

Aug. 14, 1962

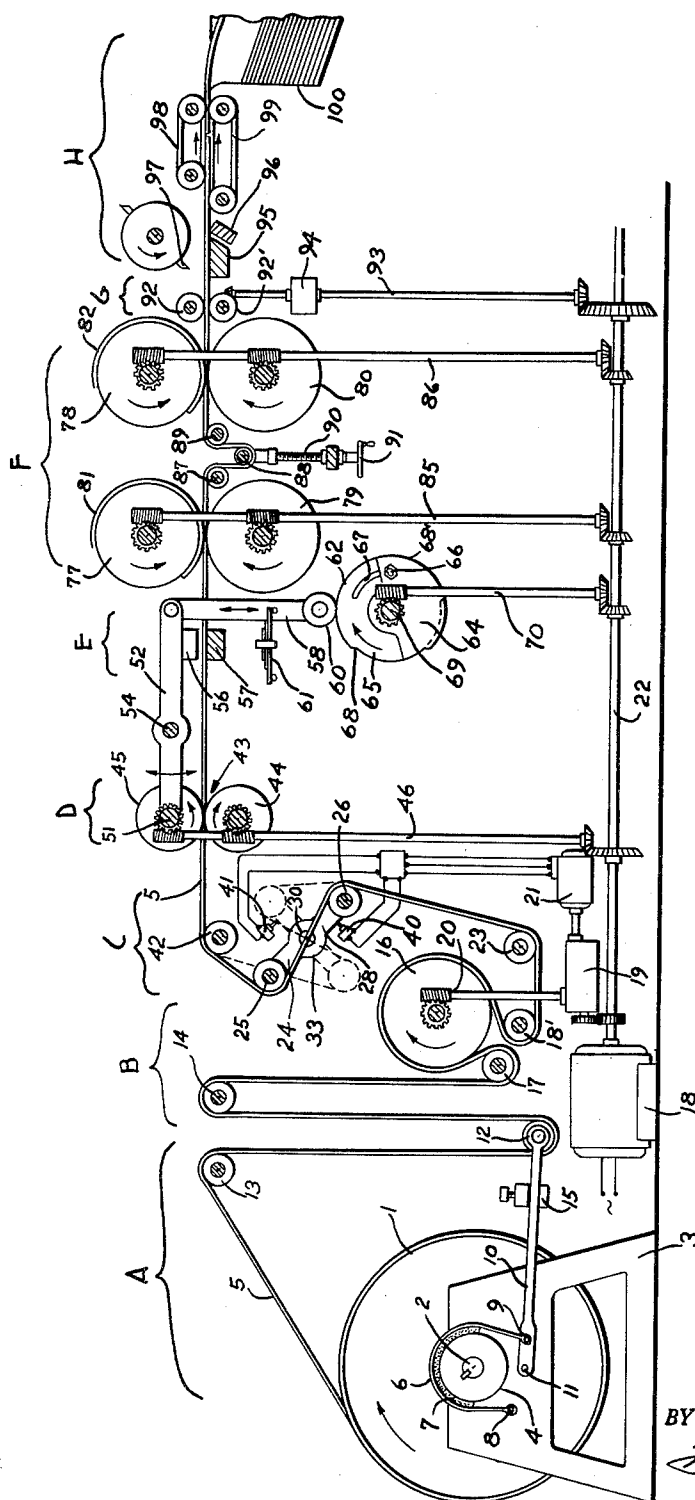
R. R. SMITH, JR

3,049,078

ROTARY PRESS

Filed March 31, 1960

2 Sheets-Sheet 1



INVENTOR.

Roy R. Smith Jr.

BY

BY *Fishburne & Gold*

ATTORNEYS.

