

April 2, 1963

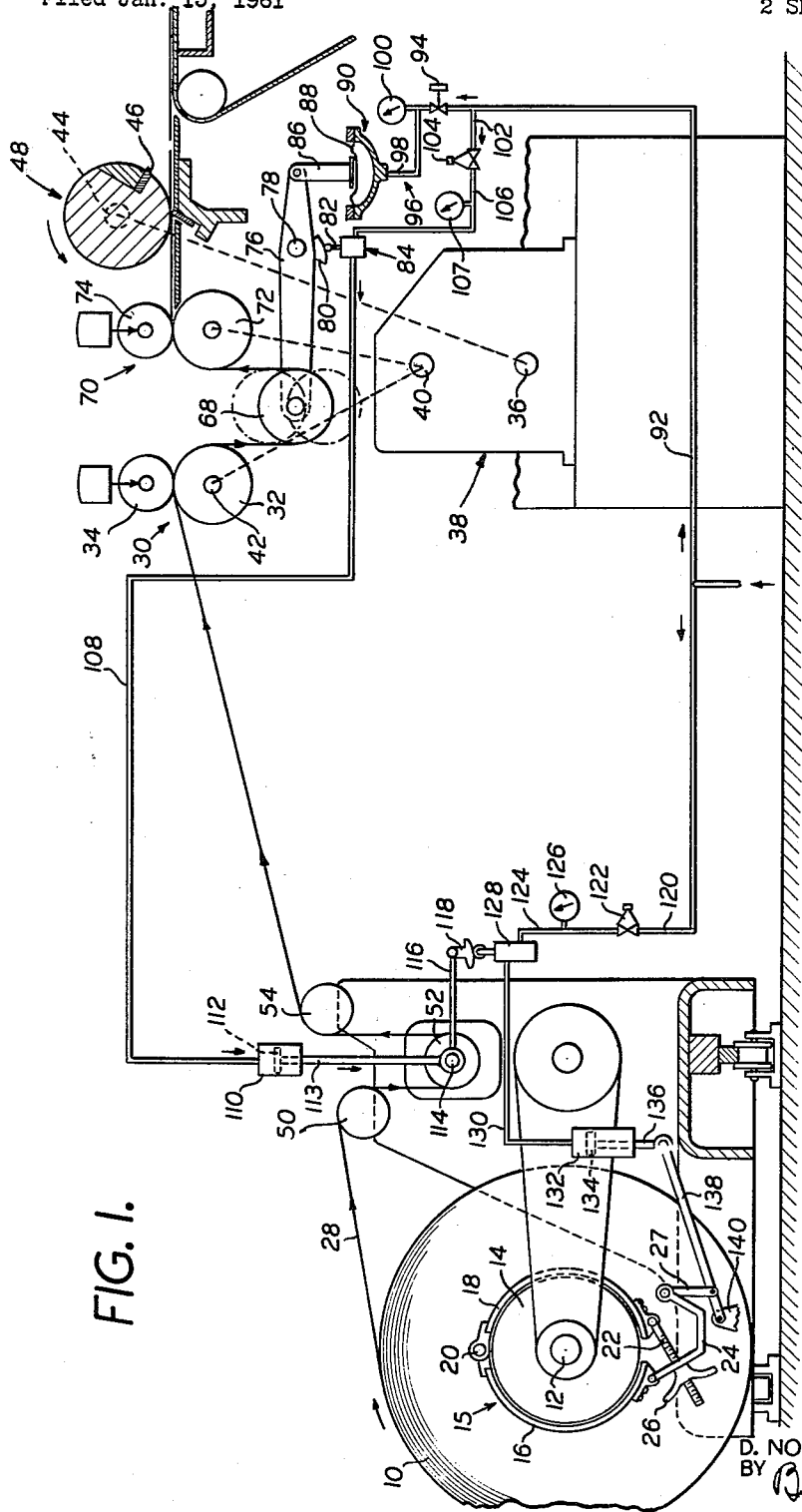
D. N. OBENSHAIN

3,083,602

PRECISE WEB METERING DEVICE

Filed Jan. 13, 1961

2 Sheets-Sheet 1



INVENTOR
D. NOEL OBENSHAIN
BY *Berry & Crews*
ATTORNEYS.

