June 4, 1968 N. E. DOVEY 3,386,323

ACCESSORY DEVICE FOR A SLITTER

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FIG. 1

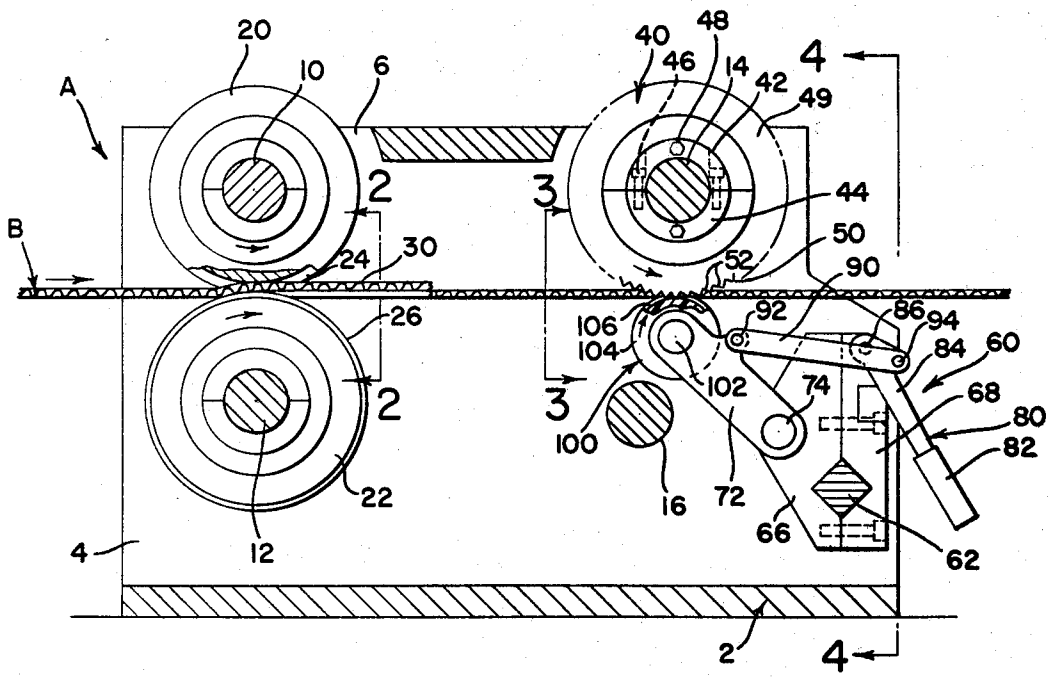


FIG. 2

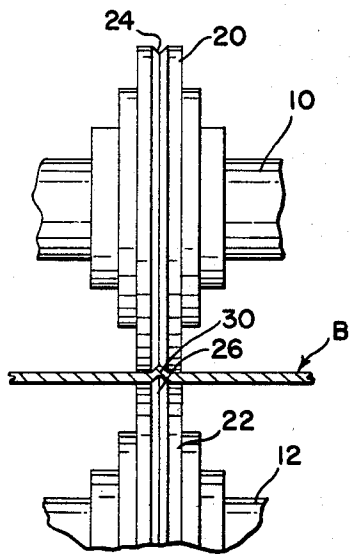
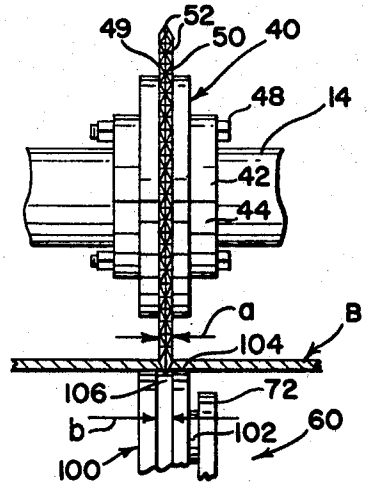


