

[54] **METHOD OF CUTTING THICK BOOKS**  
 [75] Inventor: **Richard H. Barbour, Jr.**, Milton, Mass.  
 [73] Assignee: **Comstock and Wescott, Inc.**, Cambridge, Mass.  
 [22] Filed: **July 22, 1971**  
 [21] Appl. No.: **165,273**  
 [52] U.S. Cl. ....**83/37, 83/425, 83/676, 83/925, 144/223**  
 [51] Int. Cl. ....**B23d 25/02**  
 [58] Field of Search.....**83/403, 409, 37, 83/925 A, 469, 437, 404, 470, 676, 401; 144/223, 323; 143/140, 143**

3,344,822 10/1967 Wilder.....143/143 X  
 3,299,917 1/1967 Pearson.....143/140 X

*Primary Examiner—Andrew R. Juhasz*  
*Assistant Examiner—W. Donald Bray*  
*Attorney—James H. Grover*

[57] **ABSTRACT**

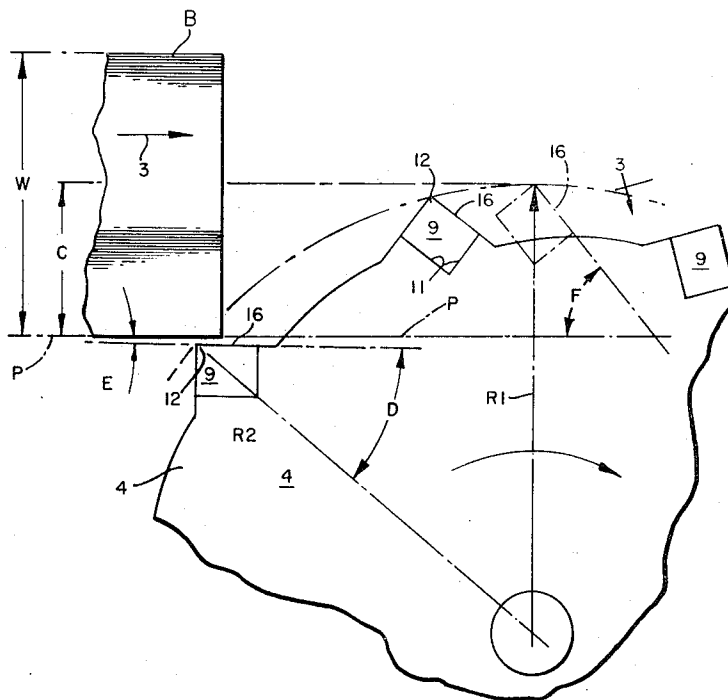
A group of collated book signatures or other layers of paper are cut with bevel edged bits spaced around the circular periphery of a wheel by feeding the paper in the same direction as the teeth rotate such that an exposed side of the paper advances in a plane intersecting normal to the circular radius more than half an inch from the outer end of the radius, and such that the bevelled outer corner of the cutting edge enters through the paper plane first and with the edge inclined away from the paper plane at an angle of zero to 20°. At its furthest penetration each cutting edge is inclined at less than 60° to the cutting plane.

[56] **References Cited**

**UNITED STATES PATENTS**

2,531,841 11/1950 Cashin.....83/676  
 3,009,848 11/1961 Simon.....83/425 X

**4 Claims, 3 Drawing Figures**





## METHOD OF CUTTING THICK BOOKS

## BACKGROUND OF THE INVENTION

In the art of making books, the individual pages are generally printed as an array on large sheets of paper which are subsequently folded into signatures and col-  
lated for binding. One book making method involves first cutting off the signature folds to expose individual pages at the book backbone and then applying an adhesive binding to the backbone. A cover may be applied over the adhesive. Typically the collated signatures are held by clamps with the backbone exposed, and conveyor means move the clamp and book past a stationary rotating cutter disposed to saw off the signature folds to prepare the backbone for application of adhesive.