April 2, 1963

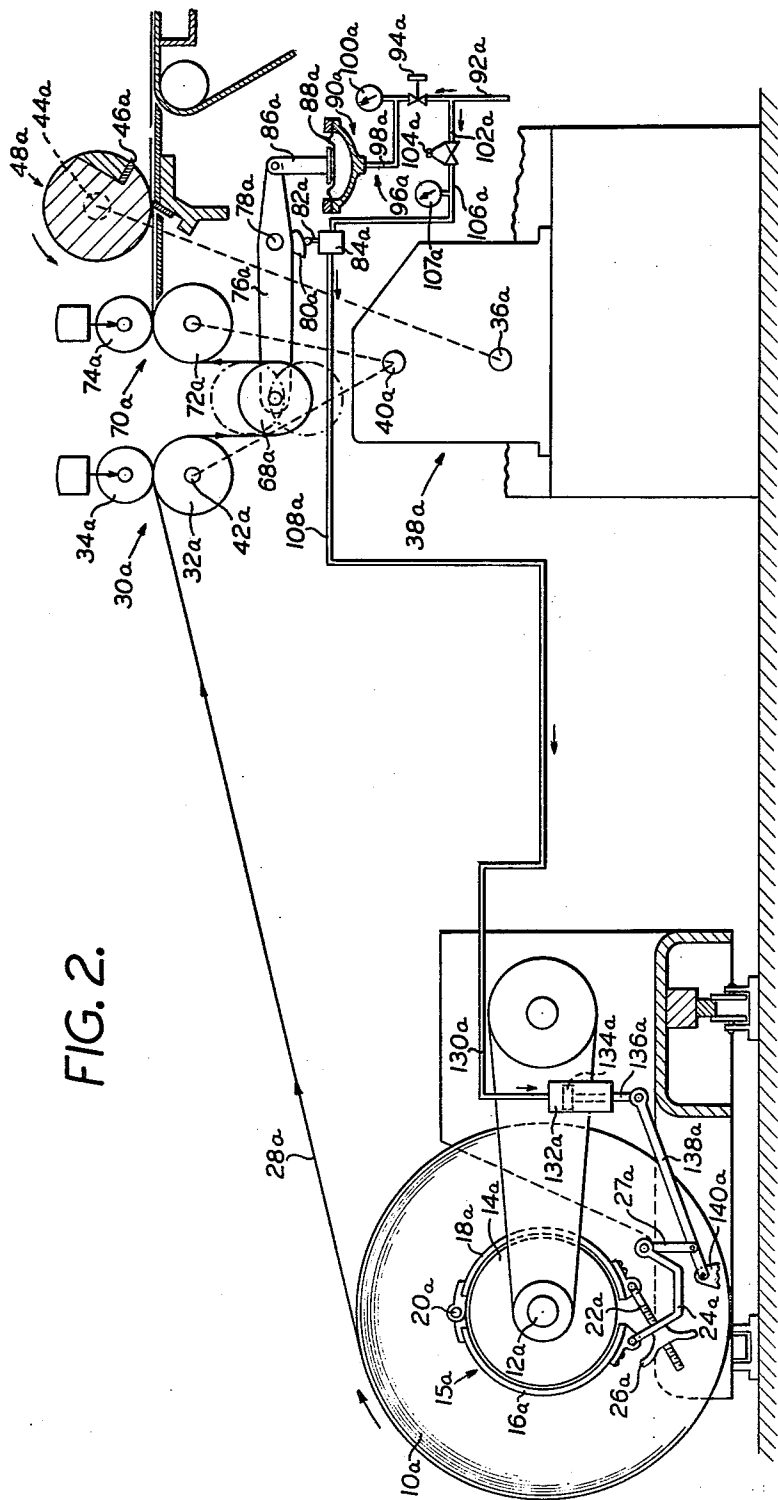
D. N. OBENSHAIN

3,083,602

PRECISE WEB METERING DEVICE

Filed Jan. 13, 1961

2 Sheets-Sheet 2



INVENTOR
D. NOEL OBENSHAIN

BY
Perry & Brews
ATTORNEYS.

1

3,083,602

PRECISE WEB METERING DEVICE

David Noel Obenshain, Luke, Md., assignor to West Virginia Pulp and Paper Company, New York, N.Y., a corporation of Delaware

Filed Jan. 13, 1961, Ser. No. 82,488

8 Claims. (Cl. 83-75)

This invention relates to mechanism for feeding web material, such as paper, from a reel, and cutting it to selected sheet lengths. The invention is characterized by the fact that the sheets are cut with such uniformity and precision that the cut material is ready for packing and shipping without the need for corrective trimming by a guillotine cutter and without the waste of material and extra handling which such corrective trimming entails.

