April 26, 1966 E. D. NYSTRAND 3,247,746

CUT-OFF DEVICE

Filed July 2, 1964 2 Sheets-Sheet 1

FIG. 1.

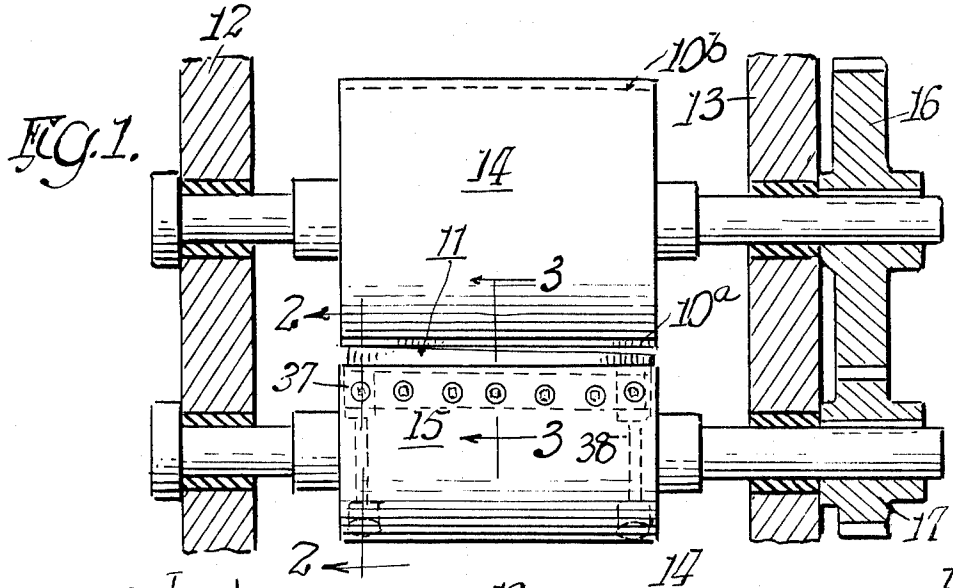


FIG. 2.

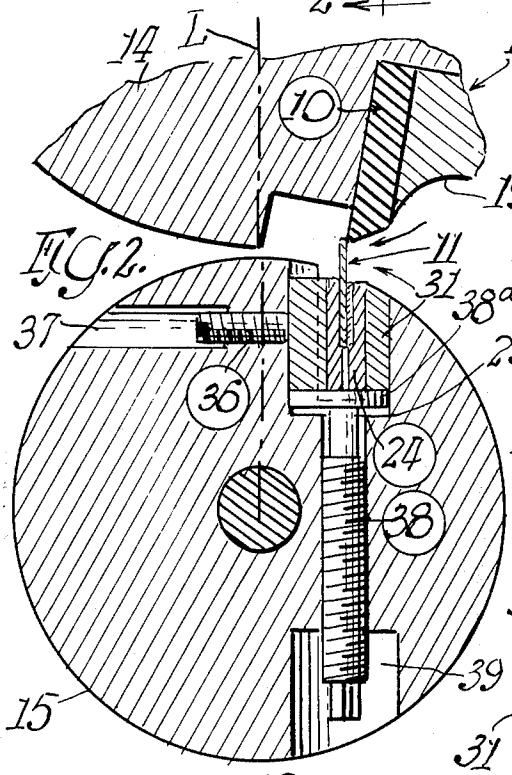


FIG. 3.

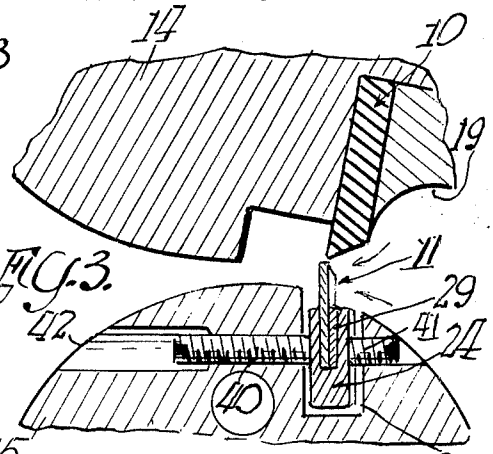


FIG. 4.

