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|---|-----------|---------|------------------|----------|
| [54] APPARATUS FOR SEVERING MOVING WEBS | 1,953,196 | 4/1934 | Smith et al..... | 83/600 X |
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| [75] Inventor: Gerhard Voswinckel, Aachen, Germany | 3,279,292 | 10/1966 | Beard..... | 83/623 X |
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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 260,206, June 6, 1972, abandoned.

Foreign Application Priority Data

June 14, 1971 Germany..... 2129409

[52] **U.S. Cl.** **83/171; 83/397; 83/552; 83/566; 83/600; 83/623**

[51] **Int. Cl.²** **B23D 15/02**

[58] **Field of Search**..... 242/56 R; 83/600, 171, 83/175, 176, 623, 552, 566-569, 397

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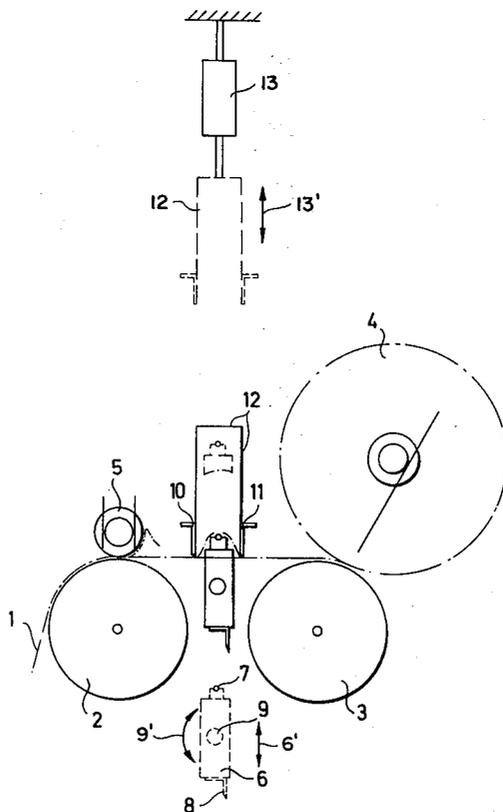
621,097 3/1899 Keim..... 83/552

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[57] **ABSTRACT**

The present severing apparatus severs moving webs of goods such as textile webs or the like by means of a cutting member, for example, a knife edge or a heated wire arranged adjacent to one surface of the moving web. The cutting member cooperates with two opposing rails which support the web during the cutting operation. The rails are arranged adjacent to the opposite surface of the web and upstream as well as downstream of the cutting member as viewed in the direction of web motion. The cutting member is moved to sever the web only after the opposing members have moved to a position adjacent the web.