According to conventional practice a web of paper is conventionally drawn at high speed from a reel under somewhat variable tension and is put under additional tension to eliminate waviness and wrinkles, being then fed out free of tension for severance by a flying cutter. The length of untensioned web fed out in a cutter cycle determines the length of sheet cut, and this may be varied to yield any one of a large number of selected lengths over a wide range. The procedure described promotes uniformity of length for any chosen sheet length, and it also promotes dimensional stability of the sheets, but it has been found not to be ideal, and to be susceptible of further improvement.

When a web is drawn from a reel by a feed couple, the paying out of the web is variably resisted by the reel because the radius of the reel diminishes progressively. This requires the reel to be turned more rapidly as the radius shrinks in order to maintain the linear rate of feed substantially undiminished. It also reduces the radius or effective lever arm through which the pull on the web is applied to the turning of the reel. Both of these factors tend progressively to increase the pull which must be applied by the web to the reel, and hence tend to increase the tension. In partial compensation, the mass of the reeled material diminishes progressively. The total effect, in the absence of automatic compensation, is progressively to increase the tension, and hence the stretched condition, of the unwinding web.

The length of tension free web delivered in a cutting cycle by a constantly operating feed couple varies inversely with the stretched condition of the web as it arrives at the feed couple. It is desirable, therefore, to maintain a constant tension on the unwinding web in the interest of promoting constant stretch and a constant rate of feed. This is commonly attempted and crudely approximated by providing a reel brake which is made subject to control by a web loop riding roller, the braking force applied varying with, and being characteristic of, the position of the roller; i.e., the length of the web loop. In a system of this kind, corrective adjustment of the brake can only be realized when the web riding roller is in a position too low or too high for steadily maintaining the required brake pressure. It follows that the tension necessarily varies, that the uniformly acting feed couple acts on variably stretched web, and that the sheets cut vary in length. This result is aggravated by hunting on the part of the web riding roller.

It is a primary object of the present invention to contrive a system in which the web is constantly fed under predetermined tension toward the tension free cutting zone by a positively driven, positively gripping feed couple whose feed rate per cutting cycle bears the same ratio to the intended sheet length that the length of a given quantity of stretched web under the constant tension bears to the length of the same quantity of unstretched web.

By making the uniform tension a relatively high but safe

2

tension, waviness and wrinkles are eliminated, and at the same time the length of untensioned web fed out in a cutting cycle may be limited to a range of error of not more than $\pm .02$ percent.

In the accomplishing of this purpose it is a feature that the web is fed first through an unwinding zone of moderate but somewhat variable tension, then through a constant, high tension zone, and finally into a tension free cutting zone. The constant tension zone is provided between the unwinding zone and the cutting zone, being bounded at its introductory end by one positively driven, positively gripping feed couple and at its exit end by a second positively driven, positively gripping feed couple.

The first feed couple pulls the moderately stretched web through the unwinding zone at a faster rate than the intended sheet length per cutter cycle, but at a rate calculated to produce, under the average tension maintained in the unwinding zone, the equivalent of the predetermined untensioned sheet length per cutter cycle. The second feed couple pulls the highly tensioned web through the constant tension zone at a faster rate than that at which it is pulled through the unwinding zone, the feed rate being calculated to produce under the constant tension maintained in the high tension zone, the equivalent of the predetermined untensioned sheet length per cutter cycle.

The constant tension is maintained in the high tension zone by a loaded web riding roller, the loading being adjustable, but being normally maintained constant at the exact value calculated to produce the tensioned length of web feed per cutter cycle which is equivalent to the untensioned sheet length required. It is, however, a feature of the invention that the loading of the web riding roller can be readjusted with the machine in operation if it is found that the sheets are being consistently cut longer than intended or shorter than intended.

The web riding roller of the high tension zone will rise when the tension in the unwinding zone is above the optimum and will fall when the tension in the unwinding zone is below the optimum. Deviation of tension in the unwinding zone does not affect the tension in the high tension zone, but only the rate at which the web is fed into that zone. Rise and fall of the web riding roller in the high tension zone is used to regulate correctively the tension in the unwinding zone, automatically increasing the tension progressively as the roller moves downward and automatically diminishing the tension progressively as the roller moves upward. Since an increase of tension in the unwinding zone diminishes the rate of web delivery to the high tension zone, the effect of the automatic control is to maintain the tension in the unwinding zone not far from the desired average tension, and to maintain the web riding roller within a free riding, operative range of movement.

Other objects and advantages will hereinafter appear.

In the drawing forming part of this specification,

FIGURE 1 is a view in side elevation of one practical and advantageous illustrative form of mechanism which embodies the principle of the invention;

FIGURE 2 is a view similar to FIGURE 1 of a second practical and advantageous illustrative form of mechanism which embodies the principle of the invention.