Aug. 14, 1962

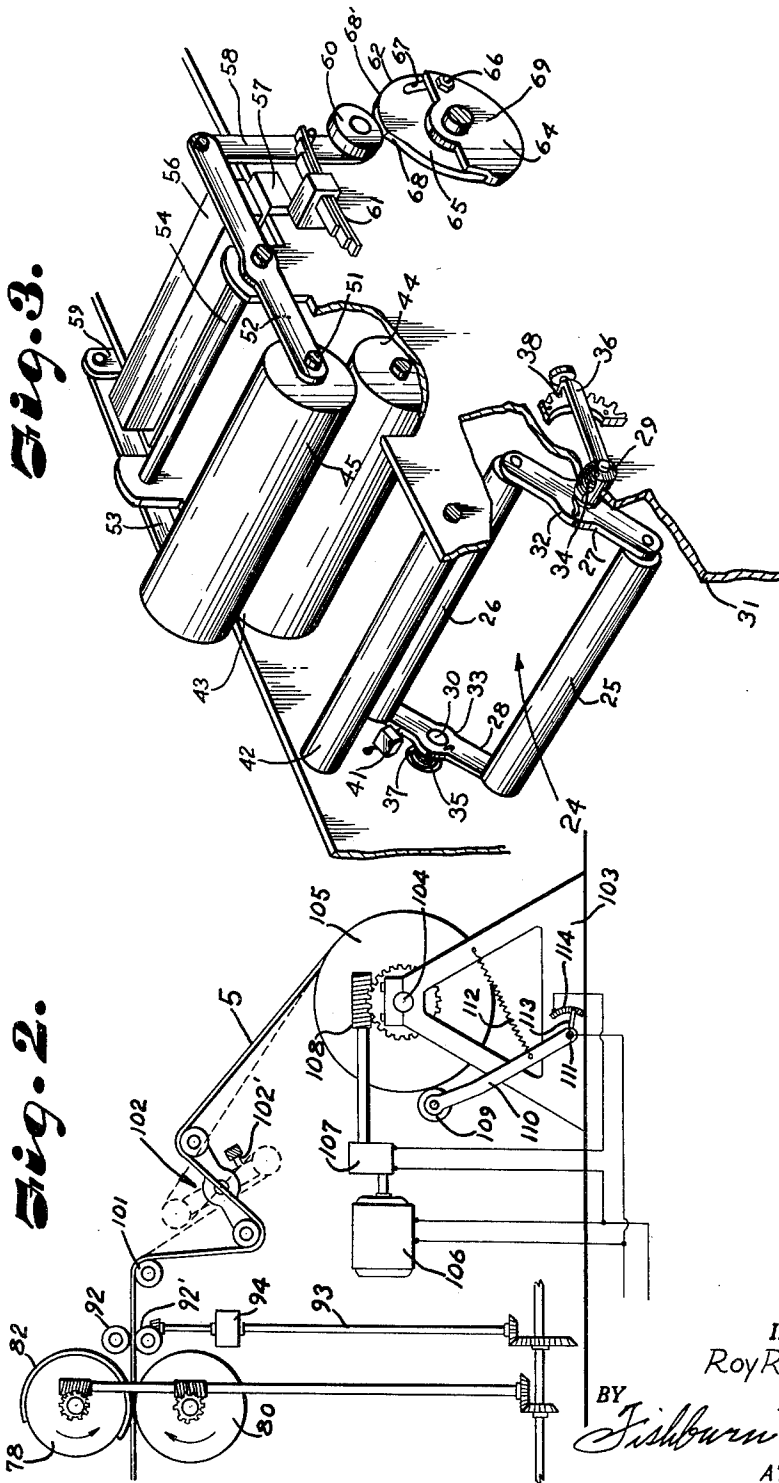
R. R. SMITH, JR

3,049,078

ROTARY PRESS

Filed March 31, 1960

2 Sheets-Sheet 2



1

3,049,078

ROTARY PRESS

Roy R. Smith, Jr., Kansas City, Mo., assignor to Econo-Pak Register Co., Inc., Kansas City, Mo., a corporation of Missouri

Filed Mar. 31, 1960, Ser. No. 18,961

6 Claims. (Cl. 101--228)

This invention relates to rotary printing presses wherein a cylindrical printing cylinder is rotated in contact with a traveling web of paper, and more particularly to apparatus for continuous paper feeding therefor.

Rotary printing presses, due to their inherent adaptability for high production rates are ideally suited for printing work which includes long runs of standardized printed form size such as in the magazine or newspaper industries. However, heretofore rotary presses were economically unsuitable for short runs of various printed form sizes. If the printed form length i.e., in the direction extending lengthwise of the web, was substantially less than the circumferential length of the printing cylinder, large unprinted spaces occurred between printed forms since the web traveled continuously at the peripheral speed of the printing cylinder, resulting in a waste of paper and trimming costs. In some cases, interchangeable printing cylinders of different diameters are used to overcome this problem; however, it can readily be seen that such a solution is often of little value because a considerable expense is involved in the fabrication and storage of many different printing cylinders, and there is considerable difficulty and labor involved in changing printing cylinders and readjusting the press for various printing jobs.

It is apparent, therefore, that printing job shops wherein short runs of a great variety of printed forms are common, the advantages of rotary presses can seldom be realized.

