

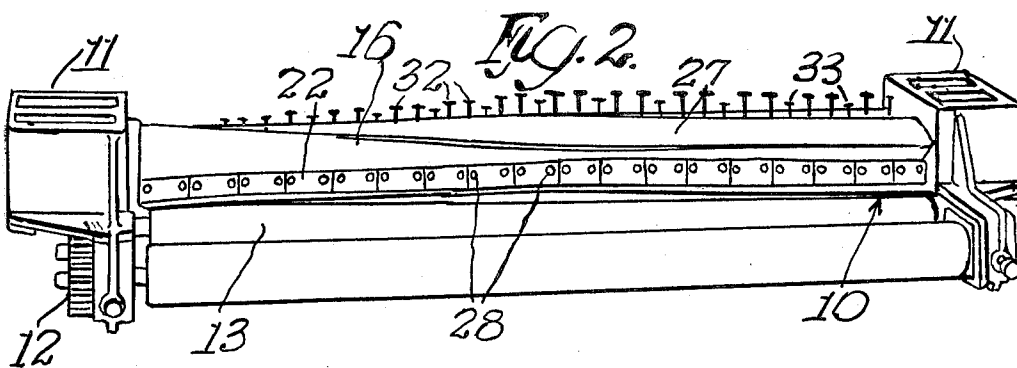
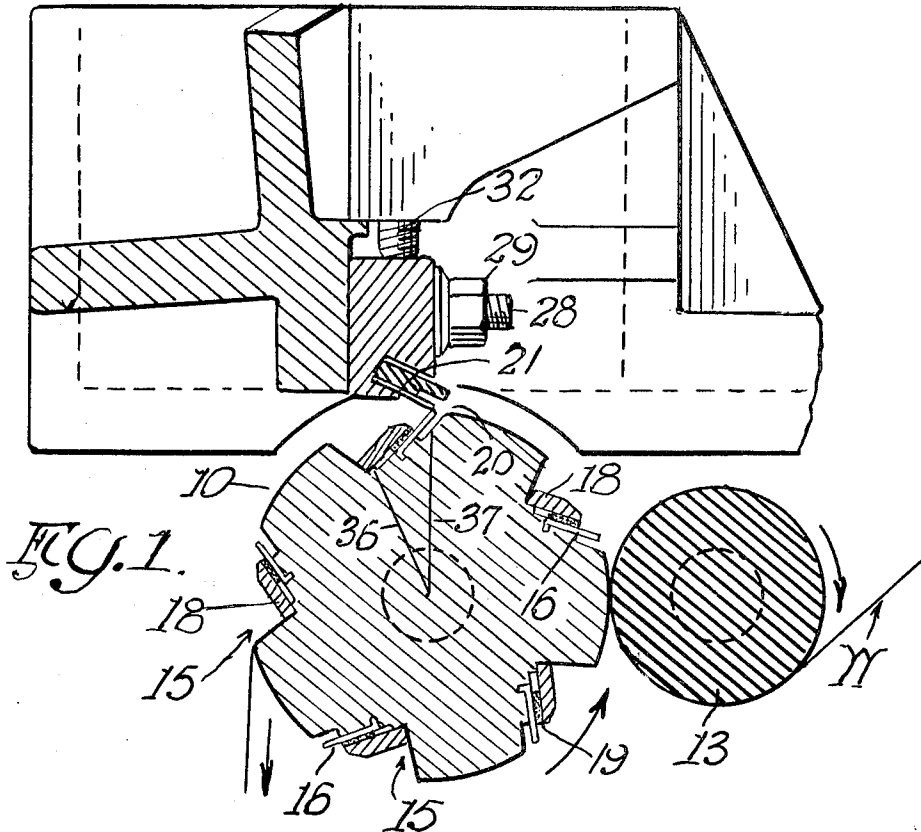
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E. D. NYSTRAND
SHEAR CUT PERFORATOR