In the illustrative machine of FIGURE 1 a paper reel 10 is supported in part upon, and is connected to, a spindle 12. The spindle 12 has driving connection with a brakedrum 14. Brakeshoes 16 and 18, pivotally connected to one another at 20, substantially surround the brakedrum but are spaced from one another at their free ends. A threaded rod 22 which is pivotally connected to the free end of the brakeshoe 18, extends freely through a lever 24 which is pivotally connected to the free end of the brakeshoe 16. A wingnut 26, screwed

3

on the threaded roller 22, constitutes an adjustable fulcrum for the lever 24, so that a downward pull on the free end of the lever 24 through a pivotally connected link 27 serves to tighten the brakeshoes 16 and 18 on the drum 14 and thus to exert a braking force upon the reel which varies with the magnitude of the downward pull exerted on the lever.

The paper web 28 is drawn from the reel 10 by a positively driven feed couple 30. The couple 30 consists of a driving roller 32 and an opposed idler roller 34. The roller 32 is positively driven from a primary input shaft 36 through a positive change gear unit 38, the output shaft 40 of which is linearly connected to drive the shaft 42 and the roller 32. The primary input shaft 36 is linearly connected to drive a shaft 44 which carries the rotary blade 46 of the flying cutter 48.

The feed couple 30 draws the web 28 over a bodily fixed roller 50, beneath a web riding roller 52, and over a bodily fixed roller 54. The feed couple 30 marks the end of the unwinding zone and the beginning of a high tension zone in which a constant tension is maintained.

From the couple 30 the web 28 passes beneath a web riding roller 68, and thence through a positively driving feed couple 70 which comprises a driving roller 72 and an idler roller 74. The roller 72 is driven from the output shaft 40 of the change gear unit 38 at the same rotary speed as the roller 32 of the couple 30, but at a higher peripheral speed than the roller 32 by virtue of the fact that the roller 72 is of somewhat larger diameter than the roller 32. The couple 70 marks the end of the constant, high tension zone and the beginning of the tension free cutting zone.

The roller 68 is pneumatically loaded to exert a uniform, selected tension on the web in the high tension zone. With the diameter of the roller 72 determined and fixed, the tension chosen is determined by reference to the stretchability of the paper, this, in turn, being a combined function of the width of the web, and the stretchability per inch of width for each pound of tension. The roller 68 is rotatably supported in corresponding ends of identical, parallel carrying levers 76 which are fast upon opposite ends of a fulcrum rock shaft 78. The shaft 78 also has fast upon it a cam 80 which acts upon a movable plunger 82 of a pressure regulator 84. The ends of the levers 76 remote from the roller 68 are pivotally connected with stems 86 of deformable diaphragms 88 which form movable walls of pressure loading housings 90.

Air maintained under a suitable fixed source pressure, say of ninety pounds per square inch, is made available at that pressure through a conduit 92. The air in the conduit 92 is admitted through a manually adjustable pressure reducing valve or pressure regulator 94 to a closed system 96, which includes a conduit 98 and the housing 90. A gauge 100 indicates the pressure in the closed system and guides the operator in setting the pressure regulator. It has been found desirable, for some applications at least, to cause the web to be stretched in the high tension zone to a length of approximately 100.21% of the untensioned length of the web, or in the ratio of 36.076 to 36. The size of the roller 72 is, therefore, so chosen that 36.076 inches of tensioned web will be drawn through the high tension zone per revolution of the roller 72 and will be fed out to the cutting zone as 36 inches of untensioned web.

Though the tension is maintained substantially without variation in the high tension zone, the continuous precise feeding out of 36 inches of untensioned web per revolution of the roller 72, would result only if the stretch characteristics of the paper were absolutely uniform. No paper has absolutely constant stretch characteristics. It has been found, however, that variations are so slight that accuracy within a range of $\pm 0.02\%$ can be dependably realized.

It is necessary, of course, that the web be fed into the high tension zone at the same average effective rate

4

(equivalent to 36 inches of untensioned web per revolution of the rollers 32 and 72) at which it is paid out to the cutting zone. The rate at which the web is furnished to the high tension zone depends upon the diameter of the roller 32 and the average tension or stretch of the web in the unwinding zone. The diameter of the roller 32 is not subject to change, but the tension of the web in the unwinding zone is adjusted and regulated by the rise and fall of the roller 68 in such a way that the equivalent of 36 inches of untensioned web will be delivered, on the average, per revolution of the roller 32, with so little deviation from the average that the roller 68 is maintained at all times within an operative range.

