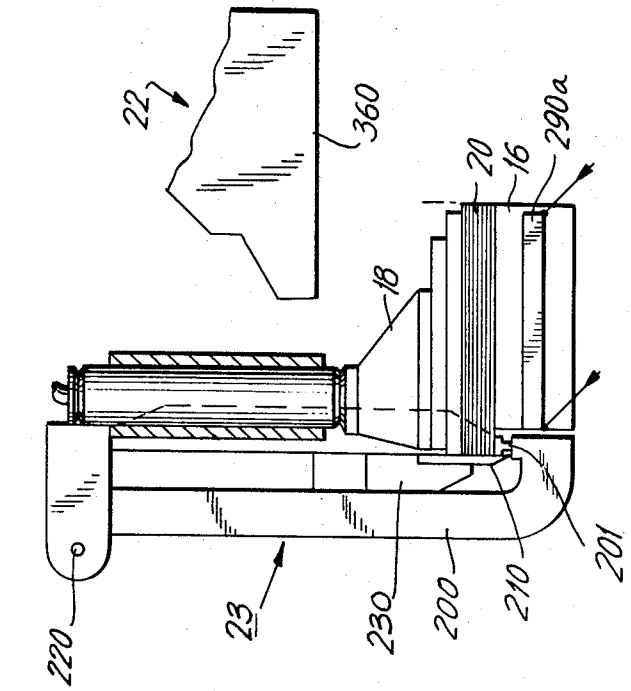


FIG. 2C

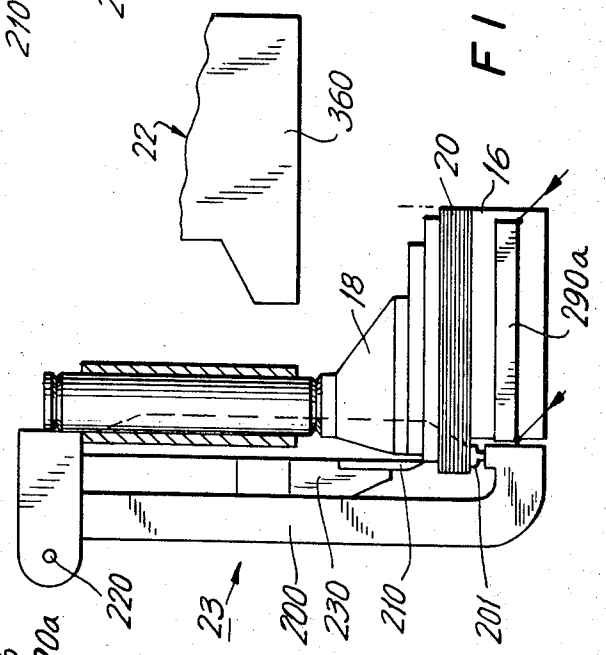


FIG. 2B

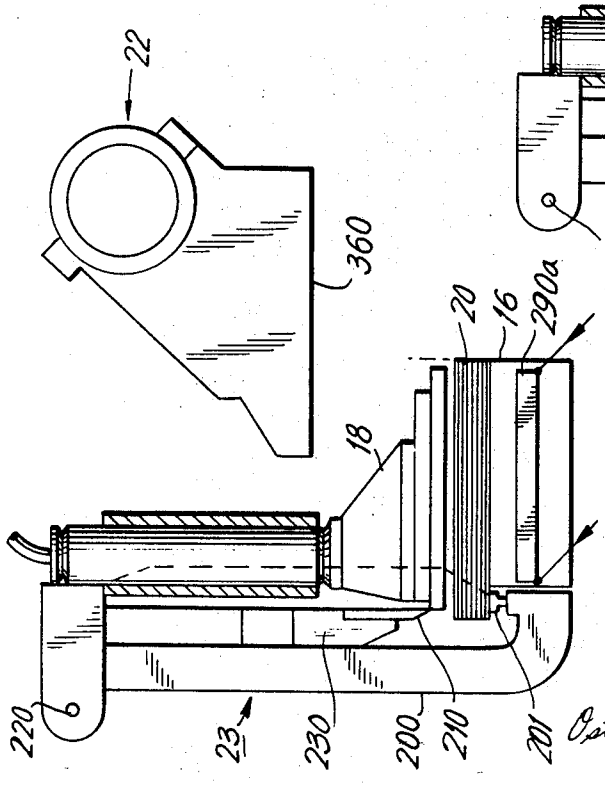


FIG. 2A

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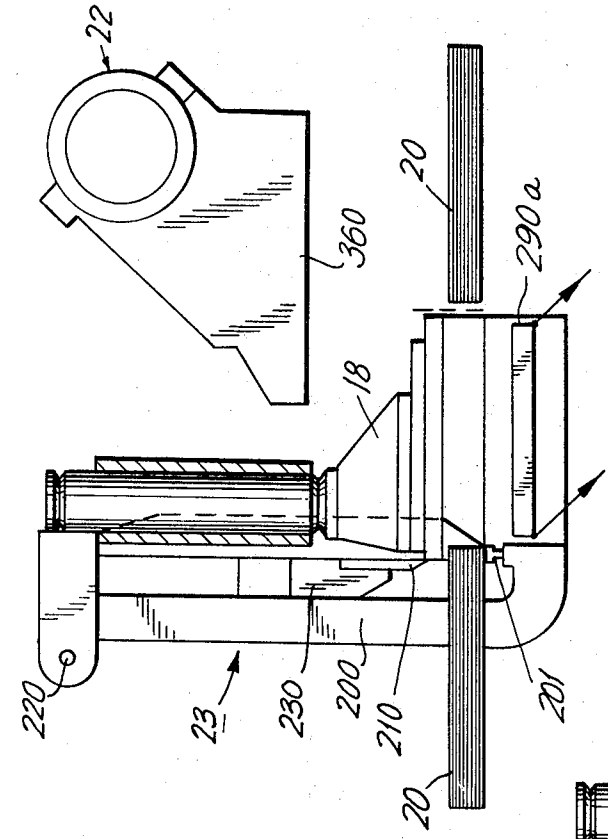