3,264,921

Filed March 4, 1965

2 Sheets-Sheet 1



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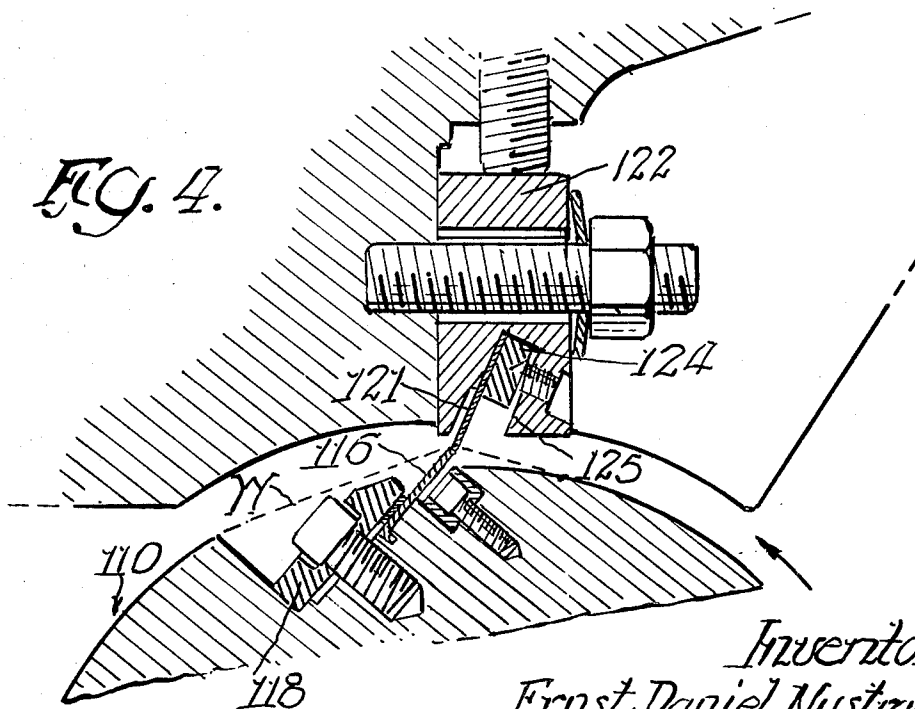
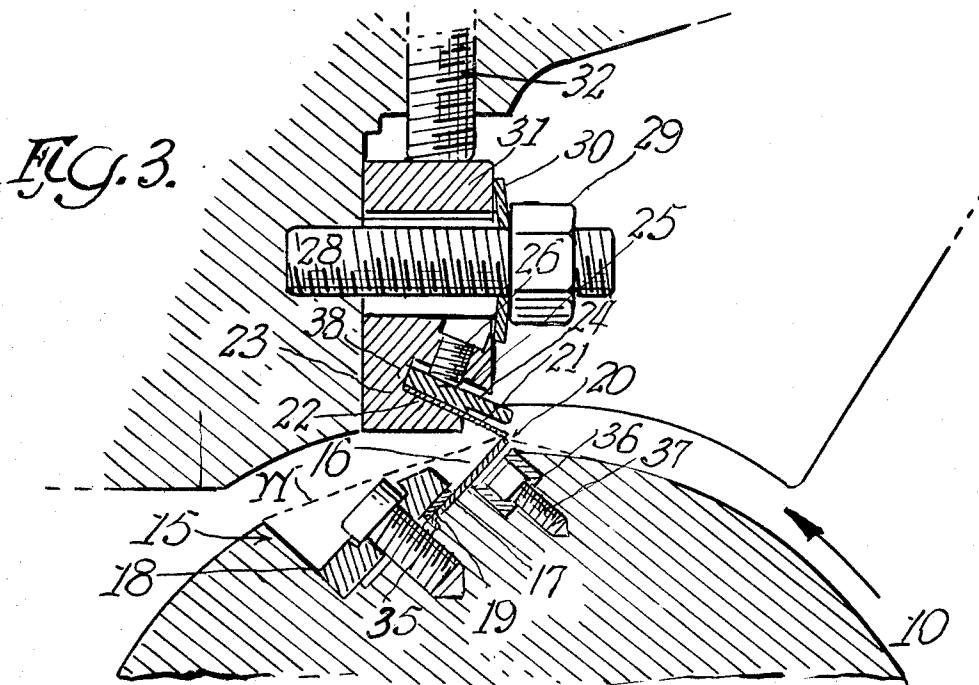
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SHEAR CUT PERFORATOR

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5 Claims. (Cl. 83-342)

This invention relates to a shear cut perforator, and, more particularly, to apparatus for transversely perforating continuous webs of toilet tissue, and the like.

This invention is an improvement on U.S. Patent No. 2,870,840, issued January 27, 1959, to Edwin M. Kwitek. It is also an improvement on U.S. Patent No. 2,986,058, issued May 30, 1961, to Orrin Besserlich.