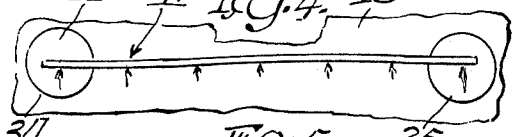
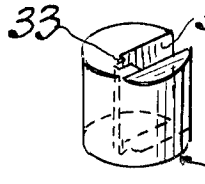


FIG. 5.

FIG. 6.



Inventor
Ernst Daniel Nystrand
by Dawson, Tilton, Fallon,
Lungmus & Alexander Attys

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CUT-OFF DEVICE

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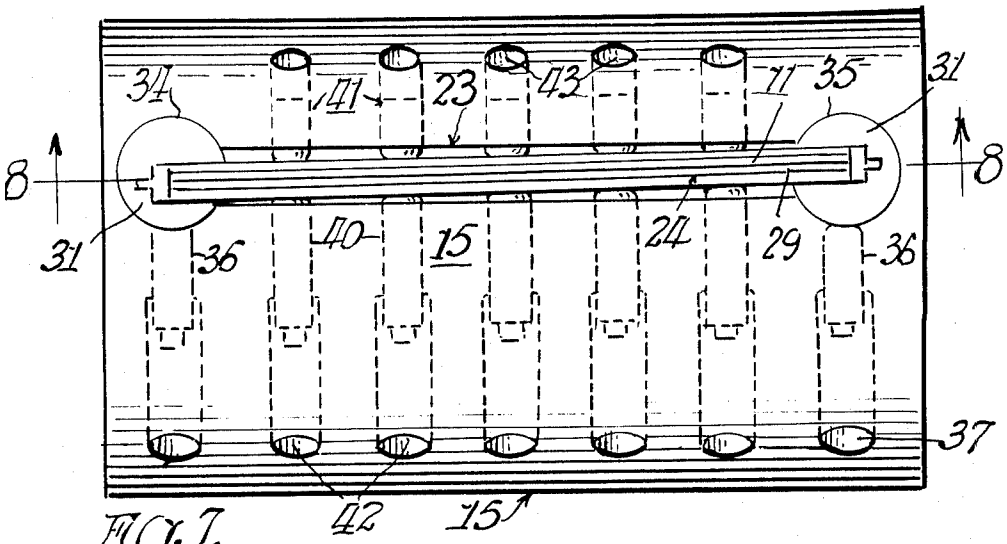

FIG. 7.

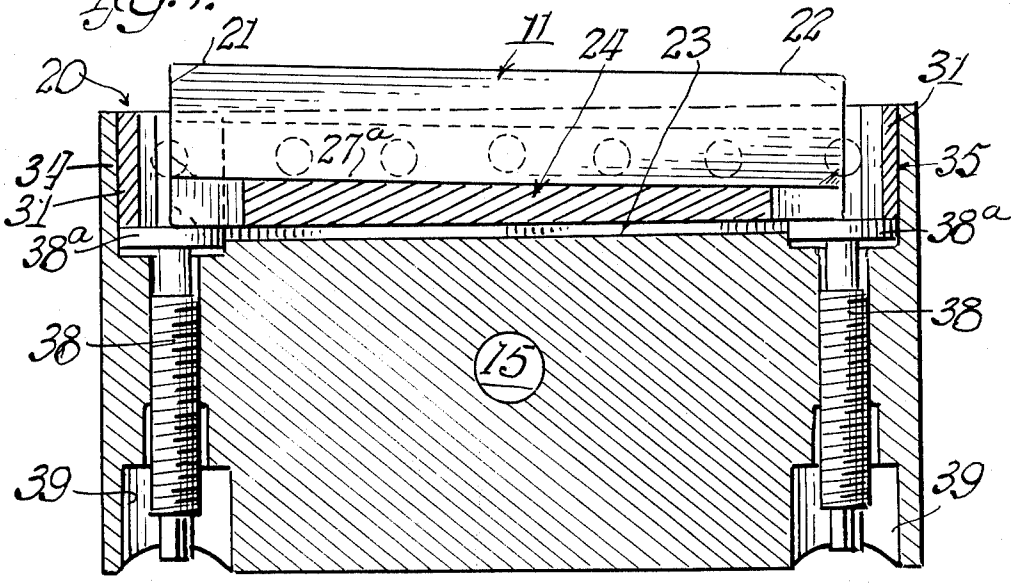

FIG. 8.

