United States Patent

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[54] **ROLL SHEETER FOR PRINTING MACHINE**
5 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **242/75.2,** 242/55, 242/75.4
[51] **Int. Cl.** **B65h 23/06,** B65h 23/10
[50] **Field of Search** 242/75.2; 242/55, 56, 75.4

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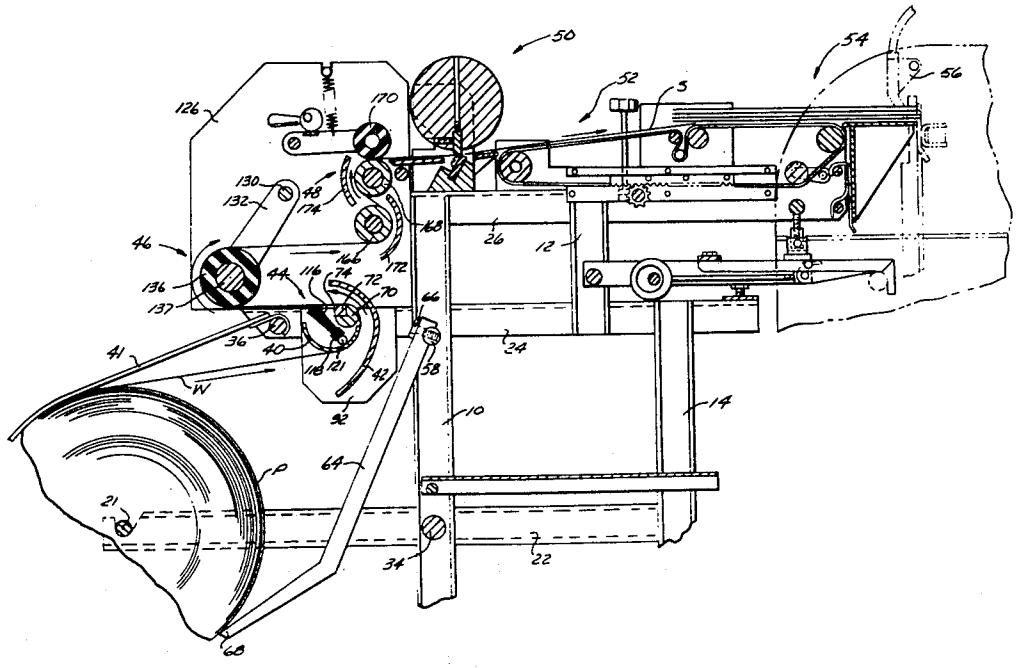
ABSTRACT: A web-decurling device for use with a roll sheeter attachment includes a rotatable bar having a sharp edge projecting into engagement with the outer surface of the web as it is unwound from a supply roll. The decurling device is self-adjusting in operation and comprises means for sensing the periphery of the supply roll and, in response to reduction in its diameter, continuously rotating the bar so as to change the attitude of the sharp edge to present an ever increasing amount of uniform decurling pressure to the web as the supply roll is depleted. Also provided is a tension control for maintaining the web taut and in effective contact with the sharp edge during operation, and for preventing web breakage and lateral runout of the web as it is unwound from the supply roll.



