United States Patent [19]

Gallagher, Jr.

[11] **3,763,748**

[45] **Oct. 9, 1973**

[54] **CORRUGATED PAPERBOARD SLITTER**

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[73] Assignee: **Harris-Intertype Corporation**, Cleveland, Ohio

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[21] Appl. No.: **254,554**

[52] **U.S. Cl.** ..... **93/36 M**, 83/24, 83/349, 83/402, 83/425.2, 83/508, 83/658, 93/58.4

[51] **Int. Cl.** **B26d 1/20**, B31b 1/18

[58] **Field of Search** ..... 83/24, 349, 425, 83/425.4, 425.3, 425.2, 402, 675, 508, 658, 429, 477.2; 93/58.2 R, 58 R, 58.4, 36 M

[56] **References Cited**

UNITED STATES PATENTS

3,176,555	4/1965	Bowker et al.	83/425 X
3,308,723	3/1967	Bergh, Jr.	93/58 R
3,548,758	12/1970	Singer	83/429 X
3,695,136	10/1972	Horne	83/658

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Attorney—Arthur H. Seidel et al.

[57] **ABSTRACT**

A corrugated paperboard slitter has slitting blades which cooperate with and have an interference fit with an expendable anvil. The anvil is preferably made in sections so that portions thereof may be discarded and replaced as needed.

10 Claims, 5 Drawing Figures

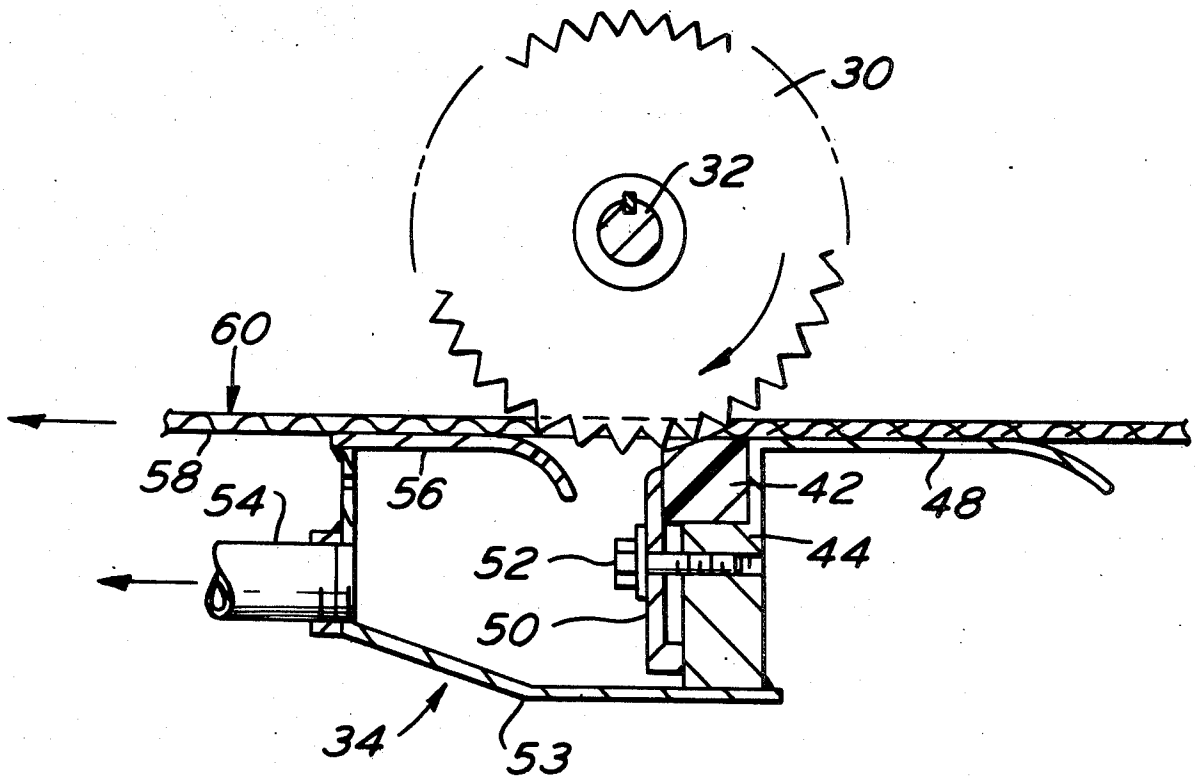
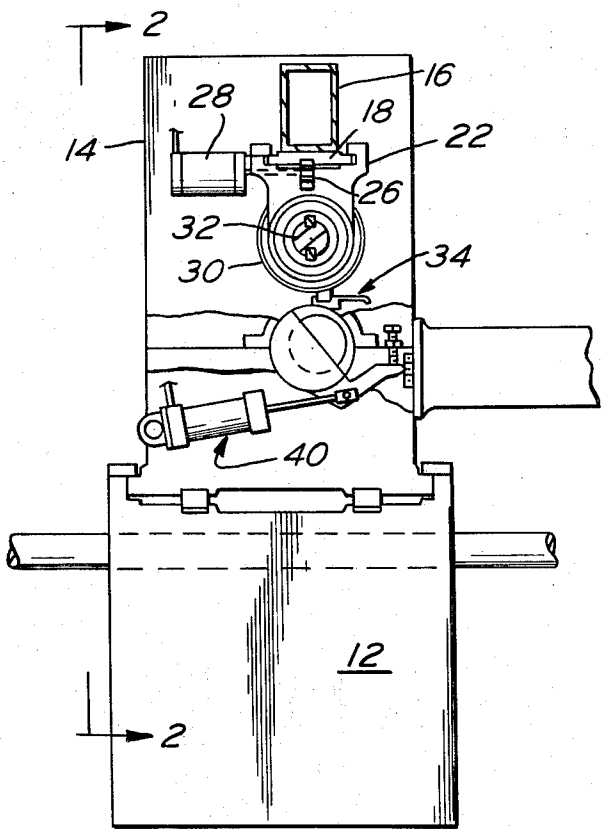