FIG. 3



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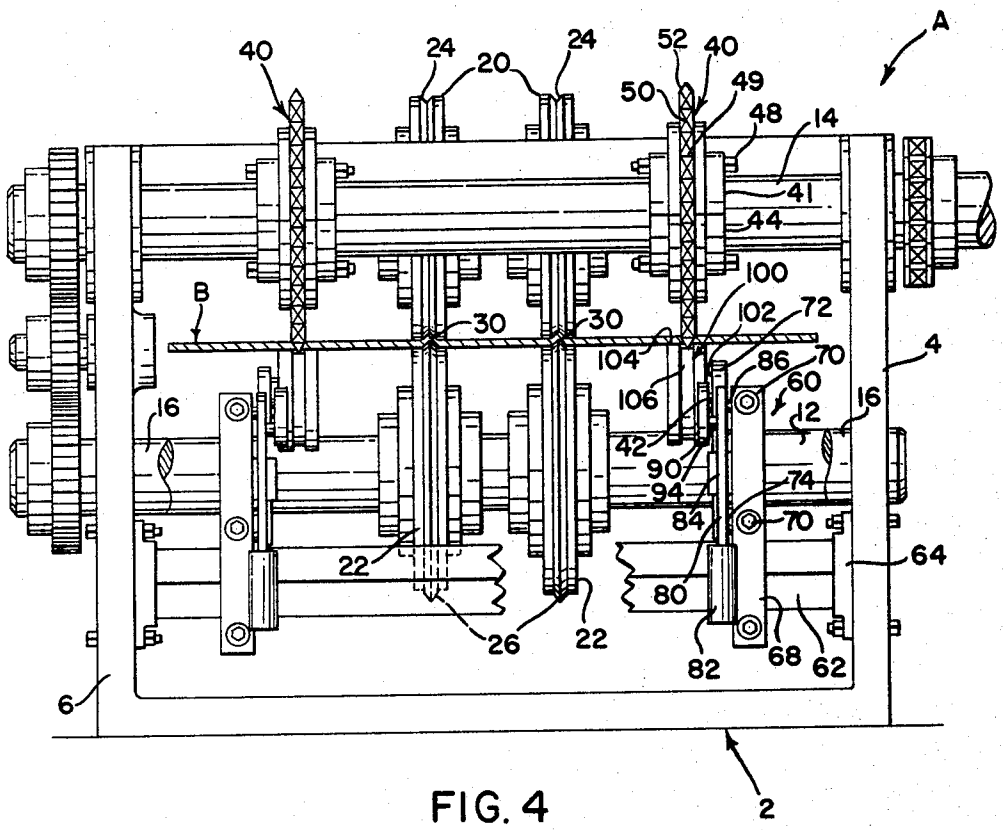
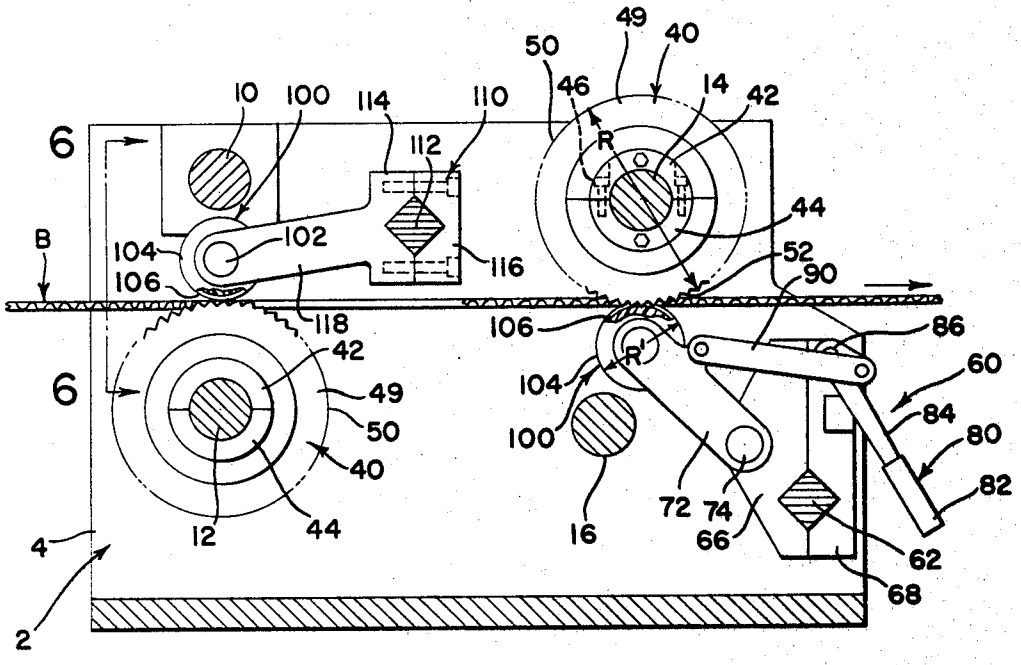