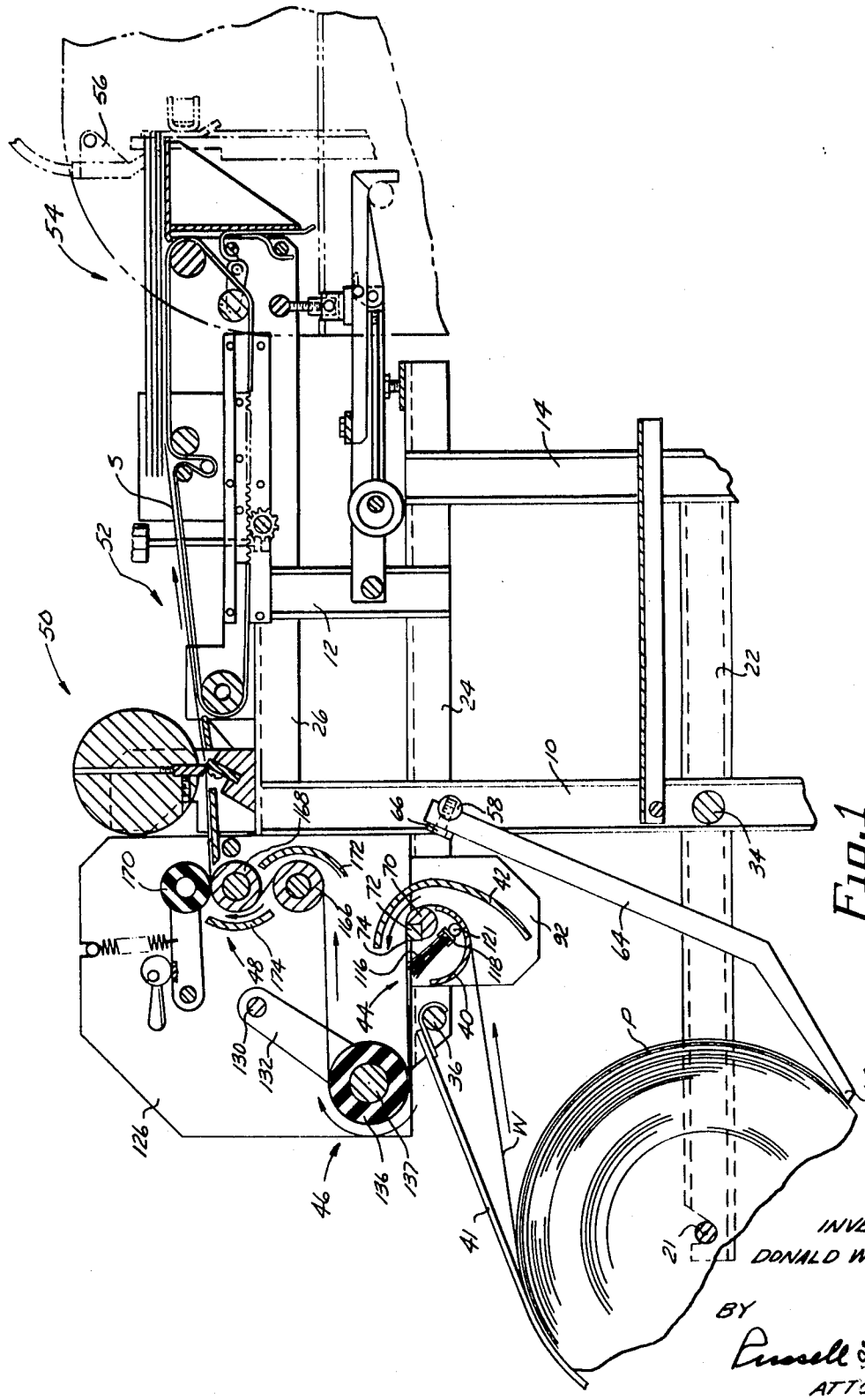


Fig. 1

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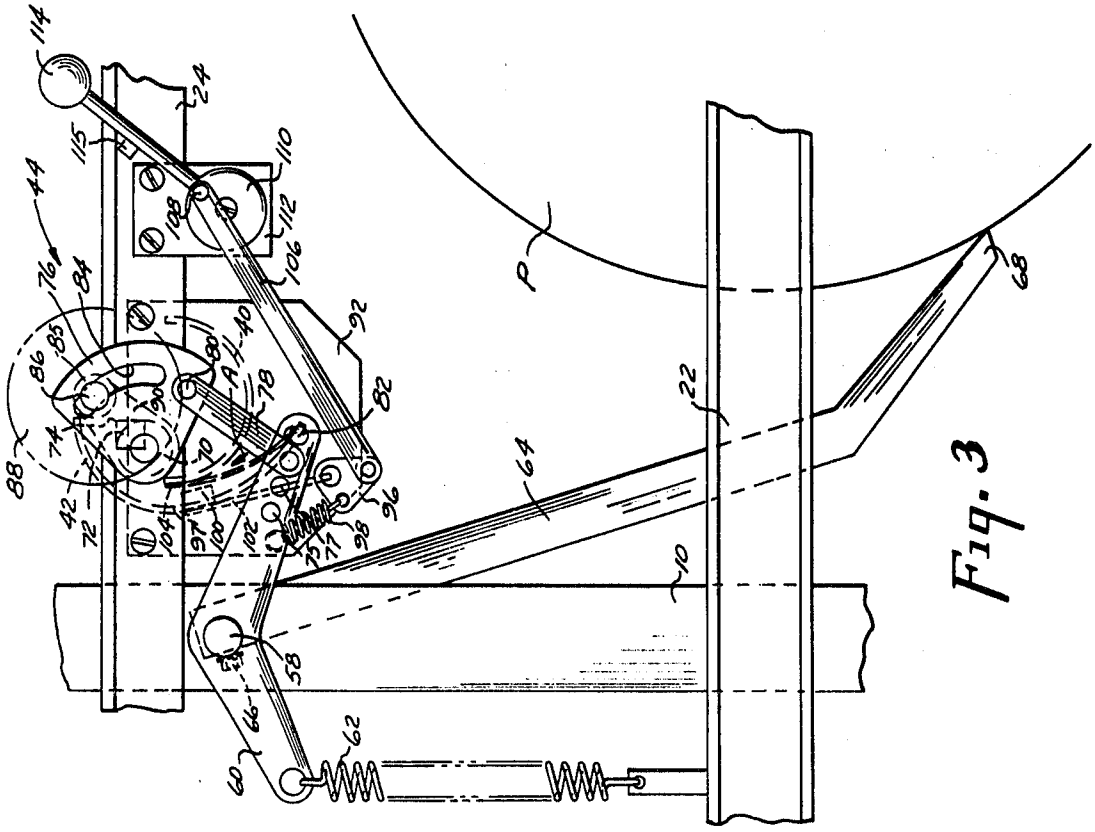

Fig. 3

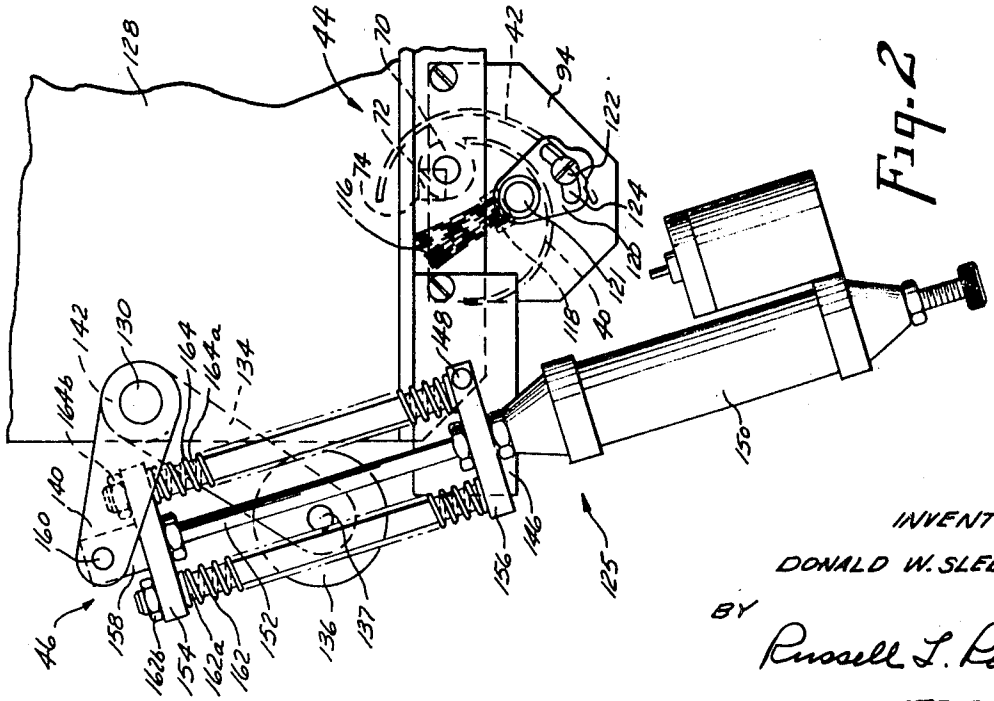

Fig. 2

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ROLL SHEETER FOR PRINTING MACHINE

This invention is a division of application Ser. No. 579,134, filed Sept. 13, 1966, now U.S. Pat. No. 3,482,477, issued Dec. 9, 1969.