FIG. 1


2
16
28
18
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34
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12
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FIG. 2

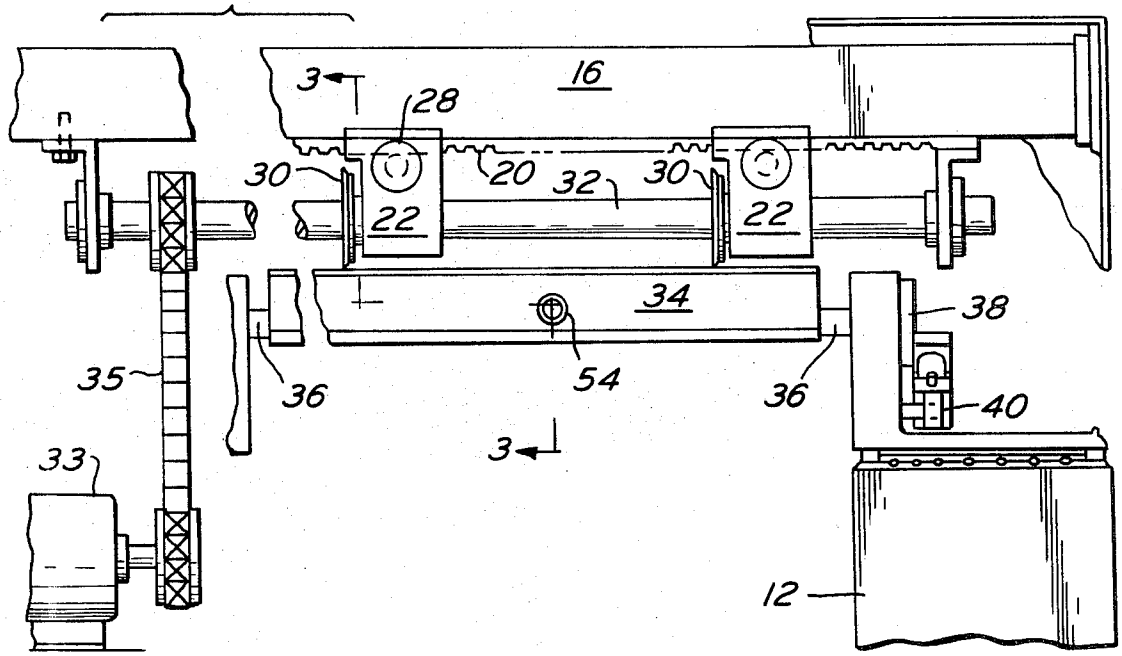
3
16
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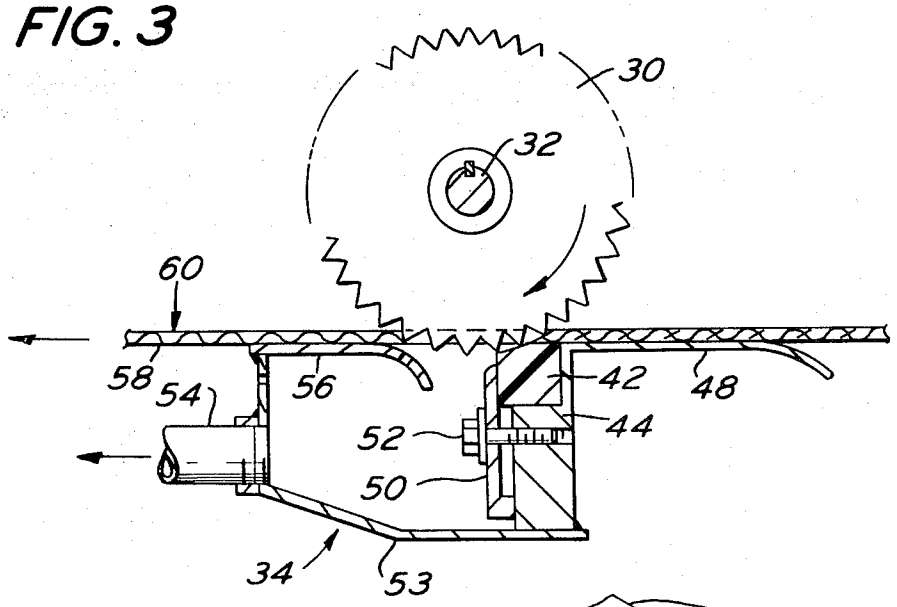
FIG. 3