Primary requirements in book cutting are that the cut be made quickly to permit hundreds of books to be trimmed per minute, that the cut be clean and uniformly smooth, and particularly that the horsepower used be minimized both to reduce power cost and to avoid applying such a high cutting force that the book as a whole will be torn from its clamp or the paper sheets wrinkled, ripped or otherwise mutilated. In addition to good bookmaking considerations there are economical salvage requirements that the strips of scrap be cut from the backbone without the formation of dust or fine confetti, and without fracturing or excessively curling the strips. A further desideratum is that wearing or dulling of the cutting tool be minimized so that the desired quality of the book cut and of the scrap can be maintained through long runs of books without the need for frequent sharpening or replacement of the cutting tool.

With very thin books, less than one half inch, an excellent quality of cut and of saleable scrap may be produced using a rotary knife, that is, a thin wheel with a continuous knife-edge around its periphery. With thicker books a rotary knife consumes excessive power, and applies forces frequently strong enough to pull the book out of the strongest available clamp, or wrinkle or tear the book. The cost of power consumption and of the heavy driving equipment for a rotary blade are several times the cost with a toothed blade described below. The rotary blade dulls rapidly and usually is continuously sharpened under supervision of an expert by grinding while in operation to allow long runs of books.

A toothed cutter, similar to a rotary wood cutting saw with forwardly raked teeth, will cut thin books at reduced horsepower, but leaves a rough surface on the book, removes a kerf producing a large quantity of dust and confetti, and the scrap is narrower, has many closely spaced fractures and is greatly curled. With books thicker than one-half inch these disadvantages of the toothed saw are so exaggerated as to make its use impractical.

The width of cut into a book of given thickness may be reduced to approximately one half of the book thickness by successively cutting into opposite sides of the book as described in U.S. Pat. No. 3,570,350, issued Mar. 16, 1971 to Robert E. Fogg. This permits the above described blades to cut thicker books, but does not increase the width they can cut satisfactorily. And even doubling the book thickness the prior cutters can handle satisfactorily will not extend their use to very thick books of 3 or 4 inches thickness such as

telephone books and mail order catalogs which are produced in runs of hundreds of thousands.

The object of the present invention is to provide a way of cutting into books over 1 inch, which produces a clean cut without wrinkling or fracturing the leaves of the book, which consumes substantially less power than previous methods and greatly reduces the cost of the cutting machinery, which produces high quality scrap with little waste or production of dust or confetti, and which minimizes dulling of the cutting tool so that long, high speed runs may be made.

## SUMMARY OF THE INVENTION

According to the invention a method of cutting through multiple planar sheets of paper with circularly spaced, bevelled cutting edges inclined to the circular radius comprises rotating the cutting edges in a given direction, advancing the paper in the same direction, penetrating the paper through the outer plane thereof with the outer extremity of each cutting edge entering first and with the entering cutting edge inclined away from the paper plane at an angle of  $0^\circ$  to  $20^\circ$ , and with the furthest penetrating cutting edge inclined at an angle less than  $60^\circ$  to the paper plane.

## DRAWINGS

For the purpose of illustration a typical embodiment of the invention is shown in the accompanying drawing in which:

FIG. 1 is an isometric view of book cutting apparatus;

FIG. 2 is a plan view of the book and cutting tool of FIG. 1; and

FIG. 3 is a section on line 3—3 of FIG. 2.

## DESCRIPTION

Shown in FIG. 1 is book cutting apparatus of the type shown more fully described in the previously identified U.S. Pat. No. 3,570,350. A book B comprising a number of signatures is held between clamps 1 and 2, the book and clamps being conveyed in the direction of the arrow 3 between two rotary cutting wheels 4 and 5 which successively cut through opposite sides of the book. In FIG. 1 the first wheel 4 is shown rotating in the same direction as the book is fed and cutting into the horizontal width of the book so as to remove a bundle of strips of scrap 7 curling slightly away from the uncut width 8 which is subsequently cut by the second wheel 5. The second wheel rotates oppositely from the first wheel but in the same direction as the opposite side of the book is conveyed.