It is an object of this invention to provide a web-feeding mechanism for rotary presses wherein the printed forms may be impressed upon the web in adjacent or spaced relationship as desired although the length of the printed form is substantially less than the circumferential length of the printing cylinder.

A further object of this invention is to provide means for stopping a portion of the traveling web in its path through the rotary press during the period when the plate on the printing cylinder is not contacting the paper.

A further object of this invention is to provide means for storing the infeed paper while the web is stopped in order that the paper feed roll may unwind continuously.

A further object of this invention is to provide a storage device which automatically regulates the speed of the press infeed roll to compensate for different thicknesses in web material and other feeding irregularities.

A further object of the present invention is to provide a web-feeding mechanism for driving the web forward under the printing cylinder at the correct moment and speed for contact with the printing plate and for maintaining the web substantially stationary during absence of printing plate contact.

A further object of the present invention is to provide means for smoothly re-rolling the web after printing although the web is being delivered from the printing cylinders in an intermittent motion.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a diagrammatic view of a rotary printing press embodying the web-feeding mechanism of this invention and adapted for sheeting the web after printing.

FIG. 2 is a diagrammatic view of the rear portion of

2

the press of FIG. 1 showing the press adapted for re-rolling the web after printing.

FIG. 3 is a partial perspective view of a portion of the press of FIG. 1 showing the oscillating storage unit and intermittent feeding unit.

A is a web tension control apparatus feeding supply web into an infeed mechanism B which delivers it to a storage mechanism C. Feed rollers D withdraw the web from the storage mechanism C. Clamping or retarding mechanism E periodically retard the web prior to contact with printing rollers F. Pullout tension mechanism G accepts the web and delivers it to cutting and storage apparatus H (FIG. 1) or re-roll apparatus I (FIG. 2).

1 designates a reel of paper for feeding into a rotary printing press. The reel 1 is supported on and rotates with a shaft 2 which is rotatably mounted in a bearing standard 3. A brake drum 4 is fixed on the shaft 2 and rotates with reel 1 as the web 5 is unwound therefrom by infeed roller 16 described hereinafter. A brake band 6 having braking material 7 mounted thereon and in contact with brake drum 4 is anchored at one end 8 on the bearing standard 3 and at the other end 9 on a lever arm 10. The lever arm 10 is pivotally mounted at one end 11 thereof on bearing standard 3 and supports an idler or guide roller 12 on the other end thereof. The end 9 of the brake band 6 is mounted upon the lever arm intermediate the ends thereof but near end 11 whereby as lever arm 10 rotates clockwise the braking material 7 is forced against brake drum 4 and retards the unwinding of reel 1.

The web 5 is conducted over a guide roller 13 and downwardly under the guide roller 12 on lever arm 10 and then upwardly over guide roller 14 forming a vertical loop the lowest point of which being determined by the position of lever arm 10. When tension on the web 5 is decreased, the lever arm 10 tends to rotate clockwise due to gravity, which clockwise motion tightens the brake band 6 around the brake drum 4, retarding reel 1 and consequently increasing the tension on web 5. Correspondingly, when the tension on web 5 increases, the lever arm 10 tends to rotate counterclockwise, causing a reduction in the tension on the web 5. A weight 15 which is adjustably secured along the length of lever arm 10 provides apparatus for setting the desired tension to be maintained on the web 5. As the weight 15 approaches guide roller 12, the tension on the web 5 is increased.

A positively driven infeed roll 16 provides the tension forces for unwinding the reel 1 and feeds the web 5 into the press. The web 5 is held in contact with most of the circumferential surface of infeed roller 16 by means of guide rollers 17 and 18. The infeed roller 16 is driven by a motor 18 through a positive infinitely variable speed transmission (PIV) 19 of well known design, and appropriate shafting and gearing 20. The speed of the infeed roller 16 relative to the speed of the motor 18 can be varied by momentarily energizing a reversible motor 21 in the desired direction of rotation.

The shaft 22, through which the feed rolls, clamping mechanism and printing cylinders described hereinafter are driven, rotates with and at the same speed as motor 18.