FIG. 4

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FIG. 5



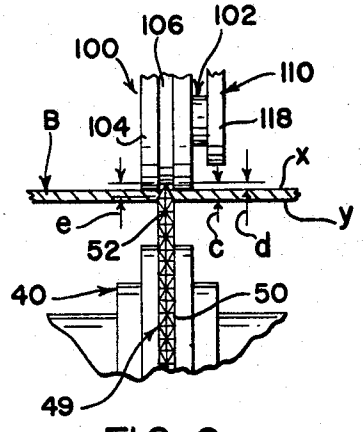


FIG. 6

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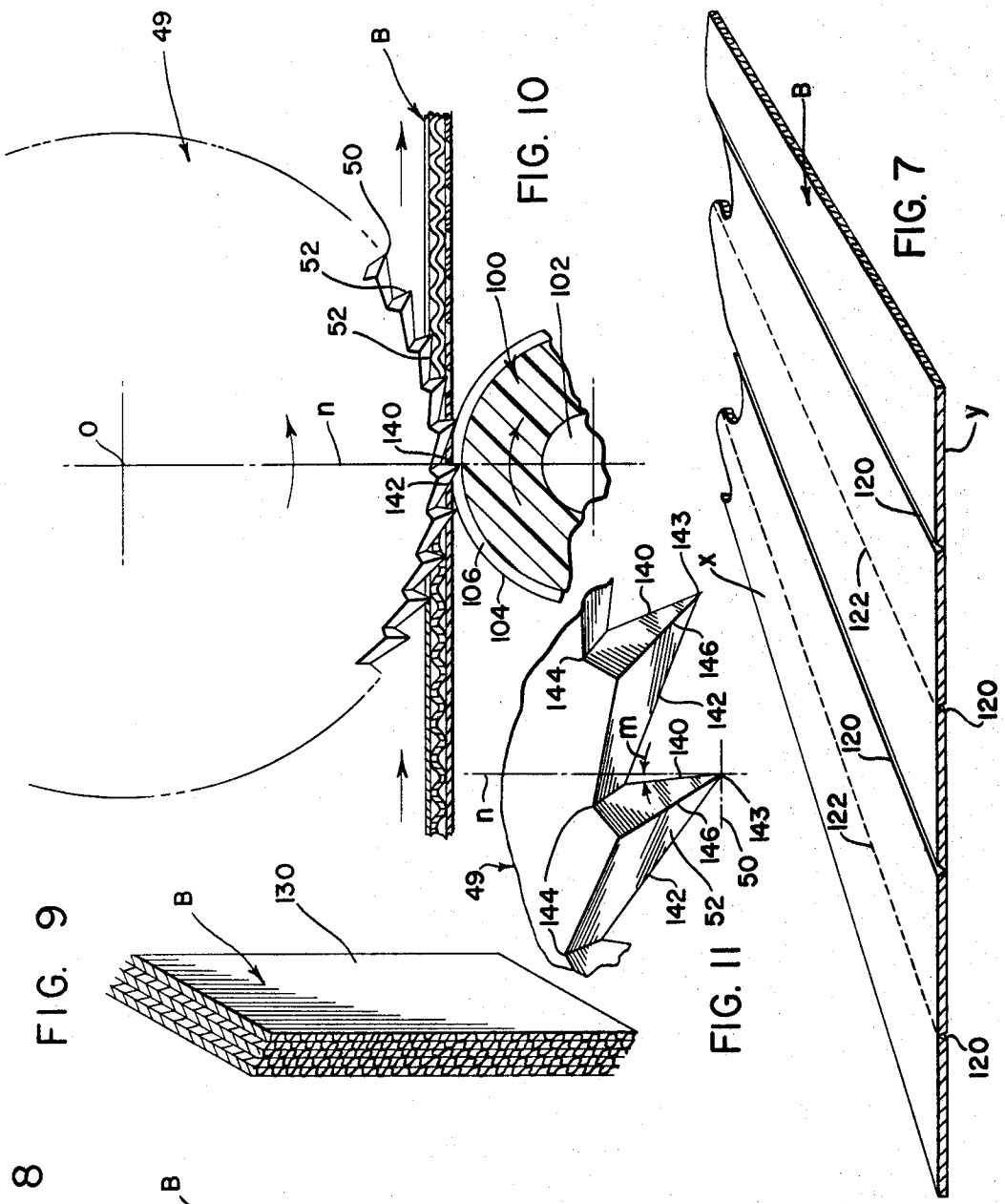


