United States Patent

[11] 3,578,229

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[54] **BOOSTER ROLL FOR INTERMITTENT FEEDS**
11 Claims, 10 Drawing Figs.

[52] U.S. Cl. 226/114, 226/117, 226/151, 226/169
[51] Int. Cl. B65h 17/36
[50] Field of Search 226/113, 114, 121, 147, 149, 151, 169, 195, 117

[56] References Cited

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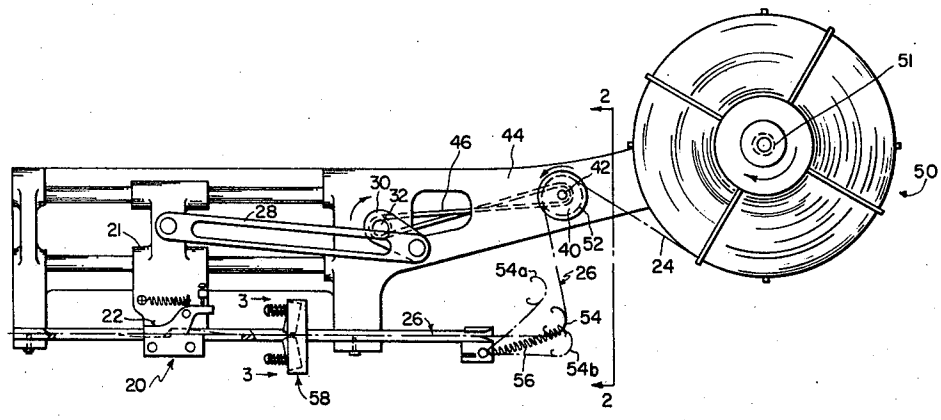
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Primary Examiner—Richard A. Schacher
Attorney—Edward Halle

ABSTRACT: This invention relates to supply means for web or ribbon feed machines where the ribbon is unreeled from a storage supply means such as a reel in substantially continuous motion, and is fed through the mechanism of the machine by an intermittent motion. The purpose of the invention is to provide mechanical filter means cooperating with a booster assist drive connected to the main drive of the device to translate the intermittent motion of the feed of the machine to a smooth, continuous motion at the supply means or reel for the ribbon. In the preferred form of the invention, the booster is a cylindrical roll in the ribbon pathway adapted to frictionally engage the ribbon, and the mechanical filter comprises a ribbon holding means, or brake, to prevent the ribbon from reversing its motion, and a coercing member, such as a tension member, spring urged against the ribbon within the ribbon pathway, between the ribbon holding means and the booster roll, as will be more fully described and claimed hereinbelow.