The present invention relates to a sheet cutter attachment particularly suitable for use with offset duplicating machines or other machines for operating on sheets, and, more specifically, to a web-decurling device for use with a sheet cutter attachment utilizing paper in roll form from which individual sheets are cut at about the same rate of speed as the use machine is effective for using the sheets.

It is an object of the invention to provide a novel web-decurling device in which the basic setting for the desired degree of curl control to suit the actual paper roll condition is simply accomplished by the operator, and the web curl control adjusts automatically as the roll diameter is diminished.

A more specific object of the invention is to provide a web-decurling device including a rotatable bar having a sharp edge in engagement with the underside of the web as it is unwound from the supply roll, and means including a sensing device riding on the periphery of the supply roll for controlling rotation of the bar to increase web deflection by the sharp edge thereof in response to decrease in the diameter of the supply roll.

It is another object of the invention to provide a web tension control which maintains proper tension regardless of frequency of starts and stops. Also, the web tension control prevents web breakage and lateral runout of the web as it is unwound from the roll.

A further object of the invention is to provide a web tension control including a tension roller and a check means for damping the motion of the tension roller in a direction towards the web, and a friction brake means for resisting rotation of the supply roll in an unwinding direction.

Additional objects and advantages will appear hereinafter as the description proceeds.

In the drawings:

FIG. 1 is a central section of a sheet-cutting attachment showing a web-decurling and tension control device according to the present invention, and showing the web threaded through the machine;

FIG. 2 is a detail elevation of the web tension control device; and

FIG. 3 is a detail elevation of the web-decurling mechanism.

With reference to FIGS. 1 and 3, it will be seen that the sheet cutter is constructed on a rigid frame comprising vertically positioned members 10, 12 and 14 at one side of the machine and similar members (not shown in the drawings) at the other side. The frame also includes a horizontal member 22 and horizontal members 24 and 26 welded to the members 10, 12 and 14 at right angles thereto, and the other side (not shown in the drawings) is the same having members which correspond to the members 22, 24 and 26. These members constitute side frame structures which are securely held together in spaced apart relation by tie bars such as 34 and 36 shown in FIG. 1.

A roll of paper P on an axle 21 can be rotatably mounted in notches formed in the ends of the member 22 and the corresponding member on the other side not shown in the drawings, and is fed into the machine as a web W in the direction of the arrows as shown in FIG. 1. Preferably, a flexible brake strap 41 of leather or the like, having a weight (not shown in the drawings) secured to one end thereof, is placed over the roll P as shown in FIG. 1. The strap is suspended from the tie bar 36 and is effective to prevent the roll from continuing to rotate and uncoiling the web when the machine is shut off and the web feed is suddenly stopped.

The web is threaded through the machine by passing the lead end thereof between a pair of guide members 40 and 42 at a decurling station indicated generally at 44. From there the curved guide member 42 is effective to reverse the direction of travel of the web to feed the web rearwardly and around a web-tensioning device 46. At this point the web is again fed inwardly, through a feed station 48, and thence to a web-cutting station 50. In operation, as the web is cut into sheets 8, the individual sheets are delivered onto a conveyor 52 which transports the sheets to the bottom of a stack of sheets at an accumulation station 54. The sheets S are fed from the top of the stack by conventional suction feed means of a duplicator as indicated in phantom at 56 in FIG. 1.