FIG. 10

FIG. 7

FIG. 11

FIG. 9

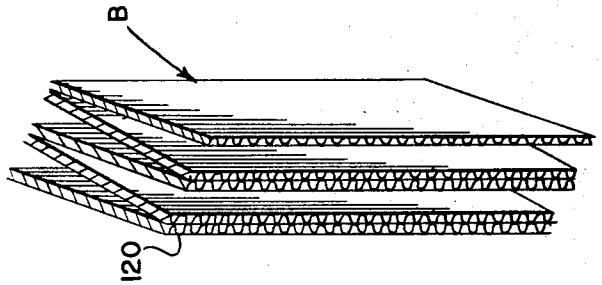


FIG. 8

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ACCESSORY DEVICE FOR A SLITTER

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3 Claims. (Cl. 83—470)

ABSTRACT OF THE DISCLOSURE

There is provided a cutting mechanism for a standard slitter which mechanism includes a small, grooved plastic anvil mounted on an auxiliary shaft. The anvil coacts with a circular serrated cutting knife to cut cardboard or other similar material passing through the slitter.

Disclosure

The present invention relates to the art of cutting corrugated board, and similar sheet material, as it is moving along a predetermined path and more particularly to an accessory device for a slitter of the type used in cutting fibrous sheet material.

This invention is particularly applicable to an accessory for use with a four-shaft slitter, and it will be described with particular reference thereto; however, it will be appreciated that the invention has broader applications and may be used as an accessory for various rotary cutting devices wherein corrugated board, or other sheet material, is conveyed between two rotary shafts having matching cutting implements mounted thereon for cutting the moving cardboard.

It has become somewhat common practice to produce cardboard or corrugated board blanks from a continuous sheet passing through a slitter. A slitter, as is well known, generally includes two longitudinally spaced sets of vertically spaced rotary shafts. Matching accessories are mounted onto the shafts of each set and are vertically aligned with each other so that the board will be processed as it passes between the shafts. These matching accessories can take the form of cutting members, which slit the cardboard longitudinally, score rolls, which form longitudinally extending indentations, known as scores, or perforating members, which perforate the cardboard longitudinally so that it may be folded along the perforations. A four-shaft slitter is more versatile than a two-shaft slitter because the board may be operated upon by accessories on the separate sets of shafts. In this manner, more implements or accessories may be mounted on the slitter without interference between the implements.

This type of installation does have certain disadvantages. For instance, when one set of shafts are utilized for a plurality of operations, the spacing between the shafts cannot be adjusted to an optimum spacing for the separate operations. Consequently, each implement or accessory must be accurately dimension to provide the desired operation, and, during continuous use, minor adjustments cannot be made without readjusting all implements on the shafts. This difficulty is compounded when a substantial number of separate operations are to be performed on one set of shafts in the slitter.

