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2,737,089

APPARATUS FOR DECURLING A WEB

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3 Sheets-Sheet 1

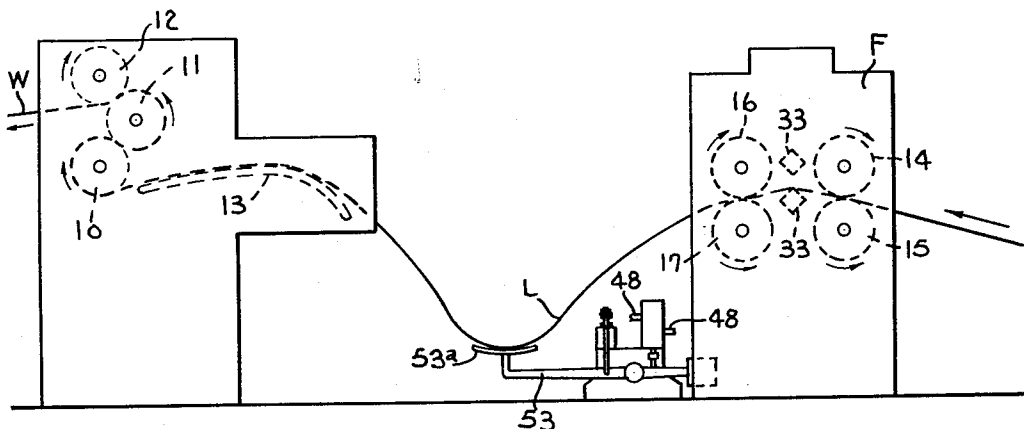


FIG. 1

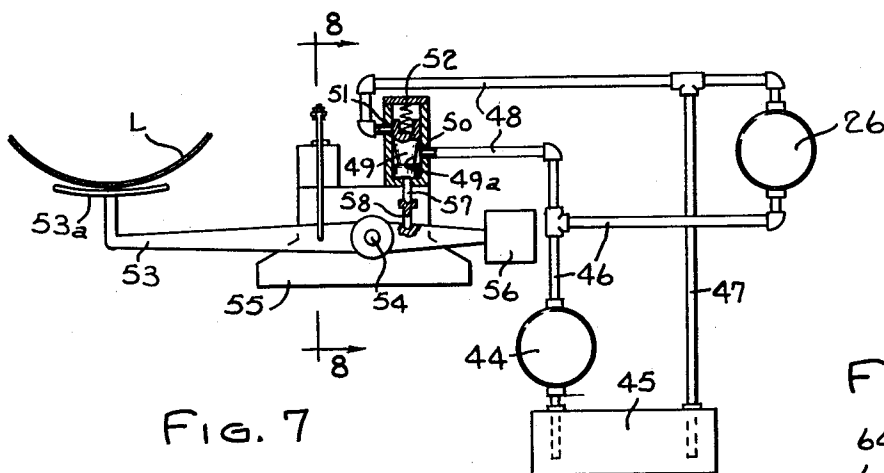


FIG. 7

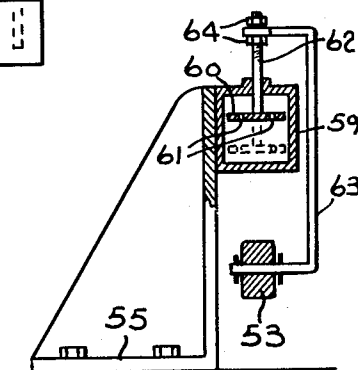
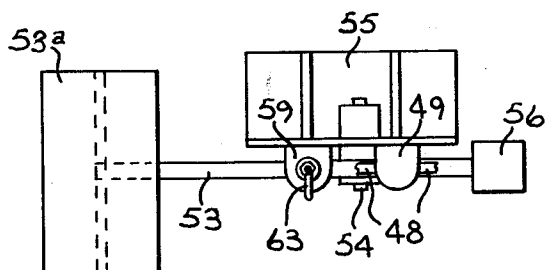