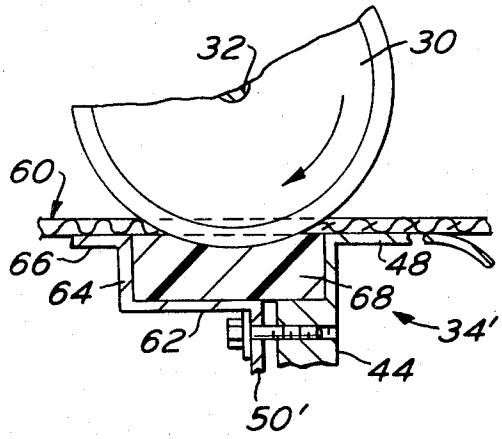


FIG. 5

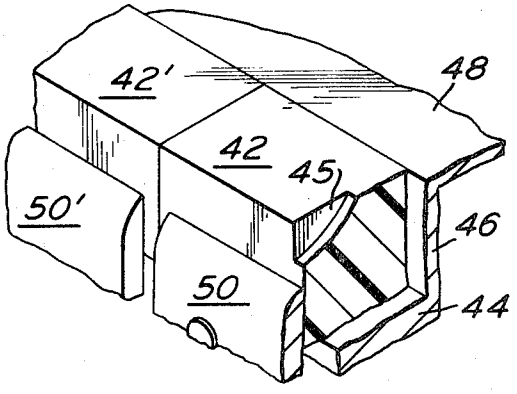


FIG. 4

CORRUGATED PAPERBOARD SLITTER

The slitter of the present invention is particularly adapted for use in a corrugated paperboard slitter-scorer which is adapted to be automated by means of a computer control such as that disclosed in U. S. Pat. No. 3,651,723 and entitled Corrugated Paperboard Slitter-Scorer. The disclosure therein is incorporated herein by reference.

The slitter of the present invention is also adapted for use in a corrugated paperboard slitter such as is used to slit panels of partition stock from wide sheets. In this application it is particularly desirable that the edges of the panels be undamaged so that they may provide rigid support to the box. This method of slitting provides the desired edges.

In the above-entitled application, the anvil cooperating with the slitter blade is a brush roll. While the brush roll type anvil is satisfactory, there are certain situations wherein the anvil of the present invention is preferred for the reasons to be set forth hereinafter.