In the past, longitudinal slitting of the cardboard sheet was performed by spaced cutting members, one mounted on each shaft, with the cutting edges of these members being in side-by-side relationship to produce a "scissor" cut. It has been found that this type of cutting requires accurate adjustment of the cutting members which could not be conveniently performed by the

relatively rigid and inflexible structure of the standard slitter.

These and other disadvantages are completely overcome by the present invention which is directed toward an accessory device for a slitter which substantially increases the versatility of the slitter and improves the operations being performed thereby. It should be appreciated that the slitter is a high speed and high production machine. Accordingly, the benefits obtained by the present invention are multiplied by the extremely high production rate commonly obtained during the operation of a slitter.

In accordance with the present invention, there is provided an improvement in a rotary cutting device, such as a slitter, having two parallel rotary shafts for mounting implements to process cardboard, or similar sheet material, passing between the shafts. This improvement comprises an auxiliary bar spaced from the shafts, a cutting anvil mounted on the bar, and adjustable means for moving the anvil longitudinally on the bar. The anvil has a diameter substantially less than one-half the spacing between the shafts so that it may be easily moved to a position on one side of the sheet and between the shafts. This improvement also includes means for selectively moving the anvil between a first position remote to the shafts and a second position between the shafts and means for locking the anvil in the second position so that the anvil can form the back-up support for a cutting member mounted on one of the shafts.

By providing a small diameter support anvil on an auxiliary bar, a rotary cutting device mounted on one shaft of the slitter coacts with the anvil, instead of with an anvil mounted on the other, vertically spaced shaft of the slitter. In this manner, the anvil can be adjusted with respect to the cutter without actually adjusting the spacing between the two shafts of the slitter and without affecting the operation of other implements mounted on the spaced, stationary shafts. This structure is extremely beneficial when the cardboard sheet is to be both scored and slit adjacent the same set of shafts. The scoring rolls can be mounted on the stationary shafts and the shafts can be adjusted to provide proper longitudinal scores in the cardboard. This adjustment need not be changed to provide fine adjustments for a slitting operation taking place adjacent the same set of shafts. In accordance with the invention, the small anvil for the slitting operation is provided on the auxiliary bar so that the anvil can be adjusted irrespective of the spacing between the shafts of the slitter. This substantially increases the versatility of the slitter and reduces the maintenance and set-up time for this type of apparatus.

In accordance with another aspect of the present invention, the anvil supported on the auxiliary bar is provided with an outer cylindrical support surface having an annular groove and the cutter supported on one shaft of the slitter is provided with serrated teeth which extend into the groove of the anvil. By this arrangement, the teeth do not drive fibers from the cardboard into the support surface of the anvil. In the past, when a cutter having serrated teeth was used as the cutting implement of a rotary cutting apparatus, not necessarily a slitter, the teeth cut against a resilient covering on an anvil supported on a rotary shaft. The serrated teeth tended to drive fibers from the cardboard into the resilient covering so that the covering ultimately had to be replaced. By utilizing the groove in the anvil, fibers are not driven into the anvil, and they cannot accumulate on the support surface thereof. This substantially increases the effective life of the cutting implements, and higher production can be obtained.

The primary object of the present invention is the

provision of an accessory for a slitter of the type used in cutting and scoring cardboard, or similar sheet material, which accessory increases the versatility of the slitter when cutting or otherwise processing the cardboard, or similar sheet material.

Another object of the present invention is the provision of an accessory for a slitter of the type used in cutting and scoring cardboard, or similar sheet material, which accessory allows adjustment of separate operating implements without affecting the adjustment of other juxtapositioned implements.

Still a further object of the present invention is the provision of an accessory for a slitter of the type used in cutting and scoring cardboard, or similar sheet material, which accessory provides an improved cut in the cardboard.