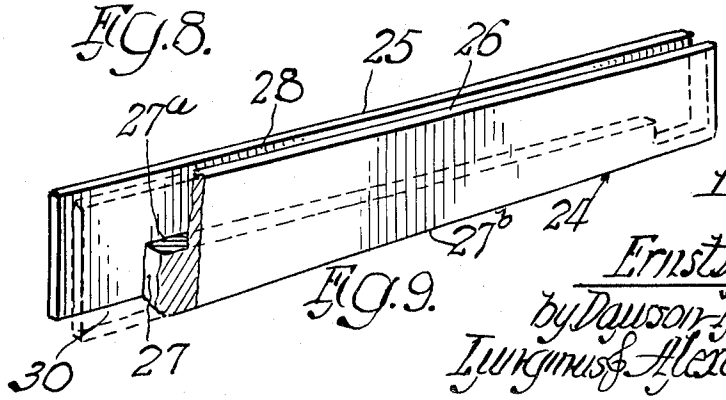

FIG. 9.

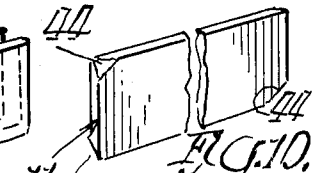

FIG. 10.

Inventor
Ernst Daniel Nystrand
by Dawson, Tilton, Fallon,
Lungmus & Alexander Attys

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CUT-OFF DEVICE

Ernst Daniel Nystrand, Green Bay, Wis., assignor to Paper Converting Machine Company, Inc., Green Bay, Wis., a corporation of Wisconsin

Filed July 2, 1964, Ser. No. 379,947
6 Claims. (Cl. 83—342)

This invention relates to a cut-off device and, more particularly, to a rotary shear for cutting fast-traveling webs, such as paper.

This invention constitutes an improvement upon Peter J. Christman Patent 2,478,240, issued August 9, 1949. More particularly, the invention concerns the method for mounting the flyknife of the above-mentioned patent.

The construction of the above-mentioned Christman patent has been widely used for over fifteen years in napkin-folding equipment. The folded webs (generally paper) used for developing the napkins are transversely severed by the coacting of two rolls. One is usually a larger roll and is partially wrapped with the web, having in its surface a longitudinally-extending knife usually referred to as the anvil knife. The other roll carries an angled blade known as the flyknife to develop a shearing action in severing the web.

Heretofore, the flyknife has not been disposed along a true helix, so that an undesirable interference occurred between the fly and anvil knives. Among the unfavorable results stemming from this interference was a limitation in speed. Heretofore, the Christman-type cut-off was limited in speed to below about 400–500 feet per minute, while with the instant invention the same machine can develop continual operating speeds of in excess of about 900 feet per minute. Therefore, an important object of the invention is to provide a machine, more particularly a fly blade mounting, which achieves this advantageous speed.

Another object of the invention is to provide a holder mounting arrangement in a shear cut-off device which permits the flyknife to be arranged in a configuration much more closely approximating a true helix than that possible heretofore, thereby providing advantageous longevity in the coacting knives.