FIG. 9

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FIG. 2

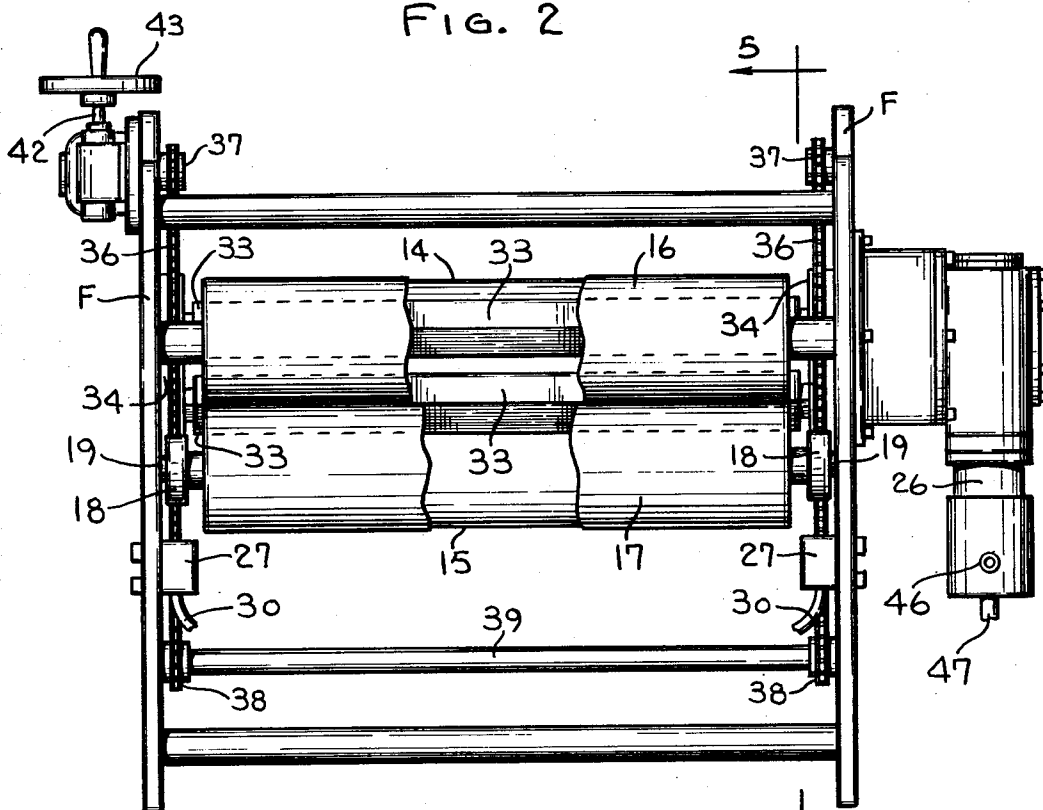
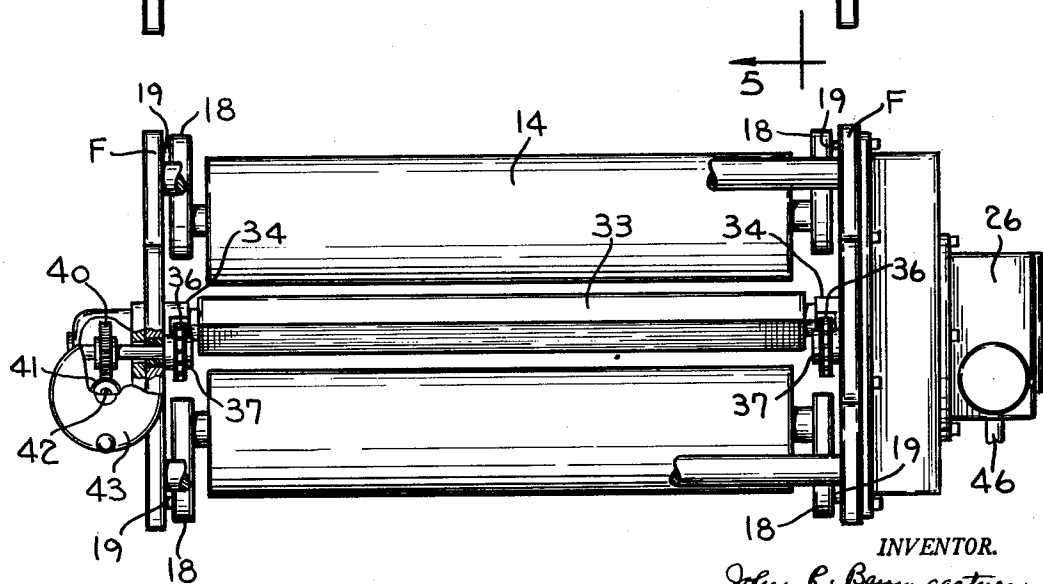