Still another object of the present invention is the provision of an accessory for a slitter of the type used in cutting and scoring cardboard, or similar sheet material, which accessory reduces down time and set-up time, and increases the over-all productivity of the slitter.

These and other objects and advantages will become apparent from the following description used to illustrate the preferred embodiment of the invention as read in connection with the accompanying drawings in which:

FIGURE 1 is a side elevational view illustrating, somewhat schematically, the preferred embodiment of the present invention;

FIGURE 2 is an enlarged cross-sectional view taken generally along line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged cross-sectional view taken generally along line 3—3 of FIGURE 1;

FIGURE 4 is a front elevational view taken generally along line 4—4 of FIGURE 1;

FIGURE 5 is a side elevational view illustrating, somewhat schematically, a further modification of the preferred embodiment of the present invention;

FIGURE 6 is an enlarged cross-sectional view taken generally along line 6—6 of FIGURE 5;

FIGURES 7–9 are pictorial views illustrating a blank produced by the embodiment of the invention shown in FIGURE 5;

FIGURE 10 is an enlarged, schematic view illustrating another aspect of the present invention; and,

FIGURE 11 is a partial view illustrating in more detail the aspect of the invention shown in FIGURE 10 and a slight modification thereof.

Referring now to the drawings herein the showings are for the purpose of illustrating preferred embodiments of the invention only and not for the purpose of limiting same, FIGURES 1–4 illustrate a slitter A, of the four-shaft type which is used for scoring or slitting cardboard, such as corrugated board B. In accordance with the illustrated embodiment of the invention, the slitter A includes shafts **10**, **12**, and shafts **14**, **16**. Score rolls **20**, **22** are supported on the entrant shafts **10**, **12**, and they are positioned with respect to each other so that a groove **24** coacts with a rib **26** on the rolls to produce a longitudinally extending score **30** in the board B. As shown in FIGURE 4, a plurality of score rolls **20**, **22** can be longitudinally spaced along the shafts **10**, **12**.

In accordance with the invention, the slitter A is provided with a rotary cutter **40** supported on shaft **14**. Although a plurality of rotary cutters **40** can be provided along the shaft **14**, only one of these cutters is described in detail. This cutter includes split retainer rings **42**, **44** which are clamped by bolts **46** onto the shaft **14**. Bolts **48** extending axially through the split retainer rings **42**, **44** secure an annular cutting blade **49** with respect to the shaft **14**. The periphery of the blade **49** is formed into a cutting edge **50** having a plurality of spaced, serrated teeth **52**. These teeth are provided by grinding a plurality of grooves around the periphery of blade **49** with a grinding tool having a V-shaped cross-section. After these grooves are provided on one side of the blade **49**, similar grooves are provided on the other side of the blade and these grooves intersect to form the serrated cutting edge **50**. See FIGURE 11 for more details of teeth **52**. This general procedure of forming serrated teeth is known in the art of accessories for cardboard cutting apparatus; however, as will be described later, the present invention contemplates an improvement in the procedure for forming the spaced teeth.

Heretofore, a cutting device for slitting the board B in a longitudinal direction has included a cutting blade on both shafts **14**, **16**. These cutting blades were abutted in an axial direction to provide a scissoring effect for slitting the board. This procedure for cutting the board has proven unsatisfactory and, in accordance with the present invention, the cutting operation is accomplished by rotary blade **49** which coacts with an accessory **60** secured onto frame **2** of the slitter A. Accessory **60** includes a longitudinally extending bar **62** secured onto sides **4**, **6** of frame **2** by spaced brackets **64**, best shown in FIGURE 4. Split supports **66**, **68** are adjusted longitudinally of bar **62** by loosening bolts **70** and then manually adjusting the supports before the bolts are tightened. See FIGURE 1. A support arm **72** is pivotally mounted by pin **74** on accessory **60**. The arm **72** is controlled by a manual operator **80** including a handle **82**, lever **84**, pivot pin **86**, link **90** and pivot pins **92**, **94**. As seen in FIGURE 1, the operator **80** is utilized for swinging the support arm **82** between a first position remote from shafts **14**, **16** and a second position between the shafts **14**, **16**. The latter position is illustrated in FIGURE 1.