FIG. 2F

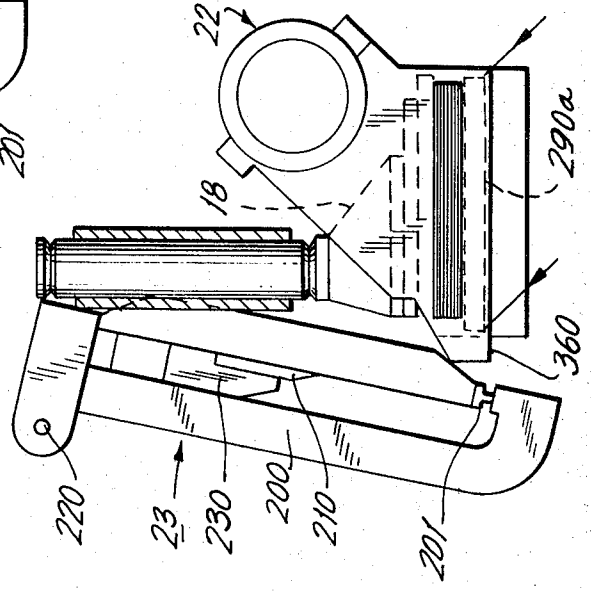


FIG. 2E

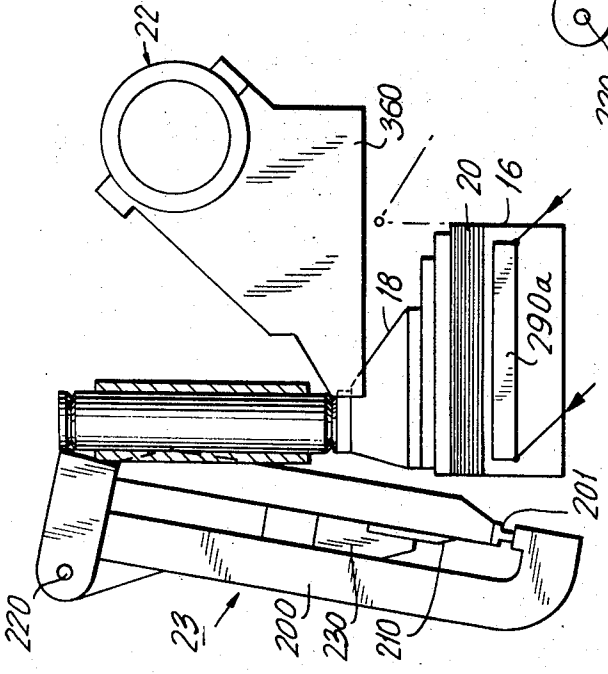
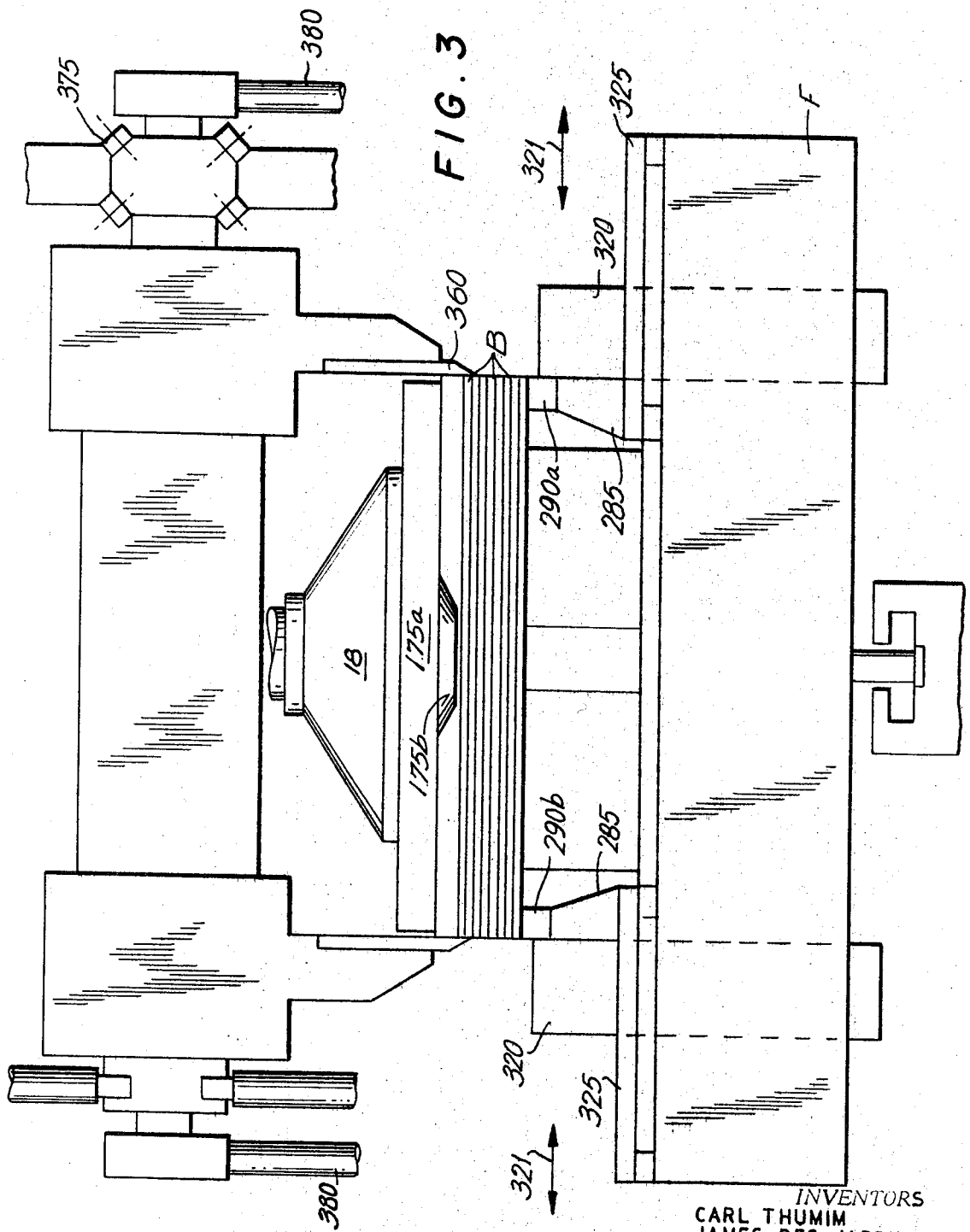