FIG. 3

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3 Sheets-Sheet 3

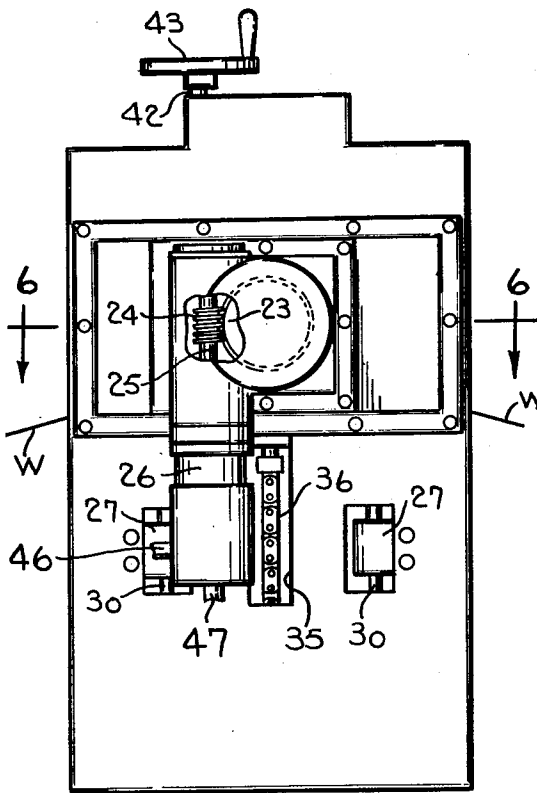


FIG. 4

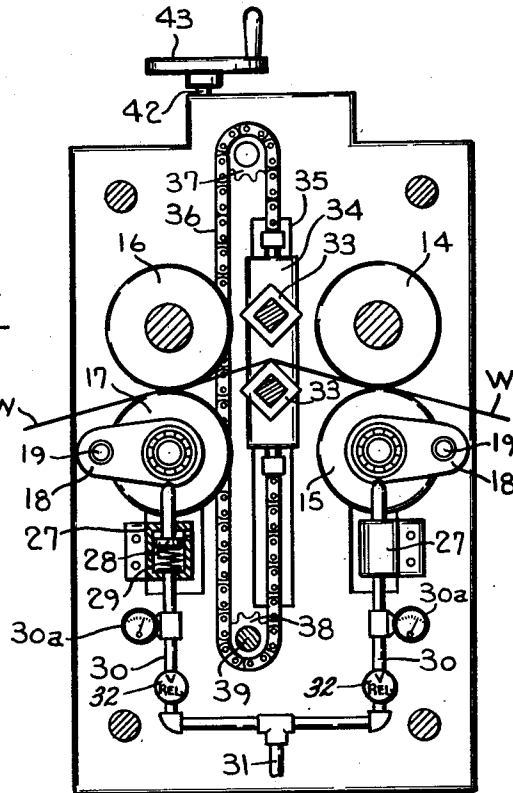


FIG. 5

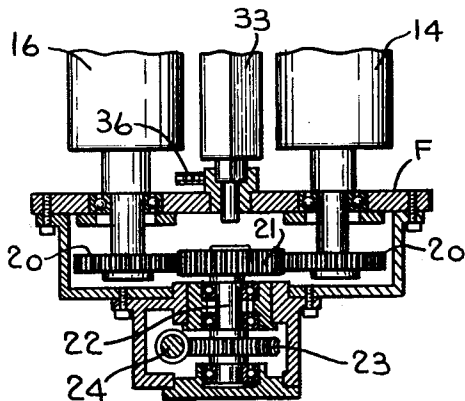


FIG. 6

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APPARATUS FOR DECURLING A WEB

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Application October 21, 1953, Serial No. 387,497

3 Claims. (Cl. 92-70)

The invention relates to paper fabricating apparatus and more particularly to means for conditioning a paper web before it is led to a printing press, a printing press, a blanking press, or other apparatus operating on the surface of the web.