Support arm **72** is utilized for rotatively mounting a cutting anvil **100** by a rotary shaft **102**. The cutting anvil includes an outer support surface **104** which has a diameter generally less than one-half of the spacing between shafts **14**, **16**. The limitations on the diameter of the anvil will be discussed later.

Referring now to FIGURES 5 and 6, to provide a slitting or cutting operation adjacent shafts **10**, **12**, another accessory **110** is provided. This accessory is similar to accessory **60** adjacent shafts **14**, **16**; however, this accessory includes only a longitudinally extending bar **112** supported on frame **2**, split supports **114**, **116** for adjusting the accessory longitudinally of bar **12** and a support arm **118**. The support arm mounts an anvil **100** similar to the anvil mounted on accessory **60**.

The anvil **100** with support surface **104** and groove **106** form a substantial part of the present invention. As seen in FIGURES 3 and 6, the blade **49** has a width *a* which is only slightly less than the width *b* of groove **106**. In operation, teeth **52** of cutting edge **50** protrude into the groove **106** so that the blade **49** coacts with the groove to provide a longitudinally extending cut in board B as the board moves through apparatus A. In the past, serrated blades, such as blade **49**, have been utilized for cutting cardboard. Generally these blades protrude into the outer resilient covering of an anvil. By this prior arrangement, the cutting operation, caused the teeth to drive fibers from board B into the support surface of the anvil. This ultimately requires replacement of the anvil. Replacement of the anvil was often required after a very short time because of the rapid rate at which the serrated teeth **52** cut the board B.

It has been found that the provision of groove **106** in the anvil prevents an accumulation of fibers on the support surface **104** of the anvil. In accordance with the preferred embodiment of the invention, the anvil **100** is formed from a plastic material, such as polytetrafluoroethylene, which has low adherent and high bearing characteristics. These characteristics further prevent accumulation of fibers in the groove during the cutting operation. After extended experimentation, it has been found that the groove **106** inhibits accumulation of fibers most efficiently when the diameter of the anvil **100** is substantially less than the diameter of the cutting edge **50**. Referring now to FIGURE 5, the diam-

eter of the cutting edge is R and the diameter of the support surface R'. It has been found that fiber accumulation is drastically reduced when the ratio R/R' is within the range of 4.0–7.5. In practice, R equals 9.0 inches and R' equals 1.5 inches. This gives a ratio of approximately 6.8. As the diameter of the anvil **100** increases, fibers from board B tend to accumulate in the groove **106** apparently because the teeth **52** are cutting against a surface approaching a flat surface instead of an arcuate surface as provided by a smaller diameter anvil.

By providing the auxiliary bars **62, 112**, the board B can be cut in the longitudinal direction without requiring adjustment of the spacng between the shafts **10, 12** and **14, 16**. These shafts can be used for providing scoring rolls to produce longitudinally extending scores **30** at the same time that the board B is being slit by an accessary constructed in accordance with the present invention.

Referring now to FIGURE 6, the dimension *c* is the combined depth of the groove **106** and the thickness of board B. Dimension *e* represents the effective height of teeth **52**, and dimension *d* represents the depth of groove **106**. If the dimension *c* is greater than the dimension *e*, the teeth **52** perforated side *x* of board B and completely cut side *y* of board B. In this manner, the board B is not severed in a longitudinal direction. The advantage of this feature will be hereinafter described in some detail. If the dimension *d* is greater than the dimension *e* and the blade **49** is adjusted so that the cutting edge **50** extends to the bottom of groove **106**, the board B will be severed in a longitudinal direction and both sides *x* and *y* will be slit longitudinally. It is appreciated that various adjustments can be made to the spacing of the blade **49** with respect to the anvil **100** to produce the desired finish cut on board B.