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 described in conjunction with an illustrative embodiment in the accompanying drawing, in which—

FIG. 1 is an elevational view, partially in section and in fragmentary form, of apparatus for cutting fast-traveling webs and which incorporates the teachings of the invention;

FIG. 2 is an enlarged fragmentary sectional view as would be seen along the sight line **2**—**2** of FIG. 1;

FIG. 3 is an enlarged fragmentary sectional view taken along the line **3**—**3** of FIG. 1;

FIG. 4 is a fragmentary plan view of the flyknife mounting before the same has been adjusted in accordance with the teachings of the invention and which serves to illustrate in exaggerated fashion the problem of the prior art;

FIG. 5 is a view similar to FIG. 4, but in which the flyknife is adjusted so as to closely approximate a true helix;

FIG. 6 is a perspective view of one of the end plugs employed in conjunction with disposing the flyknife in helical configuration;

FIG. 7 is a plan view of the flyknife roll showing the flyknife disposed as previously seen in FIG. 5;

FIG. 8 is a sectional view taken along the line **8**—**8** of FIG. 7;

FIG. 9 is a perspective view, partially broken away and partially shown in dotted line, of the blade holder utilized in conjunction with the mounting of the flyknife; and

FIG. 10 is a fragmentary perspective view of the flyknife or blade, showing the beveled corners which permit reversibility of the flyknife so as to utilize four cutting edges and thereby provide a longer effective working life.

At the outset, it will be appreciated that the terms "knife" and "blade" are used interchangeably. The important distinction made in the instant invention is between the anvil knife generally designated **10** in FIG. 3, and the more flexible flyknife generally designated **11** in that view.

Referring now to FIG. 1, the numerals **12** and **13** designate side frames of a machine for performing a web-shearing operation. For this purpose, the side frames **12** rotatably carry an anvil roll **14** and a flyknife roll **15**. In accordance with the teaching of the previously-mentioned Christman patent, the anvil roll **14** is driven by a gear **16** mating with a spur gear **17** provided as part of the flyknife roll **15**. The gears **16** and **17** are driven from a suitable power source (not shown). The roll **14** is seen to be a "two-time" roll providing anvil blades at **10***a* and **10***b*.

In the illustration given, only one set of knives is shown. However, depending upon the width of the web, multiple sets of knives in the rolls may be provided—double, triple and quadruple width, as well as the single width shown. Further, it will be appreciated that the roll bearings shown in FIG. 1 are only for illustrative purposes, since in actual practice precision roller bearings are employed. The gears **16** and **17** are ordinarily constructed to provide a gear ratio of 2:1 or 1:1, with one of the gears being a timing gear to provide the desired angular relationship. In any event, the roll carrying the flyknife, i.e., the roll **15**, is made larger so that the surface speed of the flyknife **11** is higher than the surface speed of the anvils **10***a* and **10***b*.

The operation of the blades **10** and **11** in a web-cutting operation can be appreciated from a consideration of FIGS. 2 and 3. The blade **11** is traveling faster than the blade **10**, and the high point (i.e., the extreme left-hand point in FIG. 1) of the blade **11** has just engaged the blade **10**. At this instant, the remainder of the blade **11** is disposed rearwardly (relative to the path of travel) of the blade **10**. However, further rotation brings each successive point on the blade **11** into contact with a corresponding point on the blade **10** so as to develop a progressive or shearing action. In general, this was the operation of the Christman device. However, the progressive point contact was imperfect in Christman because of the failure of the fly blade **11** to closely approximate a true helix. In the instant invention, the cutting occurs during the 5° movement of the anvil blade **10**, starting 13° before bottom dead center and finishing the cut 8° prior to bottom dead center. Holding the web in position against the surface of the anvil roll **14** is a vacuum advantageously developed through a port generally designated **18** and which is characterized by a surface relief as at **19** (see FIGS. 2 and 3).

For developing the shearing acton generally characteristic of the above-mentioned Christman patent, the flyknife **11** is canted relative to the surface **20** of the flyknife roll **15** (see FIG. 8). In FIG. 8, it will be noted that the left-hand portion **21** of the flyknife **11** is higher than the right-hand portion **22**, whereby the left-hand portion constitutes the leading or first-engaging end of the flyknife **11** in a web-shearing operation.