With reference to FIG. 3, a description will now be given of the web curl control mechanism of the decurling station 44. A shaft 58 is rotatably mounted in the member 10 and the corresponding member on the other side not shown in the drawings, is provided at one end with a bellcrank 60 rigidly affixed thereon. A spring 62 is connected between one end of the bellcrank and the member 22 and urges the shaft 58 in an anticlockwise direction as viewed in FIG. 3. Positioned medially of the ends of the shaft 58 is a sensing arm 64 which is secured thereto as with a bolt 66. The sensing arm 64 extends downwardly from the shaft 58 and then outwardly such that a tip 68 of the sensing arm is continuously in contact with the periphery of the paper roll P as a result of the urging of the spring 62.

A decurling rod 70 is rotatably mounted at its ends in the member 24 and a corresponding member on the other side, and is provided with a longitudinal cutout for receiving a square bar 72. The bar is securely mounted in the cutout and presents a sharp edge 74 which projects beyond the diameter of the rod 70 and into engagement with the underside of the web W as will be further explained below.

One end of the rod 70 has an adjusting plate 76 loosely mounted thereon and, the adjusting plate and the other end of the bellcrank 60 are interconnected by a link 78 pivotally connected at 80 on the adjusting plate and pivotally connected at 82 on the bellcrank. The adjusting plate 76 is provided with an arcuate slot 84 which receives a stud 86 fixed in an arm 90. The arm is rigidly secured to the rod 70 at a position directly behind the adjusting plate 76 as viewed in FIG. 3, and the end of the stud extending through the slot 84 is threaded into a hand wheel 88. A sleeve 85 is loosely positioned on the stud 86 such that when the hand wheel is tightened on the threaded end of the stud 86, it draws up tight against the sleeve 85 and the sleeve is drawn against the face of the adjusting plate 76 to clamp it against the arm 90 and maintain the adjusting plate 76, the arm 90 and the rod 70 against relative movement. In this way, by slightly loosening the hand wheel 88, the arm 90 is free to be manually moved in either direction by swinging the stud within the limits permitted by movement of the stud 86 in the slot 84, to thereby rotate the rod 70 and properly position the edge 74 against the web. This setting of the rod 70 and the edge 74 can be made without disturbing any of the other parts such as the adjusting plate 76, bellcrank 60 etc., and permits proper initial setting of the bar, with respect to the diameter of the roll P and, particularly, of the edge 74 in respect to the paper web W. Once the bar is properly set, the hand wheel is turned to clamp the adjusting plate between the arm 90 and the sleeve 85, to maintain the rod 70 in set position.

During operation of the sheet cutter, as the paper is being unwound from the roll the sensing arm 64 is gradually urged inwardly towards the center of the roll and, at the same time, the bellcrank 60 is being urged in an anticlockwise direction as viewed in FIG. 3. Thus the bellcrank, through the link 78, transmits counterclockwise rotation to the adjusting plate 76, which is held fast to the arm 90 as described above, to thereby impart rotation to the rod 70 and continuously change the attitude of the edge 74 with respect to the web W. Because the web closer to the axis of the roll is more tightly wound than the web at the outer periphery of the roll, the more tightly wound portion of the web requires more decurling. Accordingly, by continuously rotating the rod 70 as described above, the edge 74 presents an ever increasing amount of uniform decurling pressure or drag to the web as the paper roll is depleted to effectively decurl the web prior to its arrival at the cutting station 50. It will be seen in FIG. 3 that the bellcrank 60 is provided with additional holes 75 and 77 to allow for changing

the link 78 from its connection at 82 to a connection at the hole 75 or at the hole 77. This, of course, shortens the stroke of the link and decreases the amount of rotation imparted to the rod 70 carrying the square bar 72. By this adjustment it is possible to set the size of the curl bar activity zone to suit the weight, stiffness and other properties of the type of paper most commonly used.

To insure that the web is maintained in rubbing engagement with the edge 74 of the rod 70 as it travels between the guide members 40 and 42, a device is provided to apply a slight frictional drag to the web so that the web is kept taut as it passes over the edge 74 of the rod 70.