FIG. 2D

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FIG. 3



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CONTINUOUS ONE-STATION THREE-KNIFE BOOK TRIMMER

This invention relates to book and magazine trimming machines of the guillotine type, and more particularly to a continuous three-knife trimmer which cuts the front and top and bottom edges of books, magazines, etc., while such material remains at a single cutting station of the machine.

The paper cutting and trimming industry has long felt the need for a continuous high-speed trimmer capable of accurately trimming three edges of a book, magazine or other similarly stacked paper material such that the output from the machine can be forwarded to the final steps of manufacture such as edge coloring, binding, etc. In U.S. Pat. application Ser. No. 533,328, filed March 10, 1966, in the name of Carl Thumin et al, entitled "Continuous Three-Knife Trimmer", and assigned to the assignee of the instant invention now U.S. Pat. No. 3,424,044 issued January 28, 1969, there is disclosed such a high-speed continuous three-knife trimmer which is fully automatic, highly accurate and capable of trimming three sides of a book, stack of books, or paper at rates as high or better than 100 units per minute. As disclosed in greater detail in said application, the continuous three-knife trimmer thereof utilizes what is commonly known as a two-station cutting cycle. Thus a book is initially fed into the cutting area of the machine, properly aligned and clamped at a first position. A front knife then operates to trim the front edge of the book. Subsequently, the book is transported to a second position where the side knife assembly may non-interferingly cut the top and bottom edges of the book. The entire trimmer of the Thumim et al. application, and particularly the utilization of a movable clamp disclosed and claimed therein, represents a significant advancement in the book trimming industry.

Despite the above, however, it must be appreciated that the trimmer disclosed in the aforesaid application is of the two-station type and does require that the book be transported between a first and second cutting station to trim the front and top and bottom edges, respectively. Consequently, and despite a high degree of engineering precision there is still the possibility that the book or other material being cut may become slightly misaligned as it is being transported between the first and second cutting stations. Thus even though every precaution is taken to manufacture a machine that has acceptable tolerances, continuous usage over the lifetime of the machine makes it an almost certainty that misalignment will eventually occur.

In contradistinction to the above described concept of two-station cutting, the instant invention utilizes a one-station cutting sequence which eliminates any possibility of misalignment inherent in the two-station procedure. Thus, with the instant invention, a book is fed into the cutting area of the machine and immediately clamped to a work table. A front knife then operates within its associated frame structure to trim the front edge of the book. Immediately thereafter the entire front knife frame swings away from the clamped book to allow the side clamps and knives associated therewith to swing up and down, respectively, to trim the top and bottom edges of the book. After the side knives operate, the main clamp releases the book whereby it may be delivered at the rear of the machine while at the same time the front knife frame swings back to its initial position to receive the next oncoming book such that the cycle may be repeated. It is to be appreciated that during the entire cutting sequence the book or material being cut was firmly clamped at the single cutting station, whereby the prior disadvantages inherent in two-station cutting are eliminated.

As other particularly advantageous features of the instant invention, the above described cutting cycle is integrally related and co-acted with other essential operations of a continuous trimmer such as imput feed and output delivery. The various operating mechanisms of the invention are all timed with relation to one another at what may be conveniently classified "Cycle Speed" so that there is no waiting time between functions of the components which might otherwise increase the operational time of the machine.