In the paperboard slitter of the present invention, the anvil is of an expendable type and preferably made in sections so that portions thereof subjected to the greatest amount of wear may be discarded and replaced as desired. The anvil is preferably provided with a flat top surface and made from material, solid or hollow, which may be easily cut into but is sufficiently tough so as not to unduly wear when subjected to the rubbing pressure of the paperboard. A wide variety of different types of materials have been used satisfactorily for the anvil of the present invention. I prefer to use a solid polymeric plastic material for the anvil such as polyurethane containing about 15 percent molybdenum disulfide and having a durometer hardness of about 65 Shore D scale.

The anvil is preferably made in a plurality of sections so that the portions thereof in the trim area which wear out quicker may be replaced as needed. The section of the anvil in the trim area may have a life of about several months whereas the sections in the other areas of the anvil have a life four or six times longer. The anvil is preferably provided with a cross-sectional configuration wherein a corner thereof is juxtaposed to the blade with an interference fit.

The present invention has a substantial number of advantages over the conventional anvils and methods of slitting as well as the method of using an anvil of the brush roll type illustrated in the above-mentioned patent application. An anvil in accordance with the present invention is cheaper to install, provides a positive surface for preventing the liner sheet on double-faced board from pulling away from the flutes where a bond has not yet cured, permits the use of cheaper blades, and facilitates the cutting of very narrow trim such as trim having a width of one-sixteenth of an inch. Also, the anvil of the present invention will extend the life of the cutting blades. For example, a cutting blade which was considered to be 100 percent worn out on a slitter as shown in the above-mentioned patent application was utilized to successfully cut heavy paperboard with a narrow trim when using the anvil of the present invention.

Furthermore, a trim of one-sixteenth inch width has been cut on double wall corrugated paperboard comprising at least two 90-pound liners. The cut edge was square and clean and the corrugations were undamaged.

In operation, the cutter blades are preferably rotated so as to have a peripheral surface speed which is substantially greater than the surface speed of the paperboard being cut. In this regard, good results have been attained when the surface speed of the peripheral cutting edge of the blades was 2 ½ times the surface speed of the paperboard. The interference fit between the periphery of the cutter blades and the anvils of the present invention may be approximately one-sixteenth of an inch when using a new blade and up to about one-eighth of an inch when using an old blade.

It is an object of the present invention to provide a novel paperboard slitter.

It is another object of the present invention to provide a paperboard slitter which is simpler, easier to install, cheaper to maintain, and which extends the life of the slitting blades.

It is another object of the present invention to provide an inexpensive corrugated paperboard slitter which has a positive surface for contacting the paperboard liner to prevent the same from breaking away from the bond with the corrugated medium.

It is another object of the present invention to provide a corrugated paperboard slitter which will facilitate cutting narrow trim from heavy paperboard with a sharp clean edge while at the same time being inexpensive and capable of being utilized on an automated paperboard slitter-scorer.

Other objects will appear hereinafter.

For the purpose of illustrating the invention, there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIG. 1 is a side elevation view of a slitter in accordance with the present invention.

FIG. 2 is an elevation view taken along the line 2—2 in FIG. 1.

FIG. 3 is a sectional view taken along the line 3—3 in FIG. 2.

FIG. 4 is a partial perspective view of the anvil and clamping means therefor.

FIG. 5 is a sectional view similar to FIG. 3, but illustrating another embodiment of the anvil.

Referring to the drawing in detail, wherein like numerals indicate like elements, there is shown in FIG. 1 a side elevation view of a slitter, partially in section, which is adapted to be automated as disclosed in the above-mentioned copending application. The slitter **10** is part of a slitter-scorer driver in synchronism with the corrugated paperboard processing equipment including a double facer and cut-off machine.

The slitter **10** includes a suitable frame **12** having sides **14** which support the beam **16**. Beam **16** may be hollow as illustrated and is provided with a track **18** on the lower surface thereof. Track **18** is provided with a rack **20** on its lowermost surface.

A plurality of slitter heads **22** are provided on a drive shaft **32** and are movable along the track **18**. Each slitter head **22** includes a pinion **26** in meshing engagement with the rack **20**. Each head **22** includes a stepper motor **28** supported thereby. Any one of a wide variety of commercially available stepper motors may be utilized. One suitable example of a stepper motor is a H.S. **50L** stepper motor manufactured by Superior Electric. Motor **28** is reversible so that it may cause the head **22** to move in a transverse direction along the length of

track 18 to any position by energizing it with a predetermined number of pulses.