11 Claims, 9 Drawing Figures



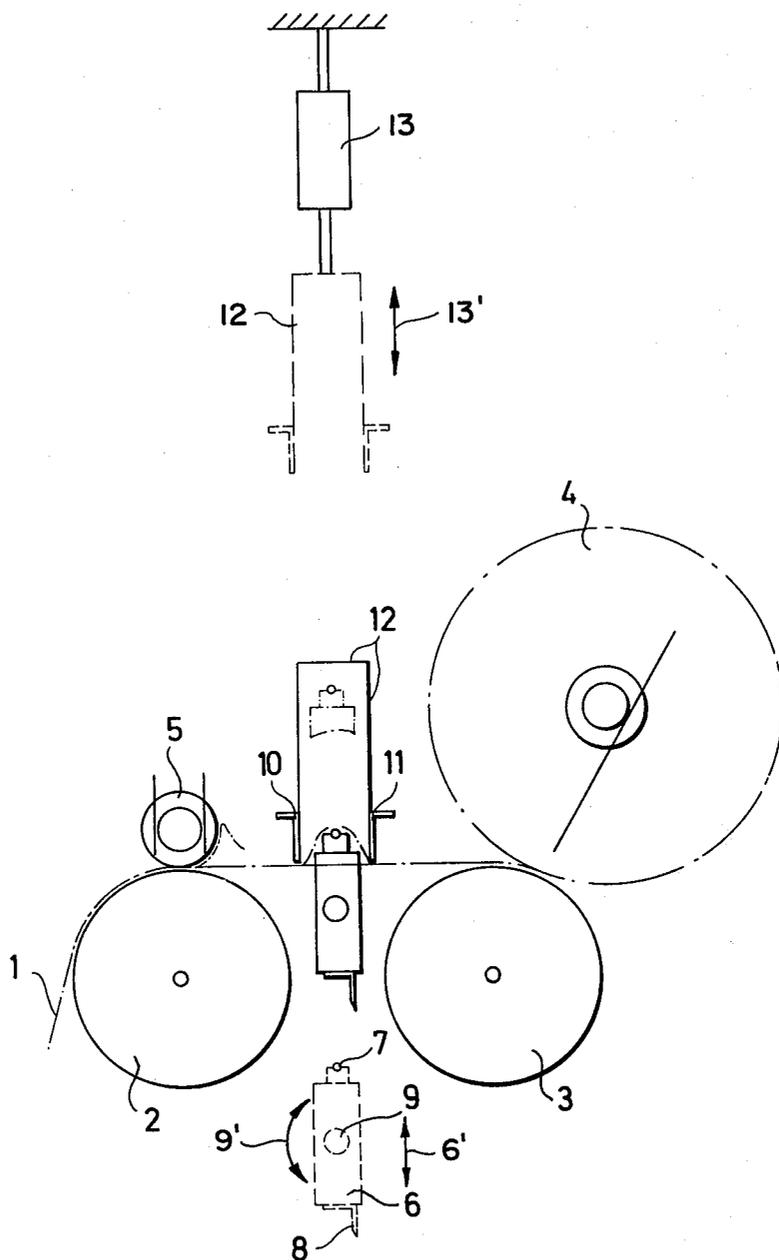


FIG. 1

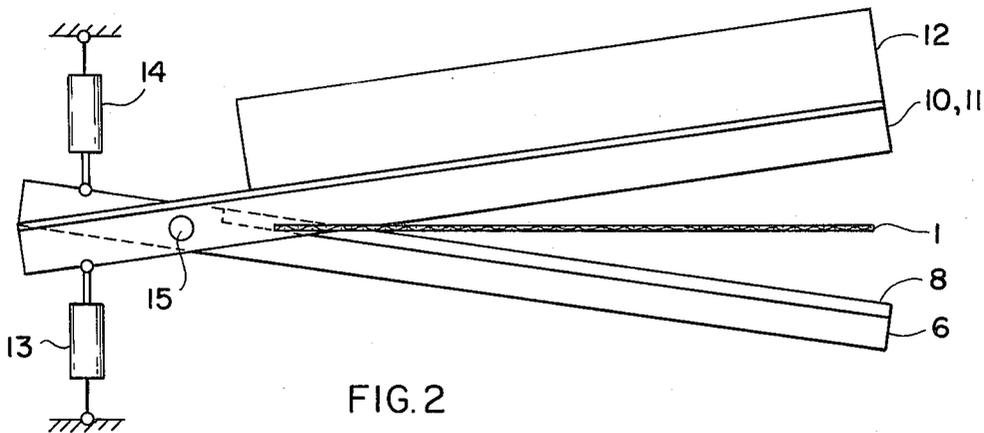


FIG. 2

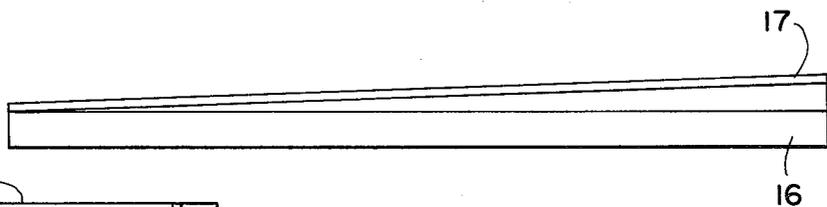


FIG. 3

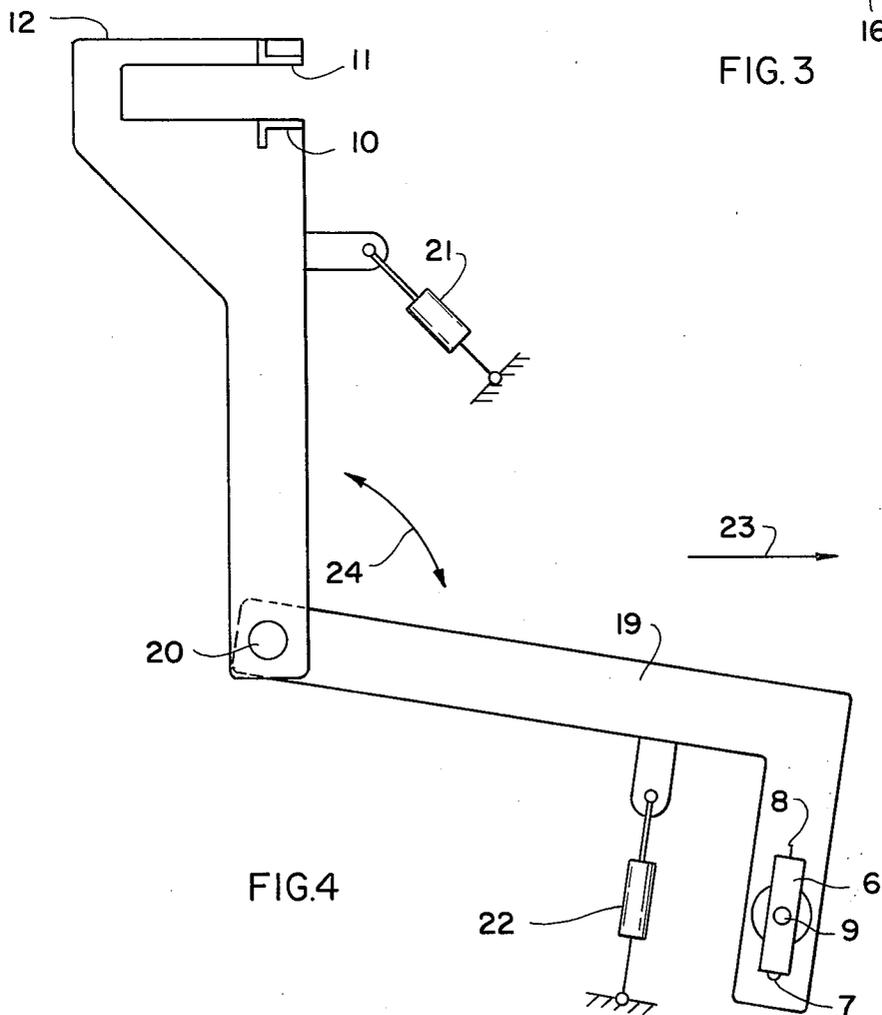


FIG. 4

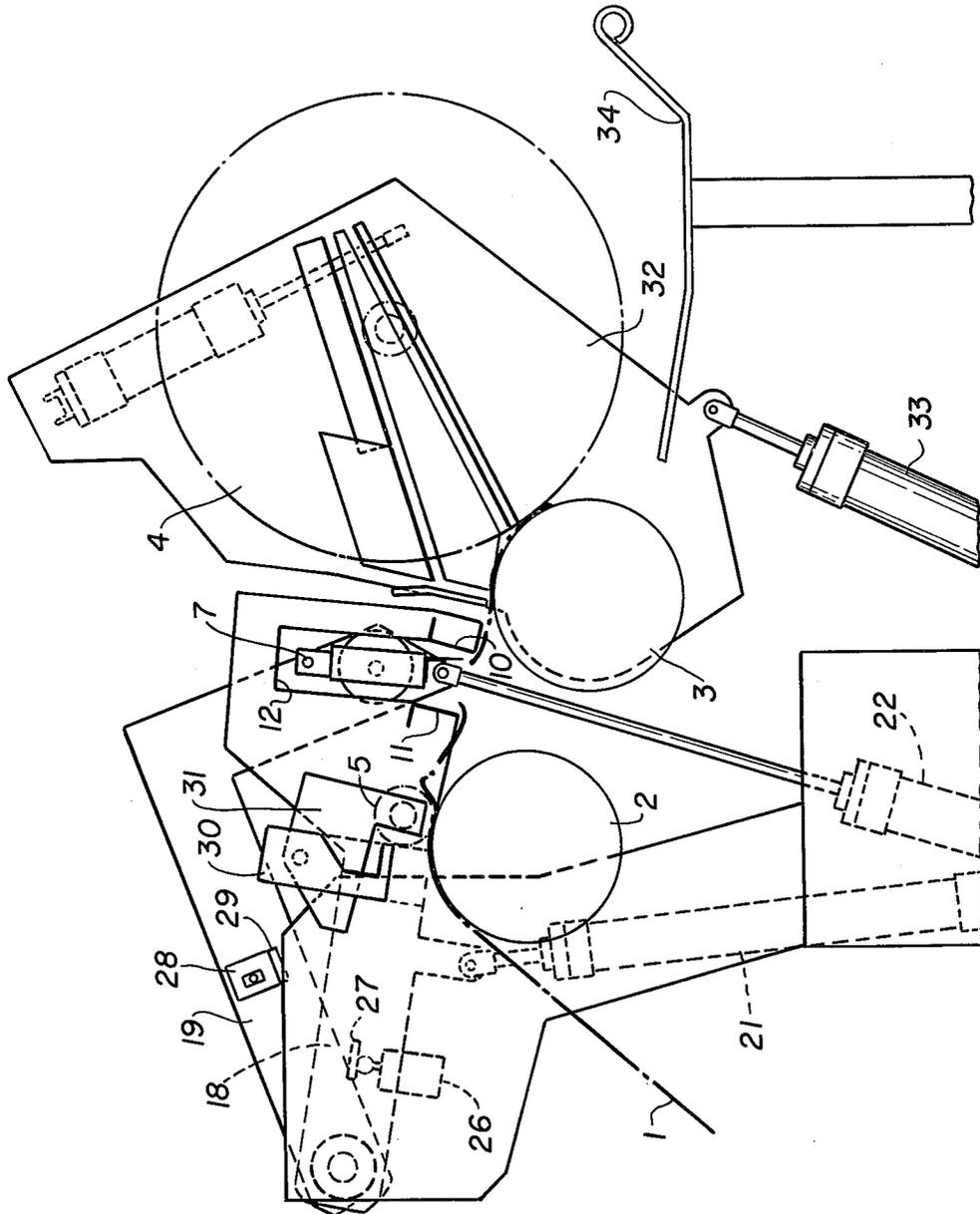


FIG. 6

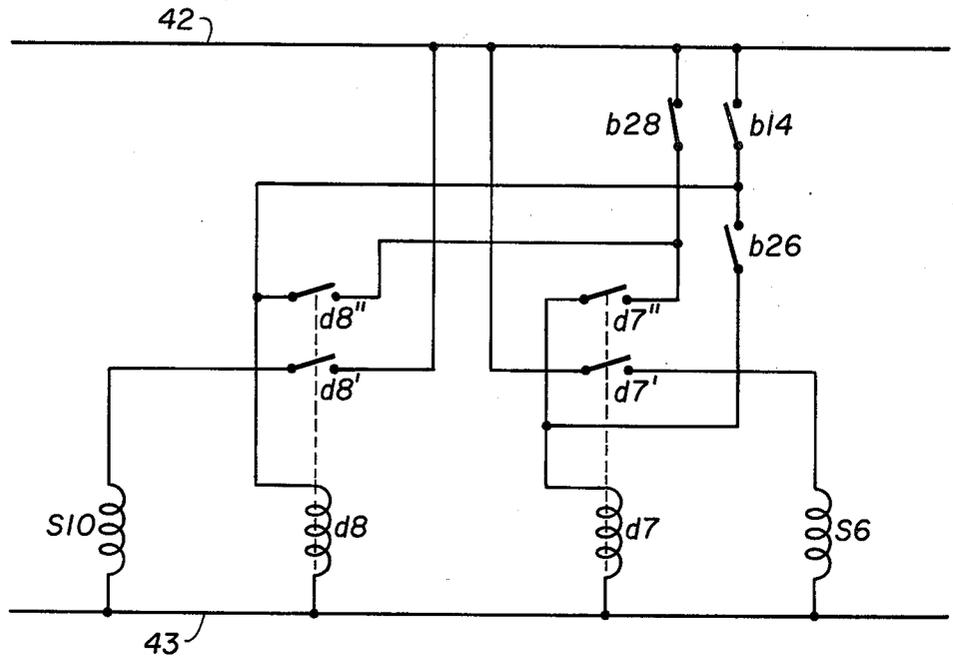


FIG. 7

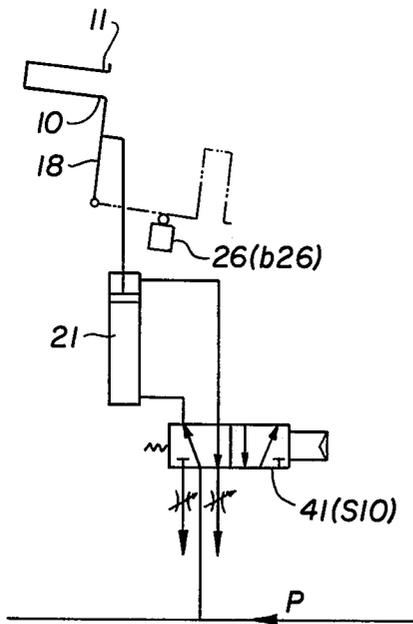


FIG. 8

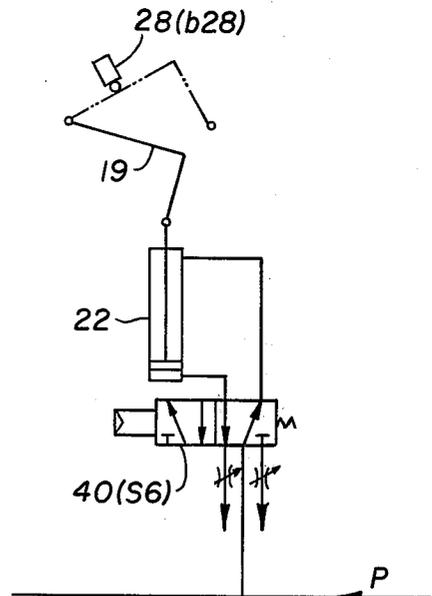


FIG. 9

APPARATUS FOR SEVERING MOVING WEBS

CROSS REFERENCE TO COPENDING APPLICATION

This is a continuation-in-part application of patent application Ser. No. 260,206 filed June 6, 1972, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus for severing moving webs of goods by means of a cutting bar which extends across the width of the web. The cutting bar is movable for example along a straight line or along a curved path.

Depending on the strength or rather the severability of the web material to be cut, it is necessary to keep the web under a tension force which is large enough to assure a proper cut so that the cutting bar may carry out the severing by an instantaneous crossing of the advancing web. The problem is to