Accordingly, it is an object of the instant invention to provide a three-knife trimmer which continuously, rapidly, and accurately trims three edges of a book, magazine or similar stack of paper material.

Another object of the instant invention is to provide such a continuous three-knife trimmer which performs all the cutting operations at a single cutting station thereby eliminating inaccuracies inherent in two-station cutting.

Still another object of the instant invention is to provide such a continuous three-knife trimmer which co-acts with input and output mechanism in such a manner as to provide a rapid continuous cutting operation upon a continual input of books, magazines or the like.

Still another object of the instant invention is to provide such a continuous three-knife trimmer wherein the various operational components are so timed with respect to one another as to eliminate any possible delay in the overall trimming of books.

Yet another object of the instant invention is to provide a one-station continuous three-knife trimmer which utilizes a swinging front knife assembly which after performing its cutting operation, swings away from the work so as to avoid interference with the subsequent cutting motion of the side knives of the machine.

Other objects and a fuller understanding of the instant invention may be had by referring to the following description and drawings, in which:

FIG. 1 is a partial side view of a continuous three-knife trimmer of the instant invention;

FIGS. 2A—2F illustrate a complete cutting cycle for the apparatus shown in FIG. 1; and

FIG. 3 is a front view of the machine of FIG. 1.

Referring to FIG. 1, there is shown a partial side view of a continuous three-knife trimmer **10** constructed in accordance with the teachings of the instant invention. As has been previously noted, the three-knife trimmer **10** is capable of rapidly and accurately trimming up to three edges of a book, magazine or other similarly stacked paper material in a fully automatic continuous operation. For ease of identification and nomenclature, throughout the remainder of this specification, the material to be trimmed by the instant invention will hereinafter be referred to as a book, although it is to be understood that the instant invention is equally applicable to a stack of books, a magazine or stack of magazines, or any other similarly stacked quantity of paper material capable of being trimmed in a guillotine fashion.

The trimmer of FIG. 1 may be conveniently broken down into sub-assemblies which include a stacking mechanism generally indicated at **12**, an input feed mechanism **14**, a table **16**, a clamp **18**, front knife assembly **20**, two side knife assemblies **22** and a delivery mechanism, not illustrated in FIG. 1. The stacking mechanism **12**, the input feed mechanism **14** and delivery mechanism may all be of the type disclosed in the aforementioned Thumim Pat. No. 3,424,044, the disclosure of which is incorporated herein by specific reference thereto. However, it is to be understood that various types of stacking, input feed and delivery mechanisms could be used in the practice of the instant invention. The importance is not in the particular input or output delivery mechanism chosen but in the manner in which such mechanism is sequentially related with respect to the cutting cycle to be described in greater detail.

Assuming that stacking and input feed mechanism of the type disclosed in the aforementioned U.S. Pat. No. 3,424,044 were being utilized in combination with the instant invention, books **20** would be continuously delivered by stacking mechanism **12** to the working surface **22** where they would be fed by the input feed mechanism **14** through the front knife assembly **23** and onto the work table **16**.

The clamp **18** is preferably hydraulically operated and is shown in FIG. 1 carried by the machine frame F, and having the hydraulic power cylinder **180**, and carrying a plywood base **175***a* with a cardboard pressure pad **175***b* therebelow for bearing against the book **20**. It will be understood that the

input feed mechanism including the pusher **14** pushes the book below clamp **18** and withdraws, the book **20** then being in the single cutting location at which it will remain during front and end trimming.

The first element of the trimming machine which becomes operative once the book **20** is in trimming location is, of course, the clamp **18**, except for various side and back gauges which determine the positive location of the book and which are movably related and adjustable with respect to the cutting table **16** (such side and back gauges are conventional in the trimming industry, form no part of the instant invention, and consequently need no further discussion).

The front knife assembly **23** comprises a guide frame **200** for the front knife **210** which guide frame is pivotally carried by a pin **220** supported in the machine frame F. Thus it will be understood that the guide frame **200** can swing from the solid line position to the phantom line position shown in FIG. **1**. The knife **210** is carried in the holder **230** reciprocally guided in the guide frame **200**, and the holder **230** is connected by pull bars **240** to cranks **245** rotated by power shaft **250** whereby cutting and withdrawal movement of the knife **210** can be effected.