Referring now to FIGURES 7–9, the product produced by the embodiment of the invention shown in FIGURE 5 is illustrated. Board B is severed at **120** on one side of the board and is perforated at **122** on the other side of the board. By alternating the orientation of these cuts and perforations, the board may be folded, as shown in FIGURE 8, to produce an accordion stack **130**, as shown in FIGURE 9. An appliance constructed in accordance with the present invention is well adapted for producing the accordion stack **130** at a relatively low cost and at a high rate. Heretofore this type of cardboard cut was not economically performed by a slitter, of the type shown in FIGURES 1 and 5.

Referring now to FIGURES 10 and 11, another aspect of the present invention is shown in detail. Each tooth **52** is formed with a leading edge **140**, a trailing edge **142** which converge at an outermost cutting point **143**. The cutting points and edges define the cutting edge **50** of blade **49**. As best shown in FIGURE 11, the leading edge **140** and the trailing edge **142** of adjacent cutting teeth **52** form an apex **144**. This apex is produced during the grinding operation wherein grooves are ground from both sides of blade **49** to produce the cutting teeth **52**. This grinding operation also produces ridges **146** on the side of the cutting teeth **52**. It is appreciated that FIGURES 10 and 11 are only schematic to show certain features of teeth **52**. It has been found that during the grinding operation of standard serrated cutting edges for cardboard, and similar sheet material, the apexes **144** could not be produced with a sharp point. Consequently, there was, inherently, a slight radius at the apexes. Heretofore, the apexes were used in actually cutting the board B. The radius at the apexes tended to drive fibers from the board into the mandrel against which the teeth were cutting. In accordance with an aspect of the invention, the leading edge **140** forms an angle *m* with respect to the radius line *n* extending from the center *o* of blade **49**. By providing the angle *m*, which may be relatively small, only a few degrees, the point **143** of each tooth cuts into board B and the apex **144** aligned with the point slips into this previous cut. This prevents the apex from actually cutting the board. In FIGURE 10, the leading edge **140** is shown to coincide with radius line *n*. In other words, the angle *m* is zero. Bl this arrangement, the apexes **144** do not perform a cutting function; however, it is preferred that the leading edge **140** be offset slightly from line *n*, as shown in FIGURE 11. In essence, both the leading and trailing edges **140, 142**, respectively, of each tooth **52** are on one side of the radius line *n*. This radius line extends between the centers of the blade **49** and anvil **100** when point **143** is aligned between these centers. When point **143** is aligned with the centers of the blade and anvil, the radius line *n* is perpendicular to the surface of the board B, as shown in FIGURE 10.

The present invention has been described in connection with certain structural embodiments; however, it is appreciated that various changes may be made in these embodiments without departing from the intended spirit and scope of the present invention as defined in the appended claims.

Having thus described my invention, I claim:

1. A cutting mechanism for a cardboard slitter of the type having upper and lower rotatable shafts between which a cardboard sheet passes on a given feedline generally transverse of said shafts, said mechanism comprising a circular knife mounted on and concentric with one of said shafts and rotated thereby, said knife having an outer serrated cutting edge and a given thickness, a mounting bar generally parallel with said shafts and mounted remote from a position between said shafts, an anvil assembly mounted to reciprocate along said bar, said assembly comprising: means for locking said assembly in various positions on said bar, an extension having a terminal end located between said shafts and spaced from said cutting edge, a cylindrical plastic anvil journalled adjacent said end and on an axis generally parallel to said shafts, said plastic anvil having an outer surface with a diameter substantially less than the diameter of said cutting edge and a circumferentially extending groove in said outer surface with a width larger than the thickness of said knife, said anvil being held in a position with said cutting edge extending into said groove.

2. A cutting mechanism as defined in claim **1** wherein said cutting edge has a diameter R, said anvil has a diameter R' and the ratio of R/R' is at least approximately 4.0

3. A cutting device as defined in claim **1** including means for pivotally mounting said extension on said assembly and a lever system for shifting said extension between a first position with said cutting edge in said groove and a second position with said cutting edge out of said groove.

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