The web 5, after leaving the infeed roller 16 travels over a guide roller 23 from which it is directed into a storage mechanism 24 adapted to store a varying length of web during each printing cycle or rotation of the printing rollers F. The storage mechanism 24 consists of a pair of lightweight guide rollers 25 and 26 mounted at opposite ends of a pair of arms 27 and 28 to form a rectangular structure with two opposite sides thereof being rollers 25 and 26 and the other two opposite sides thereof being arms 27 and 28 (FIG. 3). The storage mechanism 24 is pivotally mounted on shafts 29 and 30 in the press frame 31 for oscillating motion about the intermediate portions

32 and 33 of the arms 27 and 28. Torsion springs 34 and 35 bias the storage mechanism 24 in a counterclockwise direction. The springs 34 and 35 are respectively anchored in adjusting levers 36 and 37 which are position-
 5 able in ratchet device 38 to vary the bias on the storage mechanism 24. The web 5 is threaded in a bent path over guide roller 26, across the storage mechanism 24, and then around the guide roller 25. The tension of the web 5 tends to rotate the storage mechanism 24 in a clock-
 10 wise direction, or in opposition to the springs 34 and 35.

Switches 40 and 41 are respectively located at opposite ends of the path of the arm 28 and are actuated when contacted by the arm 28. When the switch 40 is actuated, reversible motor 21 is energized for an interval to adjust transmission 19 whereby the infeed roll 16 is speeded up
 15 with respect to drive motor 18. Conversely, if the switch 41 is contacted by the arm 28, the reversible motor 21 rotates for an interval in the opposite direction slowing down the relative speed of the infeed roller 16. Thus speed of infeed roller 16 will automatically be adjusted to
 20 deliver the web 5 at the correct rate which is determined by exceeding the limits of either the maximum or minimum predetermined length of web in the storage mechanism 24. This infeed system is particularly valuable for short runs of paper of different thicknesses since an in-
 25 crease in paper thickness will result in an effective increase in the diameter of infeed roller 16 which causes a slight but cumulative error in infeed.

After leaving the storage mechanism 24, the web 5 is passed over a guide roller 42 and into a feed couple 43 comprising driven feed drums 44 and 45. Feed drums 44 and 45 are driven by means of the main shaft 22 and appropriate shafting and gearing 46. Feed drum 45 is supported by a shaft 51 which is rotatably mounted on lever arms 52 and 53. The lever arms 52 and 53, in the intermediate portion thereof, are mounted for oscillating motion with respect to the press frame 31 upon a shaft 54. A web clamp comprising upper clamp member 56 and a lower clamp member 57 extends transversely and on opposite sides of the web 5. The upper clamp member 56 is rigidly mounted on lever arms 52 and 53 near the oppo-
 30 site ends from the feed drum 45. The lower clamp member 57 of the web clamp is rigidly mounted on the press frame 31 in position for mating with the upper clamp member 56 whereby, when clamp members 56 and 57 are held together the web 5 is clamped therebetween. Links 58 and 59 are pivotally mounted at one end thereof respectively on lever arms 52 and 53 in the vicinity of the upper clamp member 56. At the opposite end thereof of link 58 cam follower 60 is rotatably mounted. The cam follower 60 as well as the leaf spring 61 and cam 62 described hereinafter have identical members (not shown) acting upon link 59. The leaf spring 61 biases link 58 in the clamp closing direction.

The cam follower 60 rides upon cam 62 which is of the design known as a "split cam" in which cam portions on the periphery thereof may be lengthened or shortened as desired. For example, the face 64 may be rotatably ad-
 35 justed upon cam body 65 and locked into position by means of locking nut 66 which rides in adjusting slot 67, in order to vary the length of the depression 68 with respect to greater diameter portion 68' on the cam periphery corresponding with various lengths of printing plates 81 and 82 described hereinafter. The cam 62 is fixedly mounted upon a shaft 69 which is driven by means of the main shaft 22 and appropriate shafting and gearing 70.

The cam depression 68 (shown greatly exaggerated, FIGS. 1 and 3) permits the cam follower 60 and its corresponding link 58 to move causing clamping between clamp members 56 and 57 for a selected interval during each revolution of the cam shaft 69. This motion is slight, in the order of a few thousandths of an inch, but is sufficient to provide a positive clamping action on the web 5, stopping it completely. At the same instant that clamping occurs, feed drum 45 is lifted away from the upper surface of the web 5 to permit the continued rotation of

feed drums 44 and 45 without delivering the web material therebetween.