In the course of a cutting cycle, the knife frame **200** is actuated pivotally around pin **220** to swing clear of the work after a cut is taken, being locked in vertical alignment during the cut and also being actuated to swing, by means of rollers **255** and **260** carried by frame **200** which rollers engage respective cams **265** and **270**. These cams are rotated by a shaft **275** and are provided in pairs at each side of the shaft and rotated in timed sequence with the cutting and raising motions of the knife, as will be further described.

Front knife frame **200** carries a T-shaped front clamp bar **201** which is positioned beneath the trailing edge of the book **20** whereby a smooth cut is guaranteed as the blade **210** and holder **230** are reciprocated by means of the power shaft **250**. Thus clamp **18** applies pressure to the book **20** and knife **210** then trims the front edge. Immediately thereafter, the knife frame **200** swings away from the stack in order to provide clearance for end trimming operation, described below.

In the same manner that the trimming by front knife **210** required the presence of the front knife clamp **201**, similarly the side knife cuts require clamps which will engage the under surface of the book at the top and bottom edges, respectively, whereby side knife edges **360** will provide a clean cut. To this end side knife clamps **290***a* and **290***b* (see FIG. **3**) are provided. However, it will be appreciated, from FIG. **1**, that such side knife clamp bars **290***a* and **290***b* cannot be permanently maintained along opposite sides of the work table **16**, level with such table, because such clamp bars would interfere with the front knife assembly **23** and particularly with the front knife clamp bar **201** previously referred to. To solve this problem, the instant invention provides that the side clamps **290***a* and **290***b* be normally maintained in the solid line position shown in FIG. **2A**, *i.e.*, non-interferingly positioned with respect to the front knife **20**. It is only after the front knife has performed its cutting operation, and the front knife frame **200** has swung about pivot point **220**, that the side knife clamps **290***a* and **290***b* will be lifted up into engagement with the under surface of the book **20** (FIG. **2E**), such that the side knives **360** may be brought down to perform the top and bottom trimming operation.

To effectuate such operation, the clamp bars **290***a* and **290***b* are carried by lower side clamps **285** which include depending portions **295***a* and **295***b* which are pivotally suspended on respective support links **300***a* and **300***b* at **300***c* and **300***d*, in turn pivotally secured to the machine frame F by respective pins **300***e* and **300***f*.

Thus the support links **300***a* and **300***b* for the lower clamps provide for transitory motion by being disposed fore and aft of each clamp as a parallel linkage. The lower clamps are translated by respective pairs of rollers **305***a* and **305***b* carried thereby which engage respective cams **310***a* and **310***b* rotated by a power shaft **315**. Translating movement is guided by guide elements **320** adjustable in the direction of arrows **321** along the bars **325** of FIG. **3** to compensate for various book lengths.

From the above it will be understood that rotation of shaft **315** will effect translation of lower side clamps **285** and the respective clamp bars **290***a* and **290***b* in an oscillatory path upwardly and forwardly against the under surface of the book along opposite sides of the table **16** thereby providing a firm surface for the parallel side knives **360** which commence downward movement even while the lower clamp members are moving upwardly, but do not cut before the conclusion of the upward lower clamp movement.

The side knives **360** are carried in holders **365** and guided in shear slots **370**. Pull bars **380** effect actuation of the side knives, being connected to the respective holders thereof at their upper ends and to cranks **390** at their lower ends, the cranks being rotated by a power shaft **395**.

The lower clamps with respective clamp bars thereon and side knives move for effecting and trimming even as the front knife moves upwardly, all shafts moving at cycle speed, and the side knives ending their stroke after passing the lower clamp bars **290***a* and **290***b*. Once the side knives have reached the bottom of their stroke, passing the lower clamp bars **290***a* and **290***b*, these bars are retracted to the initial solid line position of FIG. **1** whereupon the upper clamp **18** is released, the book is delivered at the rear of the machine and simultaneously the front knife frame **200** returns to the solid line position of FIG. **1** to await the next oncoming book.