In paper fabricating machines such as printing presses, blanking presses, the paper to be operated upon is supplied to the machine as a supply roll from which it is unwound as needed. The winding up of the paper to form the supply roll produces more or less of a curl in the web which for best results should be removed before the web is subjected to printing or to die-cutting or both, and also after the curl is removed, the web as it goes to the printer or die cutter should be free of any impulses that might be reflected in it from an out of round or eccentrically mounted stock roll. The object of the invention is to provide apparatus for decurling the web and for forming a loop in the web after decurling and prior to the feed of the web to a printing press or a die-cutting press to free the web of any undesired impulses that might be imparted to it by an out of round stock roll, and in this connection the feed rollers forming a part of the decurler also act as feed rollers that form the loop above described.

A further object of the invention is to provide a decurling apparatus in which the curl is removed from the web by pulling the web over an ironing or decurler surface while the web is under tension produced by a differential speed between sets of web feeding rolls while permitting a predetermined amount of slippage of the web on one of the sets of feed rolls.

A further object of the invention is to provide a hydraulic motor for driving the feed rolls of the decurler whose speed is controlled by a throttle valve which is under the control of the loop formed between the delivery feed rolls of the decurler and another set of feed rolls that advances the web through the machine.

This application is a continuation in part of my application Serial No. 373,953, now abandoned, filed August 13, 1953, for Paper Web Conditioning Mechanism, as to claims for common subject matter.

The invention further consists in the several features hereinafter described and more particularly defined by claims at the conclusion hereof.

In the drawings:

Fig. 1 is a general elevation view of apparatus embodying the invention;

Fig. 2 is a side elevation view of a decurler and stock feeder embodying the invention, parts being broken away;

Fig. 3 is a plan view of the structure shown in Fig. 2, parts being broken away and parts being shown in section;

Fig. 4 is an end elevation view of the structure shown in Fig. 2;

Fig. 5 is a detailed sectional view taken on the line 5-5 of Fig. 2;

Fig. 6 is a detailed sectional view taken on the line 6-6 of Fig. 4, parts being broken away;

Fig. 7 is a diagrammatic view of the feed drive mechanism and a sectional view through parts of the control used in the apparatus;

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Fig. 8 is an enlarged view of loop operated speed control mechanism, parts being broken away;

Fig. 9 is a plan view of the control mechanism shown in Fig. 8.

Referring to Fig. 1 of the drawings, the paper web W is pulled off of the usual supply roll (not shown) by sets of feed rolls in a frame F and advanced to another set of feed rolls 10, 11, and 12 over an apron 13, which last named rolls feed the web to a printing press, a die-cutting or blank forming press or other paper web fabricating apparatus. While the web is passing through the sets of feed rolls in the frame F, it is decurled, and as it passes from these rolls to the rolls 10, 11, and 12, it is freed of any vibrations or impulses that it may have had imparted to it by an out of round stock roll by the formation in it of a controlled loop L as hereinafter described.

Referring to Figs. 2 to 6, a set of feed in rolls 14 and 15 and a set of feed out or delivery rolls 16 and 17 are suitably journaled in the frame F in spaced relation to each other. The journals for the lower rolls 15 and 17 are each carried in spaced sets of arms 18 pivotally mounted at 19 on the frame F so that these rolls may be moved toward or away from their companion rolls 14 and 16 to increase or decrease the bite between each set of rolls.

The rolls 14, 15, and 17 are all of the same diameter, but the roll 16 is of slightly larger diameter so that there is a speed differential between the sets of rolls so that the rolls 16 and 17 tend to feed the web between them at a faster rate than the web is supplied to them by the rolls 14 and 15 and thus act to tension the web between said sets of rolls.

The rolls 14 and 16 are positively driven by a gear 20 on the shaft of each roll meshing with a common drive gear 21 on a shaft 22 journaled in the frame F and carrying a worm gear 23 driven by a worm 24 on the drive shaft 25 of a variable speed hydraulic motor 26.