Both of the above-mentioned patents have to do with a perforating head or attachment for a continuous re-winder. A re-winder is commonly employed in the production of retail-sized rolls of toilet tissue and toweling. In toilet tissue, for example, the web is transversely perforated on 4½" centers and this is performed during the time a web is being rewound from a parent or jumbo-sized roll into the retail-sized rolls commonly purchased.

Web winding apparatus of the character to which this invention is applicable can be seen in U.S. Patent No. 2,769,600, issued November 6, 1956, to Edwin M. Kwitek and Ernst Daniel Nystrand. Further particulars of the re-winder can be seen in the co-owned, copending application of Ernst Daniel Nystrand, John J. Bradley and Harvey J. Spencer, Serial No. 223,994, filed September 19, 1962, now Patent No. 3,179,348.

This invention is particularly concerned with the cutting blades employed in the perforating attachment of the re-winder, and a general object of the invention is to provide a unique arrangement of perforating blades to facilitate perforating during rewinding.

Other objects and advantages of the invention may be seen in the details of construction and operation set down in this specification.

The invention is explained in conjunction with an illustrative embodiment in the accompanying drawing, in which—

FIG. 1 is a fragmentary sectional view of a perforating attachment;

FIG. 2 is a perspective view of the attachment of FIG. 1;

FIG. 3 is an enlarged fragmentary sectional view of the central portion of FIG. 1; and

FIG. 4 is a view similar to FIG. 2 but showing a modified form of the invention.

In the illustration given, and with particular reference to FIGS. 1 and 2, the numeral 10 designates a perforating bedroll of the character seen in the above-mentioned Kwitek Patent No. 2,870,840. The bedroll 10 is journaled for rotation within side frames 11. A gear train 12 may be employed for rotating the bedroll 10 in synchronism with an advancing web designated W.

The web W is seen to be traveling with and on a portion of the surface of the bedroll 10, being in partial wrapping engagement therewith. For this purpose, the web is fed under an idler roll 13 and partially around an intermediate roll (not shown). Also not shown but well known to those skilled in the art is the turret portion of the re-winder which receives the web W following its passage around the intermediate roll.

The bedroll 10 is seen to be equipped with a plurality of longitudinally or axially-extending recesses 15, one of which can be seen in enlarged scale in FIG. 3. Each recess carries a flexible blade 16 in the manner shown in greater detail in the above-mentioned Kwitek Patent No. 2,870,840. In one aspect of the invention, the bed-

roll 10 and the mounting of the flexible blades 16 may follow the teaching of the above-mentioned Kwitek patent. In the patent, the recess is equipped with a rigid bearing surface at 17 supporting the lower or inner edge portion of the flexible blade 16. The blade 16 is clamped against the rigid bearing surface 17 by means of a clamp member 18, and interposed between the clamp member 18 and the blade 17 is a resilient strip 19. The recess 15 is equipped with an additional recess 20 which permits the outer or upper edge portion of the blade 16 to flex inwardly during cutting and when the same engages an anvil blade 21.

The anvil blade 21 is mounted in a fashion analogous to the roll blade 16. For this purpose, an anvil blade-supporting member 22 is provided and which is equipped with a rigid bearing surface as at 23. The inner end portion of the blade 21 is supported on the surface 23 and maintained thereon by a clamping element 24.

For the purpose of receiving the blade 21 and the clamping element 24, the member 22 is slotted as at 25 and threadedly bored to receive a setscrew 26. Thus, the blade 21 is securely fixed in place. The member 22 is in turn secured to a crossbeam 27 by means of studs 28 (see also FIG. 2). In practice, two studs 28, each equipped with suitable nuts 29, are employed for each blade-supporting member 22. The members 22 are firmly clamped to the beam 27 by means of the co-action of the stud 28, the bolt 29, and a spring-like washer 30. The block-like member 22 is equipped with a through bore 31 for the receipt of the stud 28, and it will be seen that the bore 31 is larger than the stud 28 to permit vertical adjustment of the member 22 under the influence of adjusting screws 32 and 33. Each member 22 is adjusted by three screws, the screws 32 bearing against the upper surface of the member 22, while the intermediate screw 33 is threadedly received within the member 22.

As in the case of the flexing blade 16 provided on the bedroll 10, the flexing blade 21 supported in the member 22 has associated therewith a supplemental recess 34. This permits limited flexing of the outer edge portions of the flexing blade 21 when it engages the roll blade 16. As wear occurs on the blades, the interference or overlap between the blades 16 and 21 must be adjusted, and this is achieved through repositioning of the screws 32 and 33. As the flexing blades wear, the corner cutting edges become slightly beveled so that increased interference is required. A normal interference may be of the order of about 0.008" for webs such as retail toilet tissue and toweling.