A side outlet 102 from the conduit 92 communicates through a manually adjustable reducing valve or pressure regulator 104 with a conduit 106, the operator being guided by a pressure gauge 107. The conduit 106 communicates through the pressure regulator 84 (controlled through cam 80 from roller 68) with a conduit 108 which leads to a pair of air cylinders 110. Each cylinder 110 surrounds a cooperating piston 112, and each piston is connected through a piston rod 113 with one end of a shaft 114, which shaft is carried by the roller 52 with freedom for relative rotation of the shaft and roller. The shaft 114 is connected through an operating arm 116 with a cam which is rockably mounted on a fixed axis.

The pneumatically loaded web riding roller 52 determines the tension of the web in the unwinding zone under normal operating conditions. If the roller 68 of the constant tension zone moves downward, this signifies that the web is being fed too rapidly into the constant tension zone and hence that the tension in the unwinding zone should be increased. The counterclockwise rocking of the cam 80 operates the regulator 84 to increase the loading of the roller 52 and hence to increase the stretch of the web in the unwinding zone. Since the unstretched equivalent of the amount of web delivered by the couple 30 during one revolution of the roller 32 is inversely proportional to the stretch of the web in the unwinding zone, the rate of delivery of the web to the constant tension zone is reduced until the roller 68 ceases to move downward. When the roller 68 moves upward, the same principle of operating prevails, the roller continuing to move upward until the tension in the unwinding zone has been so far reduced that the roller 68 ceases to move upward.

In order for tension to be applied to the web in the unwinding zone in the manner described it is necessary, of course, for the reel and brake to provide an adequate resistance to web feeding. An air conduit 120 in free communication with the constant pressure source communicates through a manually settable reducing valve or regulator 122 with a conduit 124. A pressure gauge 126 guides the operator in the setting of the regulator 122. The conduit 124 communicates with a pressure regulator 128, the movable operator of which is engaged and operated by the cam 118. The regulator 128 communicates through a conduit 130 with the upper, closed end of a cylinder 132. A piston 134 within the cylinder 132 is connected through a piston rod 136 to operate a lever arm 138 to which it is pivotally connected. The arm 138 is rockably supported at one end on a fixed frame member 140 and is pivotally connected intermediate its ends to the lower end of the link 27 through which the brake is operated.

With the arrangement described, the braking force is increased so long as the roller 52 continues to move downward but is diminished as the roller 52 moves upward. The brake adjustment is, therefore, regulated to meet the needs of the loaded roller 52, that is, to produce a resistance to unwinding of the web just sufficient to sustain the loaded roller but never sufficient to cause the roller to move rapidly upward or to move upward or downward to a position at which the free riding of the loop by the roller is interfered with. The loading of the roller 52 is, in turn, so regulated that the requirements of the roller

5

68 are satisfied, the feeding conditions in the unwinding zone being never far enough from parity with the feed conditions in the constant tension zone to cause the roller 68 to move rapidly upward or downward or to attain a position in which the free riding of the loop by the roller 68 is interfered with.

There must be a substantial tension in the unwinding zone at all times, but there is no need for providing a tension so high as that of the constant tension zone. With the control means shown and described properly set to produce tension in the desired range, the ratio of average tension in the unwinding zone to the constant tension in the high tension zone can be determined and maintained by proportioning the size of the roller 32 to the size of the roller 72. By making the circumference of the roller 32 36.050 inches as against a circumference of 36.076 inches for the roller 72, an untensioned web length of 36 inches will be stretched on the average to 36.050 inches in the unwinding zone as against a constant stretched length of 36.076 inches in the constant tension zone.

The fact that the tension varies in the unwinding zone does not sensibly affect the tension in the high tension zone because the tension in the latter zone is at all times controlled solely by the set loading of the roller 68.

For a web of given width and stretch characteristics, the pressure regulator settings would be the same for any length of sheet within the range of the change speed unit 38. Neither is the uniformity of sheet length adversely affected by increasing or diminishing the speed of operation of the primary drive shaft 36. In the event of web breakage, in either the unwinding zone or the constant tension zone, the roller 52 will drop rapidly beyond the normal operative range and the brake will be jammed on hard to stop the rotation of the reel without uselessly unwinding an excessive quantity of paper.

The mechanism described is unique in that automatic correction of the web feed rate in the unwinding zone, to maintain the desired average, does not depend upon a deviation of tension or of web feed rate in the high tension zone, and hence does not depend upon any ultimate deviation of sheet length from the intended norm.

A modified mechanism is shown in FIGURE 2. This mechanism is generally like that of FIGURE 1. Corresponding reference numerals have accordingly been applied to corresponding parts with the subscript *a* added in each instance, and the description will be confined to the features in which the mechanisms of FIGURE 1 and FIGURE 2 differ from one another.