FIGS. **2A**—**2F** schematically show the complete cutting operation described above.

Turning to FIG. **2A**, the book **20** has been appropriately positioned above the work table **16**. At this period of the cutting cycle, the clamp **18** is above the upper surface of the book **20**, and the front knife frame **200** is in a solid line position of FIG. **1** such that the T-shaped front knife clamp bar **201** is appropriately positioned under the trailing side edge of the book. Side knife clamp bars **290***a* and **290***b* and side knives **360** are non-interferingly positioned as illustrated.

In FIG. **2B**, the upper clamp **18** has bottomed on the upper surface of the book **20** with the front knife holder **230** and front knife **210** following close therebehind.

In FIG. **2C**, the front knife **210** has trimmed the side edge of the book **20**.

In FIG. **2D**, the front knife frame **200** has begun to swing about pivot point **220** and simultaneously the front knife **210** begins to rise. At the same time the side clamp bars **290***a* and **290***b* have begun to rise and shortly thereafter, in timed sequence, the side cutting blade **360** of the two side cutting assemblies begin to fall.

In FIG. **2E**, the front knife frame **200** is completely out of the way, side knife clamp bars **290***a* and **290***b* have bottomed on the under surface of the top and bottom of the book, and shortly thereafter the side knives **360** trim the exposed top and bottom edges of the book.

The final step is illustrated in FIG. **2F** wherein the side knife clamp bars **290***a* and **290***b* have been lowered, the side knives **360** raised, the upper clamp **18** lifted, the book **20** delivered by suitable apparatus out the rear of the machine, and at the same time the front knife frame **200** rotated back to the solid line position of FIG. **1** to receive the next oncoming book **20**.

It will be appreciated from the above that by providing that the front knife frame can move out of interfering relationship with respect to operation of the side knives, it is possible for all knives to continuously operate in their respective rectilinear paths of motion. Thus, and because the front knife is moving out of the way, the side knives need not stop and wait before beginning to move. Similarly, and because the side clamp and side knives have moved out of the way, the front knife can continuously reciprocate without interruption. This continuous knife action permits the trimmer of the instant invention to trim many more books per minute, than if the blades had to interrupt their cutting cycles to wait for other blades to move out of the way.

Thus there has been described a novel single station continuous three-knife trimmer utilizing a swinging front knife frame and continuously reciprocating knives for both front and end cuts. Although there has been described a preferred embodiment of this novel invention, many variations and modifications will now be apparent to those skilled in the art. Therefore, this invention is to be limited, not by the specific disclosure herein, but only by the appending claims.

We claim:

1. A trimmer comprising:
a cutting table having thereon a predetermined cutting location;
clamp means for clamping a book on said predetermined location during operation of both a front knife means and a side knife means;
front knife means for trimming and being positioned to trim the front edge of a book;
side knife means for trimming and being positioned to trim at least one side edge of the book, which side edge is transverse to the book front edge;
first actuating means connected with said front knife means for moving same from its starting position downwardly on a cutting stroke along a rectilinear path to a first position to cut the book front edge and for thereafter raising said front knife means to its said starting position;
second actuating means connected with said front knife means for displacing it, along a path other than said rectilinear path, from its said first position to a second position, after said front knife means has completed a cutting stroke and before it has been raised, thereby to remove said front knife means to where it would not interfere with the cutting stroke of said side knife means;
timing means connected with both of said first and said second actuating means to coordinate their operations;
third actuating means connected with said side knife means for moving same downwardly on a cutting stroke along a rectilinear path and in close sequence after the cutting stroke of said front knife; and
said timing means being also connected with said third actuating means to cause said side knife means to complete its cutting stroke after said front knife means has completed its cutting stroke and been removed from its said first position and before said front knife means has been raised to its starting position.