As shown in FIGS. 2 and 3, the guide members 40 and 42 are mounted in a pair of depending side plates 92 and 94 which are fastened to members 24 and 32 respectively. A triangular plate 96 is pivotally mounted on the side plate 92 and is urged by a spring 98 in a clockwise direction as viewed in FIG. 3. The device for maintaining the web taut comprises a shoe 100 affixed to an arm 102 fastened to the plate 96. The arm 102 extends upwardly from the plate 96, extends through an opening 97 in the guide 42, and is urged towards the paper web by the spring 98. Preferably, to prevent excessive wear to the shoe 100, and to prevent marking or scratching of the web if the shoe were in direct contact with the web, a strip of Mylar 104 or the like is fastened to the bottom edge of the guide 42 and extends upwardly to a position between the shoe 100 and the outer surface of the guide 40. In this way, the web passes between the Mylar strip 104 and the guide 40, as shown by arrow A in FIG. 3, and the shoe acts against the Mylar strip which presses the web against the guide 40 and maintains the web in a taut condition.

A link 106 is connected at one end to the plate 96 and at its other end to a pin 108 secured in a hub 110 rotatably supported on a bracket 112 which is fastened to the member 24. An operating handle 114 is provided in the hub 110. The connection between the link 106 and the hub 110 is so arranged as to permit swinging of the connection point from one side to the other of the line joining the hub axis with the plate connection of the link to form an overcenter configuration. When the handle 114 is moved upwardly, the spring 98 draws it against a stop 115 while the shoe 100 is still spaced from the guide 40 and inactive. When the handle 114 is swung downwardly past center, the spring 98 draws the shoe 100 against the Mylar strip so as to force it and the web W against the guide 40 and provide a braking action. When the shoe is in the inactive position the Mylar strip follows it and provides a clear path for threading the lead end of the web through the machine when, for example, a new roll P is required.

With reference to FIG. 2, the decurling station 44 also includes a brush assembly having bristles 116 extending upwardly from a holder 118 and into rubbing contact with the web to remove any dust or paper lint from the edges and from the surface thereof which will ultimately be presented as the exposed upper surface. The brush assembly is preferably mounted on a shaft 121 rotatably mounted in the side plates 92 and 94. An adjusting plate 120 is fixed on the shaft 121 and, through means of a lock screw 122 and a slot 124 in the plate 120, the brush assembly may be rotated and locked in place to present the bristles 116 at the desired and most effective position against the underside of the web.

The web tensioning device 46 is best shown in FIGS. 1 and 2, and comprises a combination hydraulic-mechanical control indicated generally at 125 which maintains proper tension on the web regardless of frequency of starts and stops of the machine, and also prevents web breakage and lateral runout of the web as it is unwound from the roll P.

As shown in FIGS. 1 and 2, a pair of side plates 126 and 128 are mounted on the frame members 24 and 32 respectively, and have a shaft 130 rotatably journaled therein. The ends of the shaft 130 have fixed thereon depending arms 132 and 134 for supporting a fixed shaft 137 having a rotatable roller 136 thereon. Also provided at one end of the shaft 130 is a double arm assembly comprising a pair of links 140 (only one shown in FIG. 2 of the drawings) secured to a bushing 142, and the complete assembly is fixed on the shaft and constitutes an operating crank for the shaft 130.

The frame member 32 has a plate 146 (FIG. 2) mounted thereon, and the plate is provided with a stud 148 for pivotally supporting the control 125. The control is of conventional design and is commercially available under the trade name Bellows Valvair Hydro-Check. Briefly, the control 125 comprises a hydraulic chamber 150 having a slidable actuating rod 152 extending outwardly from one end thereof and positioned between a pair of retaining plates 154 and 156. The end of the actuating arm is provided with a block 158 positioned between the links 140 of the crank and resting on the top surface of the retainer plate 154. The block 158 is pivotally connected by a pin 160 with the crank comprising the links 140. A pair of compression springs 162 and 164 are also mounted between the retainer plates 154 and 156 and surround guide rods 162*a* and 164*a* fixed in the retainer plate 156. The guide rods pass through clearance holes in the retainer plate 154 and carry stop nuts 162*b* and 164*b*.

The purpose of the control 125 is to insure that the web W is kept taut during operation. This is required to prevent sharp, jerky motions which might break the web, but is also of basic importance in that the movement of the web in taut condition across the edge 74 of the decurling bar 72 must be practically continuous during periods of web forwarding if the decurling effect is not to be erratic and unpredictable.