The pressure loaded, web riding roller 52 which is provided in the unwinding zone of FIGURE 1 is omitted in FIGURE 2, along with the pressure cylinder 110 and the associated mechanism for adjustably loading the roller, and the pressure regulator 128 and the mechanism for controlling the regulator 128 from the roller 52.

In place of the omitted mechanism, provision is made for controlling the reel brake 15*a* directly from the pressure loaded web riding roller 68*a* of the constant tension zone. The cam 80*a* is operated from the roller 68*a* through arms of the levers 76*a* and, through a cam 30*a*, controls pressure regulator 84*a*. The pressure regulator 84*a* is directly connected through conduit 108*a* to the cylinder 132*a* through which the brake pressure is controlled.

When the roller 68*a* moves downward, indicating that the web is being fed into the constant tension zone at too high a rate because of subnormal tension in the unwinding zone, an increased pneumatic pressure is transmitted to the cylinder 132*a*, the brake is applied more forcibly, and the tension and stretch in the unwinding zone are increased until the roller 68*a* ceases to move downward. When the roller 68*a* moves upward, indicating that the web is being fed into the constant tension zone at too low a rate because of excessive tension and stretch in the unwinding zone, a diminishing pneumatic pressure is transmitted to the cylinder 132, the brake is applied less

6

forcibly and the tension and stretch in the unwinding zone are diminished until the roller 68*a* ceases to move upward.

As between the forms of mechanism of FIGURES 1 and 2, the form of FIGURE 2 is preferred for its simplicity, and is highly satisfactory when relatively small, light reels are to be dealt with. For a comparatively heavy reel, however, having a weight of the order of eight thousand pounds, a more satisfactory and prompt braking of the reel is realized with the mechanism of FIGURE 1 in the event of web breakage. When the web breaks in the unwinding zone, the reel is braked more promptly and effectively with the FIGURE 1 form of mechanism, regardless of the weight of the reel, because a maximum application of the brake is immediately effected and does not have to wait for the broken trailing end of the web to enter the constant tension zone.

While certain preferred embodiments of the invention have been illustrated and described in detail, it is to be understood that changes may be made therein and the invention embodied in other structures. It is not, therefore, the intention to limit the patent to the specific construction illustrated, but to cover the invention broadly in whatever form its principles may be utilized.

I claim:

1. Mechanism for unreeling, feeding out and periodically cutting web material into sheets of substantially uniform, selected length, comprising, in combination, a web reel, a flying cutter, web feeding means including a plurality of positively acting feed couples which divide the web feed path into at least three successive zones, the penultimate zone being a constant tension zone disposed between feed couples, and the final zone being a tension free zone following the last of the feed couples and in which the cutter is located and acts periodically, a web-loop-riding roll disposed in the constant tension zone, means driving the final feed couple at a constant feed rate so related to the tension of the constant tension zone that the chosen length of untensioned web will be fed out to the cutter by said couple in each cutter cycle, means operatively associated with said web riding roll of the constant tension zone and controlled thereby progressively to increase the web tension and the stretch in the next preceding zone as the roller carrying web loop of the constant tension zone increases in length, so to reduce the quantity rate at which the web is delivered into the constant tension zone by the constantly running feed couple at the introductory end thereof, and progressively to diminish the web tension and stretch in the next preceding zone as the roll carrying loop of the constant tension zone diminishes in length, so to increase the quantity rate at which the web is delivered into the constant tension zone by the constantly running feed couple at the introductory end thereof, and means overdriving the feed couple at the introductory end of the constant tension zone at a feed rate which exceeds the chosen sheet length per cutter cycle in a fixed ratio, the overdriving ratio serving automatically to determine and maintain a prescribed average web tension and average web stretch in the zone which immediately precedes the constant tension zone.

2. Mechanism for unreeling, feeding out and uniformly cutting web material into sheets of any chosen one of a wide variety of available selected lengths, comprising, in combination, a web reel, a flying cutter, web feeding means comprising a pair of positively acting feed couples which divide the web feed path into three successive zones, the first an unwinding zone running from the reel to the first feed couple, the second a constant tension zone disposed between the feed couples, and the third a tension free zone following the second of the feed couples and in which the cutter is located and acts periodically, a web loop riding roll disposed in the second zone, means driving the second feed couple at a constant feed rate so related to the tension of the constant tension zone that

the chosen length of untensioned web will be payed out to the cutter in each cutter cycle, means operatively associated with said web riding roll and controlled by it progressively to increase the web tension and the stretch in the unwinding zone as the roll carrying web loop of the constant tension zone increases in length, so to reduce the quantity rate at which the web is delivered into the constant tension zone by the constantly running first feed couple, and progressively to diminish the web tension and the stretch in the unwinding zone as the roll carrying web loop of the constant tension zone diminishes in length, so to increase the quantity rate at which the web is delivered into the constant tension zone by the constantly running first feed couple, and means overdriving the first feed couple at a peripheral rate which exceeds the chosen sheet length per cutter cycle, the overdriving ratio serving automatically to determine and maintain a prescribed average web tension and web stretch in the unwinding zone.