For moving the rolls 15 and 17 relative to the rolls 14 and 16, in each instance an air cylinder 27 has the rod of its piston 28 engaging one of the supporting arms 18 for its associated roll 15 or 17. Each piston 28 may be initially loaded by a spring 29 to offset the greater portion of the weight of the roll assembly. Each cylinder 27 is supplied with air under pressure by branch pipes 30 connecting with a pressure supply pipe 31. Each branch pipe 30 has a pressure gauge 30a therein and an adjustable pressure relief valve 32 so that the air pressures acting on the pistons 28 will act to move and hold the rolls 15 and 17 against the web P under variable pressures determined by the adjustment of the relief valves 32 to vary the bite or nip between the spaced sets of feed rolls above mentioned and the web. It has been found that the best results are secured when one of the sets of rolls 15, 17 or 14 and 16 is allowed to slip so that the nipping pressure applied to one set of the rolls mentioned is less than the other.

For decurling the web a pair of spaced cold ironers 33 are mounted on slide blocks 34 vertically slidably mounted and guided in slots 35 in the side sections of the frame F and vertically adjustable relative to the sets of rolls 14, 15 and 16, 17 by a chain 36 secured to opposite ends of each block and running over spaced sprockets 37 and 38. The sprockets 38 are carried by a cross shaft 39 journaled in the spaced side members of the frame F while the sprockets 37 are separately journaled to said side frame members. One of the sprockets 37 has its shaft connected with a worm wheel 40 which meshes with a worm 41 on a shaft 42 provided with a hand wheel 43. Turning the wheel 43 will act through the

chains and sprockets above described to move the blocks 34 up or down in the frame F to the desired position.

The members 33 are square bars positioned to present one of their corner edges to the web and are spaced apart so that one of the members cooperates with the feed rollers above described to iron or smoothly crease the web in one direction, and the other member acts in the same manner to iron or smoothly crease the web in the other direction to put a reverse curl in the web from that which may have been produced by winding up the web on the supply roll. Since the web W is fed from one of set of feed rolls to the other, and one of the ironers 33 engages a side of the web as it is fed under tension over this ironer to produce a reverse curl, the initial curl is taken out of the web. Unless tension is applied to the web during decurling, breaks or ridges will be produced in the surface of the web, and the speed differential between the sets of rolls produces enough tension in the web as it passes over the ironer to form a smooth reverse curl. The adjustment of the variable relief valves 32 so that the nipping pressure of one set of rolls is greater than that of the other provides a means for varying the amount of tension exerted on the web as it passes over the ironer between the sets of rolls 15, 17 and 14, 16. The position of the active member 33 relative to the feed rolls may be varied from time to time to vary the amount of decurl by the operator's operation of the hand wheel 43.

On leaving the set of feed rolls 16 and 17, the web W, as previously noted, is fed to the rolls 10, 11, and 12 to produce a loop L or non-tensioned section of the web, and to keep this loop L within certain limits means are provided for varying the speed of the motor 26.

Referring to Fig. 7, the motor 26 receives its pressure supply of hydraulic fluid from a suitably driven pump 44 having its inlet connected with a liquid supply tank 45 and its outlet connected by a pipe 46 with the in put side of the motor 26 which has a waste return pipe 47 connected with the tank 45. A by-pass pipe 48 connects the pipe 46 with the pipe 47 and has a variable by-pass or throttle valve 49 having a conical surface 49a cooperating with ports 50 and 51 in its housing which connect with sections of the pipe 48. The valve 49 is moved to a closed position by a spring 52 and is moved to its throttling positions by a loop operated lever 53 having a curved loop engaging surface 53a. Lever 53 is suitably pivoted intermediate its ends by a pin 54 mounted in a block 55 and carries a weight 56 at its outer end so as to normally tend to tilt the surface 53a into engagement with the loop L. The valve 49 is operatively connected to the lever 53 by abutting thrust pins 57 and 58.