Reference to FIG. 2 reveals that a plurality of blade-supporting elements 22 are provided across the width of the machine. Advantageously, the elements 22 are arranged in a spiral fashion relative to the roll blades 16 so as to develop a progressive point contact between the blades 16 and 21. Thus, each anvil blade 21 is offset relative to adjacent anvil blades, and the composite series of chords defined by the anvil blades define a "saw" or loose spiral. Each individual anvil blade 21 is arranged at an angle to the axis of the bedroll 10 of the order of 2½ to 5° so that the above-mentioned progressive point contact between the blades is achieved. It will be appreciated that under some circumstances such as wider machines, the anvil blades 21 may be arranged in the form of several spirals so that at any given instant there are several points of contact between individual roll and anvil blades across the width of the machine.

For ease of installing replacement blades, the rigid bearing surface 17 may terminate in a shoulder 35 which facilitates the replacement of the blades 16. Also, the recess 15 may be equipped with a back-up block as at 36 suitably mounted on the bedroll 10 by means of a bolt

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37 so as to support the outermost portion of the blade 16 against excessive flexure.

Still further, it may be advantageous in some instances to provide for selective movement of the members 22 in emergency, i.e., abnormal conditions. For example, at times the fast-traveling web may develop wads or may tear and begin to wrap the bedroll 10. In such case, the rotating bedroll 10 is stopped and the waste tissue removed. This is facilitated by moving the members 22 away from the bedroll 10, and this may take the form of the hinging or pivoting described in the above-mentioned Kwitek and Besserlich patents. Such member movement can also be advantageous during start-up as when threading the machine.

Optimally, the flexible blades 16 and 21 have a thickness of the order of 0.025" to about 0.50", with the supplemental recesses 20 and 28 being of the same order of magnitude, i.e., from about 0.010" to 0.05" measured in a direction perpendicular to the confronting face of the unflexed associated blade. Normally, the blades 16 and 21 have an unsupported width of about $\frac{7}{16}$ " which advantageously may be half of the overall width. The length of each blade is conveniently set at $4\frac{1}{2}$ ", corresponding to the width of an ultimately developed retail-sized roll. Over such width, the roll blade 16 may be notched to provide bonds between perforation slits in the fashion shown in the above-mentioned Kwitek patent.

In FIG. 1, a first construction line 36 has been drawn from the center of the bedroll 15 to the inner edge of the roll blade 16, i.e., the edge abutting the shoulder 35. This is seen to be forward, relative to the direction of rotation of a radial line 37 drawn from the center of the bedroll to the cutting edge of the bedroll blade 16. In this connection, it will be appreciated that both edges may be notched so as to permit repositioning of the blade 16 in four different positions and thereby effectively extend the working life. In like fashion, the anvil flexing blade 21 may be repositioned because of the four cutting edges provided thereon.

Relative to the anvil flexing blade 21, it will be seen that its inner edge, i.e., the edge abutting the shoulder 38, is also forward of the outer cutting edge. Alternatively, this can be reversed in the fashion seen in FIG. 4 where a radial line drawn to the inner edge of the blade 21 lies rearwardly of the radial line drawn from the center of the bedroll 10 to the outer or cutting edge of the flexing blade 21. In either event, it will be seen the anvil blade 21 forms an obtuse angle with a radial line drawn to the cutting edge thereof. In contrast, the flexible blade 16 forms an acute angle with the radial line 37 drawn to its cutting edge. This acute angle advantageously is of the order of about 25° to about 65°, while the obtuse angle formed by the radial line and the anvil blade 21 is of the order of about 115° to about 155°.

In operation, the bedroll 10 may be equipped with a plurality of recesses 15 and therefore a plurality of rows of flexing blades 16. Each row is arranged parallel to the axis of the bedroll 10 and the circumferential spacing of the rows develops the distance between transverse perforations in the web 12. The web 12 may be advanced at a lineal speed of the order of 1000-2000 feet per minute, and during such operation the blades 16 and 21 yield slightly inwardly to compensate for the interference or overlap, which may be of the order of 0.008" to about 0.012". It will be appreciated that at least initially greater interference occurs at the center of the aligned blades 16 and 21, since the blades 21 are arranged on the chord of a spiral, as contrasted to a true spiral. Thus, there may be greater interference in the centers of the blades than at the edges. During operation, the inward flexing of the roll blades 16 results in a slight release of the tension on the web W, whereby the tendency of the web W to shred or burst is minimized. The slight inward, i.e., upward, yielding of the anvil blade 21 during the same en-

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gagement partially relieves the deforming stress on the roll blade 16, whereby the useful life may be prolonged.