keep the web portion adjacent to the cut under a sufficiently large tensile force and it is undesirable to subject the entire web to such tensile force. However, if the web in the cutting area is not sufficiently stressed, there is the danger that the cutting bar will entrain the web until the bar reaches its end position without effecting the desired cut. Insufficient stress of the web in the cutting area may also cause the cutting to take up too much time so that a clean cut cannot be accomplished and the severed web portions are marred by such unclean cut.

Frequently, it is undesirable to keep the moving web continuously under a large tensile force merely to assure proper cutting. Such continuous tension not only adversely affects sensitive goods such as fine textiles, it also results in a wound-up roller which is too hard.

OBJECTS OF THE INVENTION

In view of the foregoing, it is the aim of the invention to achieve the following objects singly or in combination:

to avoid the drawbacks of the prior art as outlined above;

to provide an apparatus for severing moving webs of goods which will always assure a clean sharp cut without continuously subjecting the entire web to an undesired tensile force;

to subject only a relatively narrow cutting area to an instantaneous stretching force which coincides with the cutting whereby such stretching force is sufficient to assure a proper cut;

to provide an apparatus in which stretching means and a cutting bar are moved toward and away from each other in synchronism to assure that the stretching will coincide with the cutting operation; and

to provide means which will cover the cutting edge for safety purposes.

SUMMARY OF THE INVENTION

According to the invention there is provided an apparatus for severing a moving web substantially across its width by means of a cutting bar arranged on one surface side of the web and by means of two opposing tensioning members arranged on the opposite surface side of the web. One tensioning member is arranged downstream while the other tensioning member is arranged upstream of the cutting bar as viewed in the direction of web movement.

The arrangement of the cutting bar and of the two tensioning members relative to each other as taught by the invention, assures that the cutting bar which reaches across the web deflects the moving web into the space between the two opposing tensioning members, whereby the necessary increased tension or stress in the web is created between the portion of the web bearing against the opposing members, that is, along the two hypotenuses of the two rectangular triangles, one common side of which is formed in the direction of motion of the cutting bar and the other two sides of which are formed along the direction of web movement between the two edges of the opposing members. This effect of the invention has the surprising advantage that the created tensioning force is not transmitted completely to the entire web.

Preferably, the opposing tensioning members are movable back and forth along a straight or a curved path. In this embodiment the tensioning members move toward the cooperating position before the cutting bar crosses through the moving web so that at the cutting instant, the cooperation between the tensioning members and the cutting bar will coincide. This arrangement is especially useful where the cutting apparatus is arranged between two driving rollers of a mandrel on which the web of moving material is to be wound.