3. Mechanism for unreeling, feeding out and periodically cutting web material into sheets of substantially uniform length comprising, in combination, a web reel, a flying cutter, web feeding means including a pair of positively acting feed couples which divide the web feed path into three successive zones, the first an unwinding zone of relatively low web tension running from the reel to the first of the feed couples, the second a high tension zone disposed between the feed couples, and the third a tension-free zone following the second of the feed couples and in which the cutter is located and acts periodically, means overdriving the second feed couple at a constant feed rate which exceeds by a small but definite amount the chosen sheet length per cutter cycle, a loaded, web-loop-riding roll disposed in the second zone, means for adjusting the loading of the web-loop-riding roll to select and maintain a constant web tension in the second zone which will cause the web to be stretched in that zone in the same ratio in which the second feed couple is overdriven, means operatively associated with said web riding roll of the second zone and controlled thereby progressively to increase the web tension in the unwinding zone as the roller carrying web loop of the high tension zone increases in length and progressively to diminish the web tension in the unwinding zone as the roller carrying loop of the high tension zone diminishes in length, and means overdriving the first feed couple at a constant feed rate which exceeds the chosen sheet length per cutter cycle but which falls substantially below the feed rate of the second feed couple.

4. Mechanism for unreeling, feeding out and periodically cutting web material into sheets of substantially uniform length comprising, in combination, a web reel, a brake therefor, a flying cutter, web feeding means including a pair of positively acting feed couples which divide the web feed path into three successive zones, the first an unwinding zone of relatively low web tension running from the reel to the first of the feed couples, the second a high tension zone disposed between the feed couples, and the third a tension free zone following the second of the feed couples and in which the cutter is located and acts periodically, means overdriving the second feed couple at a constant feed rate which exceeds by a small but definite amount the chosen sheet length per cutter cycle, a loaded, web-loop-riding roll disposed in the second zone, means for adjusting the loading of the web-loop-riding roll to select a web tension in the second zone which will cause the web to be stretched in that zone in the same ratio in which the second feed couple is overdriven, means operatively associated with said web riding roller of the second zone and controlled thereby progressively to increase the force with which the reel brake is applied and thus to increase the web tension in the unwinding zone as the roller carrying web loop of the high tension zone increases in length and progressively to diminish the force with which the reel brake is applied

and thus to diminish the web tension in the unwinding zone as the roller carrying loop of the high tension zone diminishes in length, and means overdriving the first feed couple at a constant feed rate which exceeds the chosen sheet length per cutter cycle but which falls substantially below the feed rate of the second feed couple.

5. Mechanism for unreeling, feeding out and periodically cutting web material into sheets of substantially uniform length comprising, in combination, a web reel, a flying cutter, web feeding means including a pair of positively acting feed couples which divide the web feed path into three successive zones, the first an unwinding zone of relatively low web tension running from the reel to the first of the feed couples, the second a high tension zone disposed between the feed couples, and the third a tension free zone following the second of the feed couples and in which the cutter is located and acts periodically, means overdriving the second feed couple at a constant feed rate which exceeds by a small but definite amount the chosen sheet length per cutter cycle, a web-loop-riding roll disposed in the second zone, pneumatic loading means for the web-loop-riding roll, means for adjusting the pneumatic loading means to select and maintain a web tension in the second zone which will cause the web to be stretched in that zone in the same ratio in which the second feed couple is overdriven, means operatively associated with said web riding roll of the second zone and controlled thereby progressively to increase the web tension in the unwinding zone as the roller carrying web loop of the high tension zone increases in length and progressively to diminish the web tension in the unwinding zone as the roller carrying loop of the high tension zone diminishes in length, and means overdriving the first feed couple at a constant feed rate which exceeds the chosen sheet length per cutter cycle but which falls substantially below the feed rate of the second feed couple.