2. The trimmer of claim 1, wherein:
said second actuating means shifts said front knife means away from the book front edge along a path that is transverse to both said rectilinear path of said front knife means and to the book front edge.

3. The trimmer of claim 2, wherein:
said front knife means is pivotally mounted on a pivot support in a manner that permits the recited shifting of said front knife means; and
said second actuating means being adapted to cause said front knife means to pivot.

4. A trimmer comprising:
a cutting table having a predetermined cutting location;
clamp means for clamping a book in a predetermined location;
front knife means for trimming a book front;
side knife means for trimming at least one edge of said book transverse to said front;
actuating means operatively connected to said front and side knife means for effecting operation thereof in a predetermined sequence which permits front and edge trimming of said book at said predetermined location, and which allows said front and side knife means to operate in continuous, uninterrupted, cyclic fashion; and
said front knife means being pivotally rotatable between a first position in which said book front can be cut, and a second position in which said side knife means will be free to operate.

5. The trimmer of claim 1, wherein said side knife means includes at least one side knife blade movable between a non-cutting and a cutting position to trim said edge of said book, said side knife blade being moved to its cutting position only after said front knife means moves away from its first position toward its second position, said side knife blade moving in a rectilinear reciprocating path of movement.

6. The trimmer of claim 5, wherein said second actuating means includes first operative means for moving said side knife blade between its non-cutting and cutting position after said front knife means has begun being moved toward its second position.

7. The trimmer of claim 6, wherein said first operative means includes:
a rotatable power shaft;
a crank arm secured to said power shaft and rotated thereby; and
a pull bar connected to said crank arm and said side knife blade.

8. The trimmer of claim 5, wherein said side knife means further includes at least one side knife clamp bar positioned under said cutting table and movable between a non-clamping and clamping position with respect to said edge of said book.

9. The trimmer of claim 8, wherein said actuating means further includes second operating means for moving said side knife clamp bar to its clamping position prior to the time said side knife blade reaches its cutting position but after said front knife means has moved clear of its first position toward its second position.

10. The trimmer of claim 9, wherein said second operating means includes:
roller means connected to said side knife clamp bar; and
rotatable cam means coacting with said roller means for moving said roller means and hence said side knife clamp bar in an oscillatory path of motion between its non-clamping and clamping position.

11. The trimmer of claim 1, wherein said side knife means includes first and second side knife blades movable between non-cutting and cutting positions to trim the opposite edges of said book which are transverse to said front, said side knife blades being moved to their cutting position only after said front knife means moves away from its first position towards its second position, said side knife blades moving in a rectilinear path of movement.

12. The trimmer of claim 11, wherein said side knife means further includes first and second side knife clamp bars associated with said first and second side knife blades, respectively, said side knife clamp bars positioned under said cutting table and movable between a non-clamping and clamping position with respect to said opposite edges of said book.

13. The trimmer of claim 12, wherein said actuating means further includes operating means for moving said side knife clamp bars to their clamping position prior to the time said side knife blades reach their cutting position but after said front knife means has moved clear of its first position toward its second position.

14. The trimmer of claim 13, wherein said operating means includes:
first and second roller means connected to said first and second side knife clamp bars, respectively; and
rotatable cam means coacting with said roller means for moving said first and second roller means and hence said side knife clamp bars in an upward oscillatory path of motion between their non-clamping and clamping positions.

15. A trimmer comprising:
a cutting table having a predetermined cutting location;
clamp means for clamping a book in a predetermined location;
front knife means for trimming a book front;
side knife means for trimming at least one edge of said book transverse to said front;
actuating means operatively connected to said front and side knife means for effecting operation thereof in a predetermined sequence which permits front and edge trimming of said book at said predetermined location,

and which allows said front and side knife means to operate in continuous, uninterrupted, cyclic fashion;

said front knife means being pivotally rotatable between a first position in which said book front can be cut, and a second position in which said side knife means will be free to operate; and

input feed means for depositing said book at said predetermined cutting location.

16. The trimmer of claim **15**, wherein said input feed means operates to deposit said book at said predetermined location only when said front knife means is in its first position.