Each pulse causes the motor 28 to translate the head 22 a certain distance. By way of example, 500 pulses applied to the motor 28 may cause the head 22 to move one-half inch along the length of track 18. In this manner, positioning of the heads 22 for a production run, and the blades supported thereby, may be more accurately accomplished in a rapid manner.

Each of the heads 22 includes a slitting blade 30 which is rotatably driven by shaft 32 and is coupled thereto by way of a key. Operation of the stepper motors 28 on each of the heads rotates the pinion to cause the heads to move along the track 18 while the shaft 32 rotatably drives the blades 30 about the axis of shaft 32. Drive motor 33 is connected to shaft 32 by means of sprockets and chain 35.

The cutting blades 30 cooperate with an anvil 34 supported therebelow on stub shafts 36. The mounting for the stub shafts 36 includes eccentrics 38. Rotation of the eccentrics 38 is accomplished by a power cylinder 40 connected thereto. Actuation of cylinder 40 causes rotation of the eccentrics 38 to move the anvil 34 toward and away from the blades 30 to increase or decrease the depth of penetration or interference fit.

The anvil 34 includes a plurality of expendable anvil inserts 42, 42', etc. aligned transversely and supported on a common support seat 44 having a vertical wall 46. The wall 46 terminates at its upper end in a horizontally disposed flange 48 whose free end is curved downwardly. The anvil inserts are clamped onto the seat 44 by contact on one side face with discrete mounting plates 50, 50', etc. A bolt 52 extends through each of the mounting plates and is threadedly secured to the seat 44. The upper end of the mounting plates is below the top surface on the anvil inserts while the latter is flush with or slightly lower than the flange 48.

As shown more clearly in FIG. 3, the anvil inserts are supported in a manner so as to be offset from a vertical plane containing the axis of shaft 32. As a result thereof, the blade 30 cuts into a corner of the anvil inserts. One such cut 45 at the corner of the insert 42 is illustrated in FIG. 4.

If desired, dust formed during cutting may be removed by providing a housing 53 coupled to the seat 44 and utilizing a conduit 54 which communicates with the housing and a vacuum pump. The upper end of the housing 53 includes a horizontal top wall 56 terminating at its righthand end in FIG. 3 in a downturned lip. Wall 56 is flush with the flange 48. Thus, the liner 58 on the double-faced paperboard 60 will be supported from below by a positive solid surface at the flange 48, top surface of anvil insert 42, and top surface of wall 56.

The provision of a flat support surface immediately adjacent the area being slit by blades 30, as provided by the top surface of the anvil inserts, precludes the tendency of the liner 58 being separated from the glued joint at the flutes. Recent developments of double-facers render the same shorter. Consequently, there is a tendency for the adhesive joint between the liner 58 and the flute tips to be uncured at the time it arrives at the slitter. The lack of a positive support surface capable of resisting pressure will permit the liner 58 to break away from the flute tips immediately adjacent the area being slit.

The use of a plurality of anvil inserts 42, 42', etc. provides the ability to use inexpensive expandable inserts which may be discarded and replaced when worn. Thus, the blades cut through the paperboard and into the inserts at a corner thereof. As a corner becomes worn due to too many cuts, the insert may be rotated or flipped over so as to provide a new clean corner. After all of the corners are worn, the insert may be discarded and a new one substituted therefor.

In the area where the web of paperboard 60 is being slit along its side edges, there is a greater amount of attrition to the inserts. Hence, the inserts in the area where the web of paperboard is being trimmed will last about several months whereas the remaining inserts may last four to six times longer.

A wide variety of different types of anvil inserts may be utilized. Different types of readily available woods, rubbers and plastics, etc. have been used. I prefer to use a polymer plastic material such as polyurethane or equivalent material. As a general rule, the anvil inserts should have a flat top to support the paperboard 60, have a corner to be presented to the blade so that the depth of the cut will not weaken the insert to the point where it will be cut to pieces, should be a material which may be easily cut but sufficiently tough so that its upper surface is not unduly worn due to the rubbing pressure with the paperboard 60, should have a low coefficient of friction, be an inexpensive material, and not contribute to attrition of the slitting blade.