6. Mechanism for unreeling, feeding out and periodically cutting web material into sheets of substantially uniform length comprising, in combination, a web reel, a brake therefor, a flying cutter, web feeding means including a pair of positively acting feed couples which divide the web feed path into three successive zones, the first an unwinding zone of relatively low web tension running from the reel to the first of the feed couples, the second a high tension zone disposed between the feed couples, and the third a tension free zone following the second of the feed couples and in which the cutter is located and acts periodically, means overdriving the second feed couple at a constant feed rate which exceeds by a small but definite amount the chosen sheet length per cutter cycle, a web-loop-riding roll disposed in the second zone, pneumatic loading means for the web-loop-riding roll, means for adjusting the pneumatic loading means to select and maintain a web tension in the second zone which will cause the web to be stretched in that zone in the same ratio in which the second feed couple is overdriven, means overdriving the first feed couple at a constant feed rate which exceeds the chosen sheet length per cutter cycle but which falls substantially below the feed rate of the second feed couple, a pneumatic actuator for the reel brake, and pneumatic control means for said actuator associated with the web-loop-riding roll and controlled thereby to increase the braking effect and thereby increase the tension in the unwinding zone as the web loop increases in length and to diminish the braking effect and thereby diminish the tension in the unwinding zone as the web loop diminishes in length.

7. Mechanism for unreeling, feeding out and periodically cutting web material into sheets of substantially uniform length comprising, in combination, a web reel, a brake therefor, a flying cutter, web feeding means including a plurality of positively acting feed couples which divide the web feed path into at least three successive zones, the first and unwinding zone running from the reel to the first of the feed couples, the penultimate zone a

zone of constant tension, and the ultimate zone a tension free zone following the last of the feed couples and in which the cutter is located and acts periodically, a web-loop-riding roller disposed in the penultimate zone and maintaining the tension in said zone constant, means driving the final feed couple at a constant feed rate so related to the tension in the constant tension zone that the chosen sheet length of untensioned web will be delivered by said feed couple in each cutter cycle, a further web-loop-riding roll in the zone which precedes the constant tension zone, means operatively associated with said web-loop-riding roll of the constant tension zone and controlled thereby progressively to increase the loading of the web-loop-riding roll in the preceding zone as the roller carrying web loop of the constant tension zone increases in length and progressively to diminish the loading of the web-loop-riding roll in the preceding zone as the roller carrying loop of the constant tension zone diminishes in length, means overdriving the feed couple between the constant tension zone and the zone which precedes it at a constant feed rate which exceeds by a substantial amount the chosen sheet length per cutter cycle, an actuator for the reel brake, and means controlled by the further web-loop-riding roll to cause the actuator to increase the braking action as the loop which carries the further roll increases in length and to diminish the braking action as such loop diminishes in length.

8. Mechanism for unreeling, feeding out and periodically cutting web material into sheets of substantially uniform length comprising, in combination, a web reel, brake therefor, a flying cutter, web feeding means including a pair of positively acting feed couples which divide the web feed path into three definite zones, the first an unwinding zone of relatively low tension running from the reel to the first of the feed couples, the second a high tension zone disposed between the feed couples, and the third a tension free zone following the second of the feed couples and in which the cutter is located and acts periodically, a loaded, web-loop-riding roller disposed

in the high tension zone and maintaining the web tension in said zone constant, means overdriving the second feed couple at a constant feed rate which exceeds by a small but definite amount the chosen sheet length per cutter cycle, means for adjusting the loading of the web riding roller to select a tension in the constant tension zone which will cause the web to be stretched in the same ratio that the second feed couple is overdriven, means overdriving the first feed couple at a constant feed rate which exceeds the chosen sheet length per cutter cycle but which falls substantially below the feed rate of the second feed couple, a further web-loop-riding roller in the unwinding zone, a variable loading means for said further web-loop-riding roll, means operatively associated with said web-loop-riding roll of the high tension zone and controlled thereby progressively to increase the loading of said further web-loop-riding roll for increasing the tension in the unwinding zone as the roller carrying web loop of the high tension zone increases in length and progressively to diminish the loading of said further web-loop-riding roll for diminishing the tension in the unwinding zone as the roller carrying loop of the high tension zone diminishes in length, a pressure applying actuator for the reel brake, and control means for said actuator associated with the further web-loop-riding roll and controlled thereby to increase the braking effect as the loop which carries the further roll increases in length, and to diminish the braking effect as the loop which carries the further roll diminishes in length.

References Cited in the file of this patent

UNITED STATES PATENTS

2,460,694	Haswell	Feb. 1, 1949
2,612,950	Ewing	Oct. 7, 1952
2,623,703	Laycock	Dec. 30, 1952
2,981,134	Johnson	Apr. 25, 1961
2,988,297	Pawlowski	June 13, 1961