After passing between the clamp members 56 and 57, the web 5 passes between one or more sets of rotary printing couples. In the embodiment illustrated (FIG. 1), two printing couples are shown, corresponding to a two-color press, although the invention herein is easily adaptable for a greater number. The printing couples comprise printing cylinders 77 and 78 which cooperate with impression cylinders 79 and 80 to squeeze the web therebetween. The printing plates 81 and 82 which cause the printed impression on the web 5 are mounted upon the printing cylinders 77 and 78 respectively. The printing plates 81 and 82 may be any circumferential length smaller than the circumference of the printing cylinders 77 and 78, but for the purpose of illustrating this invention, they are shown as being between $\frac{3}{4}$ and $\frac{3}{4}$ of the circumference of the printing cylinders 77 and 78 (FIG. 1). The printing cylinders and impression cylinders 77, 78, 79 and 80 are driven in synchronization by means of the main shaft 22 and appropriate shafting and gearing 85 and 86.

Between the impression rollers 79 and 80, the web 5 travels over a guide roller 87, under a guide roller 88 and over a guide roller 89. The guide roller 88 is adjustable in space with respect to guide rollers 87 and 89 by means of as crew 90 and hand wheel 91 in order to change the length of the web 5 between the lines of contact with printing plates 81 and 82 to maintain registry between the printed impressions.

Pull-out tension rollers 92 and 92' cooperate to keep the web 5 under a constant tension subsequent to its exit from the feed rollers 44 and 45. The roller 92' is driven by means of main shaft 22 and appropriate gearing and shafting 93 and through a slip clutch 94 of a well known design which is adjustable to transmit a desired torque. The tension roller 92 is an idler which turns due to friction with the web 5, the roller 92' providing the motive force. The roller 92' tends to run at a peripheral speed slightly above the speed at which the web is delivered from the feed rollers 44 and 45 so that some clutch slip-
 40 page will always occur for stability. A constant tension is maintained upon web 5, whether it is stationary or in the process of being printed, since, when the web is stationary, the clutch 94 will merely slip at a greater rate but still deliver the same torque to tension roller 92'.

On the downstream side of the pull-out tension rollers 92 and 92', the web 5 is directed over a support 95 and then between a stationary knife 96 and a flying cutter knife 97, which cooperate to cut the web 5 into sheets. The sheets are subsequently fed into conveyor means 98 and 99 and then into a stacking receiver 100 in a conventional manner.

By way of explanation, when the cam follower 60 is in contact with the greater diameter portion 68' of the cam 62 the web is being driven by the feed rollers 44 and 45 and is passing between the open clamping members 56 and 57. During this interval, the printing plates 81 and 82 are in contact with the web 5 for printing impressions thereon. When the depression 68 is in contact with the cam follower 60, the feed rollers 44 and 45 have released their grip upon the web 5 and the clamp members 56 and 57 hold the web 5 motionless, during which time the portions of the printing cylinders 77 and 78 which are not covered by printing plates 81 and 82 pass over the stationary web 5. During the interval when the web is stationary, the infeed roller 16 continues to feed the web 5 into the the press and the excess web is stored by the storage mechanism 24 which delivers the correct length of the web during the printing interval. Thus, it can be seen that printing forms may be spaced immediately adjacent each other on the web 5, although the printing plates 81 and 82 do not cover the entire periphery of the printing cylinders 77 and 78.

If, after printing, the web 5 is to be re-rolled instead of sheeted the apparatus illustrated in FIG. 2 may be

used, wherein a guide roller 101 directs the web 5 under, through and over an oscillating storage mechanism 102 similar to the storage mechanism 24 described hereinabove. A bumper 102' limits the counterclockwise travel of the storage means 102. The rewind unit comprises a bearing standard 103 which supports a shaft 104 on which is mounted for rotation therewith printed roll 105. The rewind unit is powered by a motor 106 through a variable torque clutch 107 and suitable shafting and gearing 108.

The clutch 107 is of a well known design which delivers a torque output proportional to the voltage impressed upon it. An idler roller 109 is mounted upon an arm 110 which is pivotally supported by the bearing standard 103 at the arm end 111 opposite the idler roll 109. The arm 110 is biased toward the surface of the printed roll 105 by a spring 112 so that the idler roll 109 is always in contact with the surface of said printed roll. A rheostat arm 113 is adapted to move with arm 110 upon a rheostat 114 whereby, as the printed roll becomes larger, the resistance in the electrical circuit feeding clutch 107 becomes smaller with a corresponding increase in voltage across clutch 107 and a corresponding increase in torque output to compensate for the increased diameter of the printed roll 105.