When using anvils of the present invention, I have found that the blades 30 have much greater life and may be of cheaper materials than those formerly used. The cutting edge on the blade is preferably serrated either along one side face or at the mid-line of the thickness of the blade. The blades are preferably rotated at a speed substantially higher than the speed of the web of paperboard 60. I prefer to rotate the blades so that their peripheral speed is about 2.5 times the surface speed of the paperboard 60.

When the location of the blades are being changed for a new production run, the anvil 34 may be lowered for a sufficient distance so as to clear the teeth from the inserts. If desired, the reverse can be provided, namely the blades may be raised relative to the anvil. A flexible connection will be utilized with the conduit 54 so as to permit the anvil 34 to be lowered prior to shifting of the blades.

In FIG. 5, there is illustrated another embodiment of the anvil designated generally as 34'. The anvil 34' is the same as anvil 34 except as will be made clear hereinafter. Accordingly, corresponding elements are provided with corresponding primed numerals.

In the anvil 34', the housing 52 has been eliminated and the mounting plates 50' are provided with a seat extension 62 terminating in a vertical wall 64 having a flange 66. Flange 66 and flange 48 are flush. The anvil insert 68 is rectangular in configuration and positioned directly below the axis of rotation for the blade 30 so that the blade 30 bites into or cuts through a side face of the anvil insert. When the insert 68 is worn due to attrition, it is flipped over to the opposite side. Thereafter, the worn insert is replaced with a new one.

Thus, the anvil insert arrangement shown in anvil 34' presents two surfaces for cooperation with the blade while the arrangement in anvil 34 will present four individual corners for cooperation with the blade. Otherwise, the anvils are identical.

A slitter in accordance with the present invention eliminates the need for high precision anvils, mating circular blades, prolongs blade life, and reduces operating expense. At the same time, narrow trim at the edge with a clean edge can be attained at high speeds of the web of paperboard without any separation of the liner 58 from the flutes adjacent the area being slit.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. A process of slitting a web of corrugated paperboard comprising the steps of feeding a web of corrugated paperboard over and in contact with a stationary anvil having at least one expendable insert, supporting the web with the top surface of said insert, using an insert of low friction and good wear characteristics when subjected to rubbing pressure with the web, rotating a circular cutting blade on an axis parallel to said insert, slitting the web as it passes between said blade and the anvil while having an interference fit between said blade and insert so that the blade cuts into the insert, and rotating said blade at a peripheral surface speed substantially greater than the linear speed of said web.

2. A process in accordance with claim **1** including rotating the insert after it is worn so as to present an alternate surface on the insert into which the blade may cut, and discarding the insert when worn.

3. A method in accordance with claim **1** including simultaneously slitting the web with a plurality of spaced blades, using a plurality of aligned inserts, with a discrete insert at the end portions of the anvil for cooperation with a blade slitting trim from the web.

4. A method in accordance with claim **1** including sucking dust away from the anvil by means of vacuum.

5. A method in accordance with claim **1** including using anvil inserts made from a polymer plastic material having discrete corners with one corner being juxtaposed to the periphery of the blade.

6. Slitting apparatus for slitting an elongated continuous web of corrugated paperboard comprising a shaft having at least one slitting blade selectively positioned therealong for slitting the web, an anvil at an elevation below the shaft, means supporting the anvil in a manner preventing the anvil from rotating, said anvil having expendable inserts of low friction material which resist rubbing pressure due to contact with the web, said inserts having a generally flat top surface for supporting the web, and means for positioning the anvil so that the inserts have an interference fit with the periphery of the blade, whereby worn inserts having an excessive number of cuts may be discarded and replaced with a new insert.

7. Apparatus in accordance with claim **6** wherein the interference fit between the inserts and the blade is at a corner of the insert.

8. Apparatus in accordance with claim **6** wherein the interference fit between the inserts and the blade is at a side face of the insert.

9. Apparatus in accordance with claim **6** wherein the anvil includes a mounting plate for each insert, each mounting plate being removably coupled to the anvil below its respective insert.

10. Slitting apparatus in accordance with claim **6** wherein the expendable inserts are aligned inserts made from a polymeric plastic material having at least two discrete corners.

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