It will be noted that the action of springs 162 and 164 is in a direction such that the roller 136 tends to make the loop of web which embraces it longer at all times. Under normal running conditions, and also, even during starting conditions when the diameter of the paper roll P is small, the roller 136 and springs 162 and 164 will act to maintain the web taut at all times. Under certain conditions, however, the springs 162 and 164 do not by themselves perform adequately, for if the paper roll is large, its inertia is excessive so that it cannot accelerate rapidly enough under the effect of paper tension. If a feed is then begun by feed rollers, which will be presently described, the inertia of the paper roll P acts as an anchor and the web loop embracing the roller 136 shortens with great rapidity. Since the roller 136 also has some inertia it may be slightly overthrown and actually escape from contact with the web loop for a few microseconds. Should it become thus separated, reengagement with the loop under the force of springs 162 and 164 could possibly produce sufficient shock load to break the web. In this situation the hydraulic check mechanism 150 comes into play. This is a one-way device and is designed to damp return of the roller 136 in a leftward direction by springs 162 and 164. It thus allows the web loop to catch up smoothly with the overthrown roller, or allows the roller to settle back into the loop gently and without shock.

It will be observed that when feeding of the web stops, the inertia of the paper roll P, depending upon its size, will have a greater or less tendency to make the roll overrun and thus enlarge the web loop about the roller 136. The effect of the brake strap 41 when added to the ordinary frictional factors, is accordingly adjusted to a value which will prevent enlarging the web loop significantly beyond the maximum throw of roller 136 even for the maximum diameter of paper roll P so that slack on the next start is avoided. The described control assembly 125 thus provides for maintaining the web substantially taut under all conditions of starting and stopping, and hence, in addition to assuring that proper decurling action will be applied to all parts of the web, guards against the chance for web breakage inherent in a slack condition occurring in a web system subject to intermittent operation.

From the tensioning station 46 the web is fed to the feed station indicated at 48 and comprising a lower roller 166, an intermediate roller 168 and an upper roller 170. As shown in FIG. 1, a pair of guides 172 and 174 are mounted between the side plates 126 and 128, adjacent the rollers 166 and 168 respectively, to facilitate the threading of the web around the feed rollers.

From the foregoing, it will be seen that the present invention provides a novel web-decurling device which is self-adjusting in operation to apply the proper degree of decurling to the web as the diameter of the paper roll is diminished, and a web tension control which maintains the web in proper taut condition regardless of frequency of starts and stops of the web feed. The web tension control thus prevents web breakage as it is unwound from the roll and fed through the machine and insures that the web is maintained in effective contact with the decurling mechanism to insure the latter's continued effectiveness.

While preferred embodiments of the invention have been described and illustrated, it is to be understood that these are capable of variation and modification. Accordingly, the aim in the appended claims is to cover all such variations and modifications as may fall within the true spirit of the invention.

1. A device for decurling a web as it is fed from a supply roll which comprises:

means for rotatably supporting a supply roll of web material;

feeding means for drawing the web from the supply roll;

a decurling bar positioned so as to bear against the web as it passes between said roll and said feeding means, said bar having a sharp decurling edge, and being movable mounted in a manner to provide greater or less deflection of the web by the edge to effect greater or less decurling of the web;

a movable sensing arm riding on the periphery of the supply roll;

means urging the arm towards the periphery of the supply roll; and

means connecting the arm with the decurling bar to so move the bar as to increase web deflection by the sharp edge thereof in response to decrease in the diameter of the supply roll.

2. A device as set forth in claim 1 in which friction brake means is provided for resisting rotation of the supply roll in an unwinding direction, and which includes a tension roller urged against the web and tending to lengthen the run between said decurling bar and the feeding means.

3. A device as set forth in claim 2 in which check means is associated with the tension roller for damping its motion in a direction towards the web.

4. A device as set forth in claim 2 which also includes a means for applying a drag to the web at a location between the supply roll and the decurling bar.

5. A device as set forth in claim 1 including means for adjusting the ambit of decurling bar movement in relation to the travel of the sensing arm.