The web 5 is delivered from the pull-out tension rolls 92 and 92' in a pulsating motion corresponding to the clamping and release of the web clamp members 56 and 57. During the periods of delivery, the storage mechanism 102 oscillates counterclockwise to take up the excess web and during the clamped period the web 5 is delivered from the storage mechanism 102 by a clockwise oscillation thereof. It is, thus, apparent that the storage means 102 acts as an averaging device which smooths out the pulsating delivery characteristics of the press and permits the printed roll 105 to be wound at a substantially constant speed, which is generally necessary due to its relatively high mass.

It is noted that the web feeding mechanism described above can be adapted to feed web material into a platen type press, however, the printing will then occur during the clamped period.

It is to be understood that while I have illustrated and described one form of my invention, it is not to be limited to the specific form or arrangement of parts herein described and shown except insofar as such limitations are included in the claims.

What I claim and desire to secure by Letters Patent is:

1. A web-feeding apparatus comprising in combination, web infeeding means and web storage means, said infeeding means feeding a web at a substantially constant rate into said storage means; said storage means having arms supporting lightweight rollers on the ends thereof to form a rectangular structure adapted to receive said web and resiliently urge same in a bent path, said structure oscillating about said arms in opposite directions in response to an increase and decrease respectively in the tension of the web; variable speed drive means operatively connected to and driving said infeeding means, means controlling the speed of said drive means and hence the feeding rate of said infeeding means in response to the extent of oscillation of said structure; web-feeding means receiving said web from said storage means, said web-feeding means cycling alternately between a web-feeding and a non-feeding state in timed relation to said storage means oscillation; means operatively connected to said web-feeding means for retarding said web during said non-feeding state; and tension means downstream from said retarding means applying a substantially constant tension to said web, whereby said web travels between said web retarding means and said tension means in an intermittent motion.

2. In a rotary printing press of the type adapted to selectively control the distance between impressions on the web and having a mechanism for storing a varying length

of web during each printing cycle, the improvement comprising; an infeed roller having a circumferential surface, at least one guide roller for holding the web in contact with a substantial portion of said circumferential surface, variable speed rotary drive means operatively connected to said infeed roller for driving said infeed roller, and control means operatively associated with and actuated by said storage mechanism for decreasing the output speed of said drive means in response to an increase over a predetermined maximum length of web in said storage mechanism during a printing cycle and increasing the output speed of said drive means in response to a decrease under a predetermined minimum length of web in said storage mechanism during a printing cycle whereby the infeed speed of web is automatically adjusted to press demand.

3. In a rotary printing press of the type adapted to selectively control the distance between impressions on a web and having a mechanism for storing a varying length of web during each printing cycle, the improvement comprising; an infeed roller having a circumferential surface, at least one guide roller for holding the web in contact with a substantial portion of said circumferential surface, rotary drive means, a variable speed transmission operatively connected between said drive means and said infeed roller, and control means operatively associated with and actuated by said storage mechanism for increasing the input-output speed ratio of said transmission in response to an increase over a predetermined maximum length of web in said storage mechanism during a printing cycle and decreasing the input-output speed ratio of said transmission in response to a decrease under a predetermined minimum length of web in said storage mechanism during a printing cycle, whereby the infeed speed of web is automatically adjusted to press demand.

4. The apparatus of claim 3 wherein said variable speed transmission is a positive infinitely variable speed transmission.

5. In a rotary printing press of the type adapted to selectively control the distance between impressions on the web, an infeed roller adapted for frictional feeding contact with the web, variable speed rotary drive means operatively connected to said infeed roller for driving same, web storage means located downstream from said infeed roller for receiving web therefrom and having at least one guide roller thereon for contacting said web and urging same into a bent path, said storage means being resiliently mounted for movement in opposite directions respectively along a path in response to an increase and decrease in tension on the web therein, and control means located at opposite ends of said storage means path and actuated in response to the movement of said storage means for decreasing the output speed of said drive means in response to an increase over a predetermined maximum length of web in said storage means and increasing the output speed of said drive means in response to a decrease under a predetermined minimum length of web in said storage means.

6. The apparatus of claim 1 including a second web storage means having arms supporting lightweight rollers on the ends thereof to form a rectangular structure adapted to receive said web and resiliently urge same in a bent path, said second web storage means being located downstream from said tension means for smoothing said web intermittent motion.

References Cited in the file of this patent

UNITED STATES PATENTS

1,282,131	Smith	Oct. 22, 1918
1,653,199	Belcher	Dec. 20, 1927
1,978,073	Belcher	Oct. 23, 1934

FOREIGN PATENTS

1,034,657	Germany	July 24, 1958
-----------	---------	---------------