For the purpose of establishing the longitudinal cant seen in FIG. 8, the roll **15** is equipped with a longitudi-

nally-extending slot 23 (see particularly FIGS. 2 and 3). The slot 23 is offset from the line L connecting the centers of the rolls 14 and 15 (see FIG. 2). The offset of the slot 23 is also apparent from a consideration of FIG. 7. Mounted in the slot 23 is a holder generally designated 24 and which is seen in perspective view in FIG. 9. The holder 24 is essentially U-shaped or channel-shaped in transverse section, being made up of upstanding walls 25 and 26 and a foreshortened base portion as at 27. The upper surface 27*a* of the base portion 27 is inclined relative to the bottom surface 27*b* of the holder, and thus the roll 15, to establish the longitudinal cant hereinbefore referred to, this being especially apparent from a consideration of FIG. 9.

Advantageously, the knife holder in a typical embodiment of the invention is ⅜" in thickness by 1¼" high, with a length corresponding to the length of the blade 11, constructed of cold drawn steel in a normalized state. The spacing of the upstanding portions 25 and 26 (to thereby develop the slot 28) is 0.125" milled in the center of the holder. Mounted within the slot 28 is the flyknife 11 and a shim 29 (designated only in FIGS. 3 and 7), each of which are, in the illustration given, 0.062" thick. This allows the cutting edge of the flyknife 11 to be in the center of the holder 24.

The slot 28 in the illustration given is 21/32" deep, and the top surface 27*a* is parallel to the upper surfaces of the upstanding portions 25 and 26, these parallel surfaces being arranged at an angle to the bottom surface 27*b* of the holder 24. At each end, the holder is saw-cut 1/16" wide as at 30 to aid in clamping the holder 24, knife 11, and shim 29 together. The taper between the top and bottom surfaces of the holder 24 is determined by the difference between the leading and trailing knife radii. This allows the inner holder edge to be in a plane parallel to the roll axis and the flyknife to be cantilevered equally across its length.

Now referring to FIG. 6, the numeral 31 illustrates a plug which is equipped with an offset, laterally-extending slot 32 which is equipped with a further or supplemental recess as at 33. One plug 31 is mounted in the cylindrical opening or enlargement 34 (see FIG. 7) at the left-hand end of the slot 23. An identical plug is positioned upside down in the right-hand cylindrical enlargement 35 which constitutes the low side of the blade 11.

The plugs 31 are immobilized in place within the cylindrical enlargements 34 and 35 and urged into clamping relation with the holder 24 by means of screws 36 which are threadedly received within the roll 15 (see FIG. 2). For this purpose, the roll 15 is drilled and threaded as at 37. Further, the plugs 31 are positioned relative to the surface of the roll 15 by axially-extending screws 38 (see FIG. 8) which are threadedly mounted in the roll 15 in passages as at 39. A washer 38*a* is positioned between each plug 31 and screw 38.

The intermediate portions of the holder 24, and therefore the blade 11, are suitably bowed to approach a true helix by means of intermediate opposed screws as at 40 and 41 (see FIG. 7). For this purpose, the roll 15 is provided with openings as at 42 and 43 respectively for the five pairs of screws made up of the units 40 and 41.

The blade 11 is seen to be clamped over about the lower half of its width. The blade has a certain degree of flexibility, being 0.062" thick by 1.312" wide, the length being such as to correspond to the width of the web being severed. Excellent results are obtained when the knife is constructed of knife stock material having a Rockwell hardness of 60–62. Further the corners are chamfered as at 44 (see FIG. 10) to allow the knife to enter under the anvil. With the four corners being beveled as shown in FIG. 10, the blade 11 is reversible so as to extend the life thereof by providing four cutting surfaces.

Bowing of the flyknife 11 over its entire length in the past has been rather difficult. However, with the inventive arrangements, the cylindrical pegs or plugs 31 at each end of the slot 23 are permitted to swivel and align themselves (compare FIGS. 4 and 5) with the bowed blade holder 24 before the clamping screws 36, 40 and 41 are tightened. The two plugs 31 mounted in the cylindrical enlargements 34 and 35 can be made exactly alike, with one plug turned end-for-end. In the illustration given, the plugs 31 are 1¼" in diameter and 1¼" long. The slot 32 is 0.375" wide the full length of the plug, and the slot depth is ¼" beyond the center line. The additional recess 33 is a 1/16" saw-cut ¼" deep. The larger slot 32 is offset as to the center line of the plug one-half the distance required to achieve the proper helix angle.