It is especially advantageous to arrange the cutting bar and the opposing tensioning or supporting members on a common journal shaft and to drive the respective elements in synchronism with each other. In this arrangement, the movement coordination is such that prior to the movement of the cutting bar toward the moving web, the opposing tensioning members are moved toward the web in a direction opposite to that of the cutting bar to a position adjacent the web. The movements are coordinated in such a manner that at the instant of contact between the cutting bar and the moving web, the opposing members have become effective for tensioning the web between the two opposing members and the cutting bar.

BRIEF FIGURE DESCRIPTION

In order that the invention may be clearly understood, it will now be described, by way of example, with reference to the accompanying drawings wherein:

FIG. 1 illustrates in a schematic manner a side view of the present apparatus;

FIG. 2 is a view in the direction of the moving web whereby the opposing tensioning members and the cutting bar are shown in a front view;

FIG. 3 is a view similar to that of FIG. 2 but showing a cutting bar with an inclined edge;

FIG. 4 shows a modified embodiment for supporting the tensioning members and the cutting bar;

FIG. 5 illustrates in a schematic manner a side view of a preferred embodiment of the invention, with the opposing tensioning members and the cutting bar in their most remote positions from the moving web;

FIG. 6 is a further side view of the arrangement of FIG. 5, and illustrating the opposing tensioning members and cutting bar in position following a severing operation;

FIG. 7 is a circuit diagram of a control circuit for the apparatus of claims 5 and 6;

FIG. 8 is a schematic illustration of the control arrangement for the opposing tensioning members of the arrangement of FIGS. 5 and 6; and

FIG. 9 is a schematic illustration of the control arrangement for the severing means of the arrangement of FIGS. 5 and 6.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

As shown in FIG. 1, the web 1 of goods is advanced by two driving rollers 2 and 3 toward a take-up roller 4 onto which the web is wound. The take-up roller 4 is driven by the drive roller 3. Further, the take-up roller 4 is supported with its journal studs in guide means (not shown) whereby the roller 4 may be moved from a position intermediate the two drive rollers 2 and 3 to the position illustrated in FIG. 1 which is the end position. Thus, when a take-up roller has reached a certain size, it is moved into the end position whereby a new take-up mandrel 5 may be placed into contact with the drive roller 2 while the web of goods is still being wound on the preceding take-up roller 4. With the roller 4 in its end position, and the mandrel 5 in its starting position as shown in FIG. 1, the space between the two driving rollers 2 and 3 is free to receive the cutting apparatus according to the invention.

Such cutting apparatus comprises a cutting bar 6 which is supported on carrier arms, not shown, in FIG. 1 in such a position that it may be moved up and down as shown by the arrow 6'. The cutting bar 6 is provided along one of its sides with a cutting edge 8 and along another side with a cutting wire 7 which may, for example, be heated in a manner known as such. Preferably, the cutting members 7 and 8 are arranged on opposite sides of the cutting bar 6. However, it is possible to also arrange further cutting elements along other sides of the cutting bar 6. In order to selectively use any one of the cutting elements, the cutting bar 6 is journaled on a shaft 9 for rotation about its longitudinal axis as shown by the double arrow 9'.

The cutting bar 6 is arranged, for example, below the moving web 1 and the opposing tensioning members 10 and 11 are arranged on the opposite surface side above the moving web 1. The elongated tensioning members or rails 10 and 11 also reach across the moving web and are attached to respective supporting arms, not shown, for movement up and down as shown by the double arrow 13' in response to actuation of a driving means, for example, a piston cylinder arrangement 13.

According to the invention, the tensioning members 10 and 11 form the web facing edges of a casing 12 into which the cutting bar 6 moves during its cutting stroke. This feature of the invention has the advantage that the rapidly moving cutting bar will not endanger any operating personnel because the cutting bar dips into the casing 12 even before the moving web has been severed. Only after the web portion between the two stretching edges 10 and 11 has been moved sufficiently into the casing 12 will the actual severing take place.

Incidentally, providing the cutting bar 6 with a plurality of cutting members or elements has the advantage that the proper cutting element may be selected in accordance with the requirements or characteristics of the web to be cut. Thus, for example, textiles would preferably be severed by a cutting edge whereas plastic sheets or webs may be severed by means of the heated wire 7.