In FIG. 3, it is seen that the anvil blade 21 is essentially forwardly and upwardly inclined (relative to the direction of web travel). This provides an advantageous arrangement in that the bedroll 10 can be "backed up." In certain emergency conditions—as where an operator is caught in the machine—it can be remedied quickly by backing the machine up slightly and arrangement of the anvil blade 21 as depicted in FIG. 3 permits this without overstressing the blades 16 and 21.

The showing in FIG. 4 differs essentially from that of FIG. 3 in the arrangement of the anvil blade 121. In FIG. 4, the anvil blade 121 is seen to be rearwardly and upwardly inclined relative to the direction of travel of the bedroll 110. However, the same cooperative action exists between the anvil blade 121 and the bedroll blades 116. The arrangement in FIG. 4 may be used in some cases where there is a tendency of the web to catch or "hang up" on the anvil blade 21 of FIG. 3. Normally, however, this does not occur with carefully prepared paper. In FIG. 4, the roll blade is seen to be secured in place by the clamp 118, and the anvil blade 121 is suitably clamped along its inner edge portion by means of a clamping member 124 mounted within the slot 125 of the anvil blade-carrying member 122.

While in the foregoing specification a detailed description of an embodiment of the invention has been set down for the purpose of explanation and illustration, many variations in the details herein given may be made by those skilled in the art without departing from the spirit and scope of the claims.

I claim:

1. In web perforating apparatus, a frame, a cutting bedroll mounted for rotation in said frame, means for rotating said roll, means for feeding a web on said roll in partial wrapping engagement therewith, said roll having an axially-extending recess in the surface thereof and a rigid bearing surface within said recess, a resilient blade having its inner edge portion rigidly supported on said bearing surface and having an inclined, outwardly-extending free portion provided with a cutting edge, said roll being provided with a further recess about said outwardly-extending free blade portion for relieving the same for flexing, the inclination of said blade being such that it forms with a radial line drawn from its cutting edge to the roll center an acute angle, a radial line drawn to said inner edge being forward of the first-mentioned radial line relative to the direction of roll rotation, an anvil blade-supporting member mounted on said frame adjacent said roll adapted to support an anvil blade for contact with said roll blade, said member being equipped with a rigid bearing surface, a resilient anvil blade having its inner edge portion supported on said member bearing surface and having an inclined, outwardly-extending free portion provided with a cutting edge, said member being provided with a recess about said anvil block outwardly-extending free portions for relieving the same for flexing, the inclination of said anvil blade being such that it forms with a radial line drawn from its cutting edge to the roll center an obtuse angle, said anvil blade inner edge portion being rigidly supported on said member bearing surface when said blades are perforating webs sized within the limits of proper adjustment of said blades, said anvil blade cutting edge being radially inward of the path of travel of the roll blade cutting edge to interfere with the same, said anvil blade being arranged with its cutting edge at an angle to the cutting edge of said roll blade as the cutting edges of said blades are brought into engagement during the rotation of said roll whereby a progressive point cutting is developed, one of said blades being equipped with a plurality of notches in its cutting edge to provide perforation bonds in said web, said member being fixed against rotation when said blades are perforating webs sized within the limits of proper adjustment of said blades.

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2. The structure of claim 1 in which said roll is equipped with a plurality of identical recesses equally circumferentially spaced, each recess being equipped with a further recess and a resilient blade.

3. The structure of claim 1 in which the thickness of each blade is of the order of about 0.025" to about 0.050" and each flexing recess has a depth measured in a direction perpendicular to its associated blade of the order of about 0.010" to about 0.050".

4. The structure of claim 1 in which means are operatively associated with said frame for moving said anvil blade out of interference with said roll blade when webs

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outside said limits of proper adjustment are presented to said blades.

5. The structure of claim 1 in which said acute angle is in the range of about 25° to about 65° and said obtuse angle is in the range of about 115° to about 155°.

No references cited.

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10 WILLIAM W. DYER, JR., *Examiner*.

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