With the illustrated construction, the problems the prior art faced in clamping have been avoided. In this connection and relative to FIG. 4, it should be appreciated that the prior art clamped the flyknife 11 close to each end, without permitting the swivel action shown in FIG. 5. In particular, the cylindrical enlargements at each end of the slot 23 were not found in the prior art.

While in the foregoing specification a detailed description of an embodiment of the invention has been set down for the purpose of explanation, 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 invention.

I claim:

1. A web cut-off device, comprising a first rotatably mounted roll having a knife adjacent its periphery provided with a cutting edge which extends straight and axially of the roll, a knife-equipped second roll rotatably with said first roll and positioned to coact therewith in producing a shearing action during rotation of said rolls, said second roll being equipped with a longitudinally-extending slot in the outer surface thereof for mounting said second roll knife, said slot being equipped with cylindrical enlargements at each end of said longitudinally-extending slot, a slot-equipped plug in each slot enlargement, an elongated knife holder in said elongated slots with the holder ends being mounted in said plug slots, and means in said roll for confining said holder and plugs to position said second roll knife (1) in a plane which is at an acute angle to the axes of said rolls, (2) with the cutting edge of said second roll knife inclined relative to the surface of said second roll, and (3) to dispose said cutting edge substantially in the form of a helix.

2. The structure of claim 1 in which each of said plugs is equipped with a supplemental slot parallel to and constituting an extension of the first-mentioned plug slot, said additional slot being narrower than said first-mentioned slot.

3. The structure of claim 1 in which said means includes a plurality of screws threadedly mounted in said second roll, said screws being operative to immobilize said plugs and to contour said holder and blade in the form of a helix.

4. The structure of claim 1 in which said second roll blade is equipped with four chamfered corners whereby said blade is reversible to provide four cutting edges.

5. The structure of claim 1 in which said holder is generally U-shaped in transverse section, the U shape being defined by upstanding arm portions and a transversely-extending bottom portion, the upper surface of said bottom portion being inclined relative to the bottom surface of said bottom portion, with the ends of said bottom portion being equipped with slots to permit clamping of said holder within said plugs.

6. A web cut-off device, comprising a first rotatably mounted roll having a knife adjacent its periphery provided with a cuting edge which extends straight and axially of the roll, a knife-equipped second roll rotatable with said first roll and positioned to coact therewith in providing a shearing action during rotation of said rolls, said second roll being equipped with a longitudinally-extending slot in the outer surface thereof for mounting said second roll knife, said slot, at each end, being

equipped with cylindrical enlargements, a slotted cylindrical plug mounted in each enlargement, a U-shaped knife holder mounted in said second roll slot and being supported at the ends thereof in said slotted plugs, an elongated flyknife mounted within said holder and projecting thereabove, a shim also mounted in said holder to position the cuting edge of said flyknife centrally longitudinally of said holder, said cutting edge being canted relative to the surface of said second roll and having a first end higher relative to said surface than the other end thereof for coaction with said first roll knife as both knives approach the line connecting the roll centers, a plurality of elongated screws threadedly mounted in said second roll and arranged with the length thereof normal to the length of said second roll slot, the end screws bearing against said plugs to immobilize the same and confine said flyknife, said holder being relieved in the base of the U

shape thereof to permit clamping of said flyknife by said holder, each of said plugs having a further recess communicating with the slot thereof to permit the stud associated therewith to clamp said holder, and a pair of screws and washers, one pair for each cylindrical enlargement, for adjustably positioning the associated plug along the axis of its associated enlargement, the slot of each plug being offset relative to a radial line parallel to the depth of the slot.

References Cited by the Examiner

UNITED STATES PATENTS

505,189	9/1893	Climer	83—699 X
1,666,533	4/1928	Heck et al.	83—612 X
3,166,965	1/1965	Stemmler	83—699 X

ANDREW R. JUHASZ, *Primary Examiner.*