The present apparatus operates as follows. At the beginning of the contact between the cutting member and the moving web, the latter is stretched in a triangular

or wedge shape into the space between the two opposing edges or rails 10 and 11 whereby the portion of the web between these two edges is changed from a straight line course into two hypotenuses of two triangles having a common side in the direction of movement of the cutting member and two other sides in the original straight line direction of web movement. This deflection of the moving web as just described results in the sufficiently high stretching of the web portion between the supporting rails 10 and 11 to assure a clean cut. Surprisingly, the tension cannot be transmitted to the entire length of web between the two rollers 2 and 3 due to the friction along the edges or rails 10 and 11. Merely an increased tension force of short duration is created in the length of web between the edges of the two supporting or opposing rails 10 and 11.

FIG. 2 illustrates the arrangement of the cutting bar 6 and the opposing rails 10 and 11 on a common journal axis 15 whereby the bar 6 is journaled to the axis or shaft 15 intermediate the edges 10 and 11. The opposing edges may be driven, for example, by a piston cylinder 13 and the knife bar 6 may be driven by a piston cylinder 14, the operation of the two piston cylinders 13 and 14 is coordinated to assure the above described cutting action of the web 1.

FIG. 3 illustrates a modified cutting bar 16 having a cutting edge 17 which is slanted relative to the longitudinal axis of the bar 16 as illustrated in FIG. 3. This feature according to the invention not only increases the active length of the cutting edge 17 of the knife bar 16, it also makes possible a drawing cut through the web material which may be comparable to a scissor cut and which is much more efficient than a simultaneous cut through the entire width of the web 1.

FIG. 4 illustrates a modified embodiment for supporting the cutting bar 6 and the tensioning members 10 and 11. The tensioning members 10 and 11 along with the casing 12 are attached to one end of first arm means 18. The cutting bar 6 is supported by second cutting arm means 19. The arm means 18 and 19 are journaled to a common journal shaft 20. The arm means 18 are driven by a piston cylinder arrangement 21 whereas the arm means 19 are driven by a piston cylinder arrangement 22. Movement of the arm means 18 and 19 is indicated by the double arrow 24 whereas the movement of the web is indicated by the arrow 23.

Referring now to FIG. 5, the tensioning members or support rails 10 and 11 and the casing 12 are attached to an arm 18 as in the arrangement of FIG. 4, the arm 18 being journaled for rotation about the journal shaft 20. The journal shaft 20 extends parallel to the axes of the rollers 2 and 3. The cutting bar 6 is supported on a further arm 19, the arm 19 being journaled to the journal shaft 20. The arm 18 is driven by a piston cylinder arrangement 21, and the arm means 19 is driven by a piston cylinder arrangement 22, as in the arrangement of FIG. 4. The journal shaft 20 is supported by a suitable support 25, to which the piston cylinder arrangements 21 and 22 are also coupled. The arrangement of FIG. 5 illustrates the positions of the support rails 10 and 11 and the cutting bar 6 most remote from the web.

A limit switch 26 mounted by suitable means on the support 25 is positioned to be actuated by the arm 18 upon movement of the support rails 10 and 11 to a position just adjacent the moving web, as illustrated in dashed lines in FIG. 5. For this purpose, a projection 27

engagable with the switch 26 may be provided on the arm 18. A further limit switch 28, which may also be mounted on the support 25 is positioned to engage the arm 19, as will be discussed with reference to FIG. 6.

Referring now to FIG. 6, the arm 18 is shown moved to a position just adjacent the web. In this position, it is seen that the projection 27 on arm 18 has engaged and operated the limit switch 26. The cutting bar has been moved by the piston cylinder arrangement 22, by rotation of the arm 19 about the journal shaft 20, to a position between the support rails 10 and 11 and into the casing 12 to sever the web. The arm 19 may be provided with a projection 29 for engaging the limit switch 28, as illustrated in FIG. 6.

Thus, FIG. 5 illustrates the positions of the arms prior to a cutting operation, and FIG. 6 illustrates the positions of the arms following the severing operation but prior to their return to the original position.

FIG. 5 further illustrates the mandrel 5 supported on a bracket 30 for movement with the arm 18. When the arm 18 is moved to its downward position, as illustrated in FIG. 6, the bracket 30 moves downwardly with the arm 18, and releases the mandrel 5 to be caught by a bracket 31, thereby positioning the mandrel 5 to its starting position for receiving the end of the severed web. The take-up roller 4 is illustrated in FIGS. 5 and 6 as supported on a bracket 32 controlled by a piston cylinder arrangement 33, the roller 4 being illustrated in the same position as in FIG. 1 above discussed. A receiving tray 34 is provided for receiving the roller 4 upon release from the bracket 32, whereupon the bracket 32 may be moved to receive the mandrel 5 at the proper time in the sequence of operation of the apparatus.