With the above arrangement when the weighted end of lever 53 is in its lowered position, the surface 53a is in a raised position and the valve 49 is in its closed position so that the motor 26 is operating at full speed. Since under these conditions the speed of rolls 16, 17 is greater than that of the rolls 10, 11, and 12, the rolls 16, 17 deliver more stock than can be taken up by the rolls 10, 11, and 12 so that a loop L builds up in the web which acting on the surface 53a swings the weighted end of lever 53 upwardly and consequently moves the valve 49 upwardly so that the throttling surface 49a then is in communication with both ports 50 and 51 and pressure fluid is by-passed from the pipe 46 to the return 47, thus reducing the speed of the motor 26 so that finally the speed of this motor is reduced to such an extent that the speed of the rolls 16 and 17 is lower than that of the rolls 10, 11, and 12 so that these rolls can take up the slack formed by the loop until the weighted end of lever 53 can again swing down toward its initial valve closing position. Thus with this control a loop is constantly maintained in the web to relieve it of tension and any vibrations or impulses it may have received while unwinding from its supply roll. In practice it has been found that where the supply roll during shipment has

been distorted out of round, that forces are set up in the web that create a considerable hunting action or pulsations that are reflected in the oscillatory movement of the lever 53, and to prevent this occurring the swinging movement of the lever 53 has been damped or slowed down by a dashpot mechanism including a cylinder 59 containing oil, a piston 60 loosely mounted in said cylinder and provided with throttling restrictions 61 and having a rod 62 slidably mounted in one end of the cylinder with its outer end operatively connected to move with the lever 53. The connection here shown includes a rod 63 secured at one end to the lever 53 and at its other secured to the rod 62 between nuts 64. Thus as the lever 53 oscillates under the action of the loop L, the piston 60 moves up and down in the cylinder 59 forcing oil from one end of the piston to the other and slowing down the swinging action of the lever 53.

It is to be noted that the rolls 17 and 15 may be of any suitable diameter and need not be of the same diameter as the roll 14 since they are not driving rolls.

I desire it to be understood that this invention is not to be limited to any particular form or arrangement of parts except in so far as such limitations are included in the claims.

What I claim as my invention is:

1. In a paper fabricating apparatus for conditioning the web after leaving its supply roll and prior to other operations thereon, the combination of two spaced sets of feed rolls, continuously engaging the web, a decurling member disposed between said sets of rolls against which the web is fed as it passes from one set of rolls to the other, positively and continuously acting drive means for each set of rolls, the set of rolls beyond said decurling member acting to feed the web at a higher speed than that of the other set of rolls to produce a tension in the web as it passes over said decurling member, means for continuously exerting a positive nipping pressure on the web between the rolls of each set, means for varying the nipping pressure between one set of rolls as compared to the other to vary the effective tension of the web as it is carried over said decurling member, other feed rolls spaced from said sets of feed rolls and operating at a speed permitting the formation of a free loop in the web between said other feed rolls and said spaced sets of feed rolls, and means controlled by the loop for reducing the speed of said spaced sets of feed rolls relative to said other feed rolls to limit the size of the loop in the web.

2. In a paper web fabricating apparatus for conditioning the web after leaving its supply roll, the combination of two spaced sets of feed rolls continuously engaging the web, a decurling member disposed between said sets of rolls against which the web is fed as it is carried from one set of rolls to the other, means including said feed rolls for tensioning the web as it passes over said decurling member, other feed rolls spaced from said spaced sets of feed rolls and operating at a speed permitting the formation of a free loop in the web between said other feed rolls and said first named feed rolls, a hydraulic motor operatively connected to drive said spaced sets of feed rolls, a supply of pressure fluid for said motor, a by-pass for said pressure fluid, a throttling valve in said by-pass to vary the speed of the motor, a loop controlled oscillatory member for controlling said valve, and means for slowing down the movement of said oscillatory member.

3. In a paper web fabricating apparatus for conditioning the web after leaving its supply roll and prior to other operations thereon, the combination of two spaced sets of feed rolls continuously engaging the web, a decurling member disposed between said sets of rolls against which the web is fed as it passes from one set of rolls to the other, one of the rolls of each set of said spaced sets of feed rolls being movable relative to its companion roll, means for positively and continuously driving said sets of rolls, means providing a speed differential between said sets of rolls so that the set of feed rolls beyond said

decurling member acts to feed the web at a higher speed than that of the other set of rolls to produce a tension in the web as it passes over said decurling member, and fluid pressure operated means for moving each of said movable feed rolls relative to its companion roll to vary the nipping pressure between each set of rolls and the web so that one set of feed rolls has a greater nipping pressure on the web than the other to vary the tensioning of the web while passing over said decurling member.

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