As shown in FIGS. 2 and 3 the wheel 4 carries at its circular periphery a number of cutting bits 9 welded or brazed in recesses 11 in the wheel. The wheel is typically 0.165 inch thick and between 6 and 24 inches in diameter measured to the outer corner 12 of each bit, approximately  $9\frac{1}{2}$  inches diameter being useful for most books. The bits are equally spaced and may be from approximately 10 to 20 in number. Each bit has an upper surface 13 on top of the wheels as shown in FIG. 1, this upper surface being parallel to the face of the wheel and overhanging the wheel face. The lower surface 14 of the bit is bevelled at  $30^\circ$ , for example, to the upper surface, and forms a cutting edge 16 extend-

ing inwardly from the outer corner 12 of the bit. Typical bits for a 9½ inch wheel are 0.200 inch thick, one-half inch wide and five-eighths inch long, and are made of carbide steel having a Rockwell C hardness of 91.6, and 460,000 psi transverse rupture.

In the process of cutting, the book B is fed in the direction of the arrow 3 with the side to be cut lying in a plane P which intersects the bit radius R1 inwardly from the outer end of the radius R1 by an amount equal to the width of cut C. With the two wheels 4 and 5 this cut C is somewhat greater than one half the book width W.

According to the present invention thick books of 1 inch or greater width (or two inches or more with two wheels) can be cut with remarkable economy in power and equipment cost, improved quality of book cut, and excellent scrap quality by a critical selection of the angle E between the paper plane P and the cutting edge 16 of the bit 4. The critical requirements are that the outer corner 12 of the cutting edge 16 enter the paper through the plane P in advance of the rest of the cutting edge, and that the cutting edge 16 be inclined away from the paper plane at an entry angle E of between 0° and 20°. A preferred cut is made with a bit whose cutting edge 16 is inclined to the radius R2 at an angle D of 45° and which enter a 1¼ inch cut C at an angle E of approximately 10°. Additionally, at its greatest penetration into the book the cutting edge of each bit should be inclined to the paper plane P at an angle F less than 60°, 45° being preferred.

Book cuts of from 1 to 1½ inches were made in the manner specified above with the bits on a 9-3/16 inch radius, the wheel being driven at approximately 3600 RPM, and removing three-sixteenths inch strips 7 from books fed at approximately 200 books per minute. No dust, confetti or waste scrap was produced and the quality of book cut was excellent. The quality of scrap was good to excellent. Most noticeably the power con-

sumed was unusually low, averaging about 1½ HP as compared with 10 HP for a rotary knife making a comparable cut, and 2½ HP for a toothed new making only a ½-inch cut. A run of nearly 2 million books was made without sharpening the cutting edges. The much lower power requirement also allows the present invention to be practiced with driving equipment costing about one half of that required for a rotary knife.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents falling within the scope of the appended claims.

I claim:

1. The method of cutting through multiple planar sheets of paper with circularly spaced, beveled cutting edges obliquely inclined to the circular radius, which comprises rotating the cutting edges in a given direction, advancing the paper in the same direction, penetrating the paper through the outer face plane thereof with the outer rotationally rearward extremity of each cutting edge entering first and to a greater penetration depth than the rotationally forward cutting edge extremity, and with the entering cutting edge inclined from said extremity away from the paper plane at a negative entry angle between 0° and 20°, and with the furthest penetrating cutting edge inclined at an angle less than 60° to the paper plane.

2. The method according to claim 1 wherein the paper is advanced with one side thereof in a plane intersecting the normal circular radius more than one half inch.

3. The method according to claim 1 wherein the cutting edge enters the paper plane at an angle of approximately 10°.

4. The method according to claim 1 wherein each cutting edge at its furthest penetration is inclined at an angle of 45° to the paper plane.

\* \* \* \* \*

40

45

50

55

60

65