FIG. 7 illustrates a circuit for operating the apparatus of FIGS. 5 and 6. In this circuit a relay coil *d7* operates a pair of contacts *d7'* and *d7''*, and a relay coil *d8* operates a pair of contacts *d8'* and *d8''*. An operating coil S6 for a hydraulic valve 40 (FIG. 9) is connected in series with the contact *d7'* between the power lines 42 and 43. An energizing coil S10 for a hydraulic valve 41 (FIG. 8) is connected in series with the contact *d8'* between the lines 42 and 43. The relay coil *d8* is connected between the power lines 42 and 43 by way of a manually operated start switch *b14*, with a bypass circuit around the manual switch *b14* extending through the second contact *d8''* and the normally closed switch *b28* (operated by the limit switch 28). The relay coil *d7* is also connected between the lines 42 and 43, by way of the manual switch *b14*, with the normally open switch *b26* operated by the limit switch 26 and forming a series circuit. The holding circuit for the relay coil *d7* extends through the switch *b28* and the second contact *d7''*.

The contacts *d7'*, *d7''*, *d8'*, *d8''* of the relays *d7*, *d8* are normally open contacts.

In operation, the starting position of the support rails 10 and 11 is their uppermost position, and the cutting bar is in its lowermost position. Upon actuation (closing) of the manual switch *b14*, the relay coil *d8* is energized, thereby closing its holding contact *d8''* by way of the closed limit switch *b28*. Upon energization of the relay coil *d8*, its other contact *d8'* energizes the coil S10, whereby the position of the hydraulic valve 41 (FIG. 8) is reversed. As shown in FIG. 8, the reversing of the valve 41 affects the downward movement of the piston of the piston cylinder arrangement 21, and

hence the downward movement of the arm 18. Upon reaching its lowermost position, the arm 18 contacts the limit switch 26 and hence closes the switch *b26* in FIG. 7. This effects the energization of the relay coil *d7* by way of the holding contact *d8''* (relay *d8*) and the switch *b28*. The energization of the relay *d7* effects the closing of its holding contact *d7''* so that at this time both of the relays are energized, so that the arm 18 is held in its lowermost position. The energization of the relay coil *d7* further closes the contact *d7'* to energize the energizing coil S6 and hence reverse the valve 40 (FIG. 9). Referring to FIG. 9, this energization effects the upward movement of this piston in the piston cylinder arrangement 22, and hence the upward movement of the arm 19. Upon reaching its uppermost position, following the severing of the web, the arm 19 engages the normally closed switch *b28* to thereby open the switch.

As can be seen in FIG. 7, upon the opening of the switch *b28*, the relay coils *d7* and *d8* are deenergized, thereby opening their holding contacts and deenergizing the coils S6 and S7. The circuit of FIG. 7 has thus returned to its initial operating condition. Upon the deenergizing of the coils S6 and S10, referring to FIGS. 8 and 9, the positions of the valves 40 and 41 are changed, so that the piston of cylinder arrangement 21 moves upwardly, and the piston of piston cylinder arrangement 22 moves downwardly. This effects the return of the arms 18 and 19 to their respective original positions, in preparation for another severing operation.

The arrangement of FIGS. 5 to 9 thereby insure that the support rails are moved to a position adjacent the web prior to any movement of the cutting bar, so that the support rails 10 and 11 are in their proper tensioning positions prior to the movement of the cutting bar to effect the severing of the web.

Although the invention has been described with reference to specific example embodiments, it is to be understood, that it is intended to cover all modifications and equivalents within the scope of the appended claims.

What is claimed is:

1. An apparatus for severing a moving web substantially across its width, comprising elongated severing means, a common journal shaft extending longitudinally of the web for journaling said severing means to extend across one surface of said moving web, web support rail means tiltably supported on said common journal shaft to extend across the surface of said web opposite said one surface and opposed to said severing means, first hydraulic drive means for pivoting said support rail means to a position adjacent said web, second hydraulic means responsive to the movement of said support rail means to said position for pivoting said severing means adjacent to and through said web for severing said web, said support rail means comprising a housing having a pair of spaced longitudinal edges, and first and second support rails on said spaced longitudinal edges of said housing, said severing means being journaled to said common journal shaft intermediate said first and second support rail means so that said first and second support rails contact the web along a line located upstream and downstream respectively of said severing means relative to the direction of movement of said web, said housing forming a safety cover for said severing means, along the entire length