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2 Sheets-Sheet 1

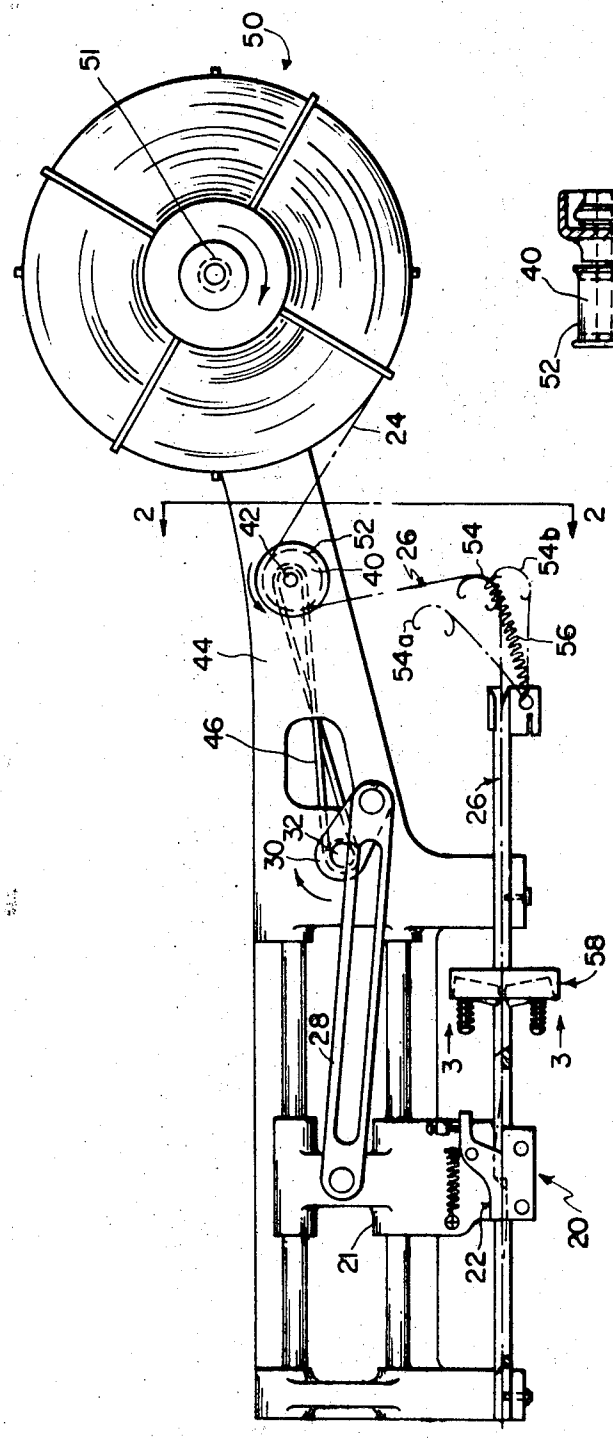


FIG. 1

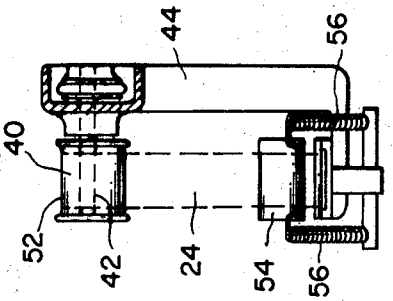


FIG. 2

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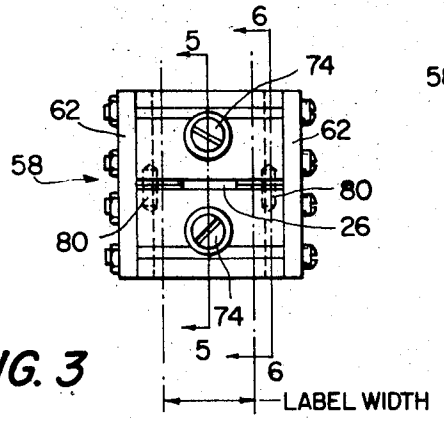


FIG. 3

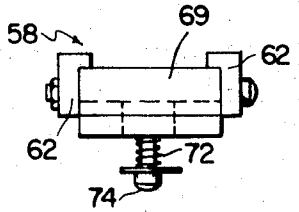


FIG. 4

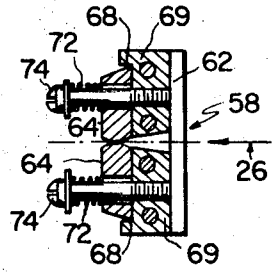


FIG. 5

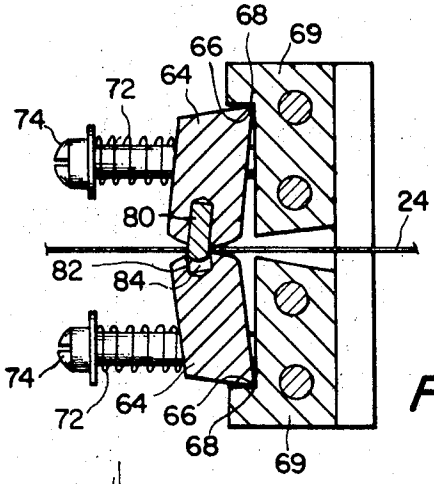


FIG. 6

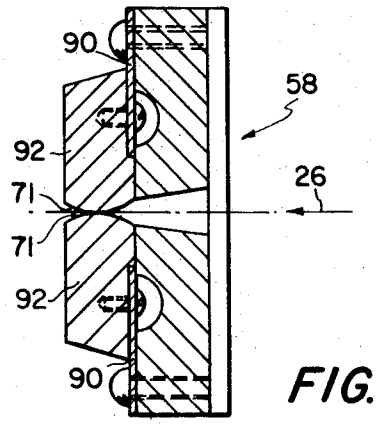


FIG. 9

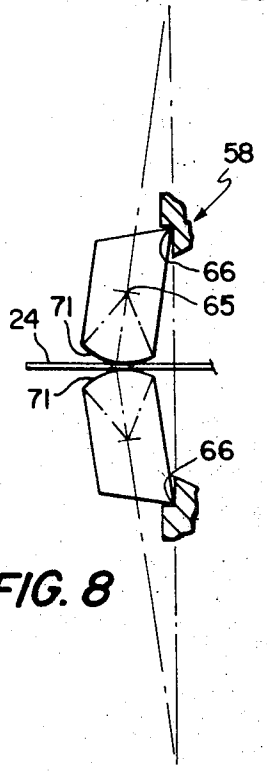


FIG. 8

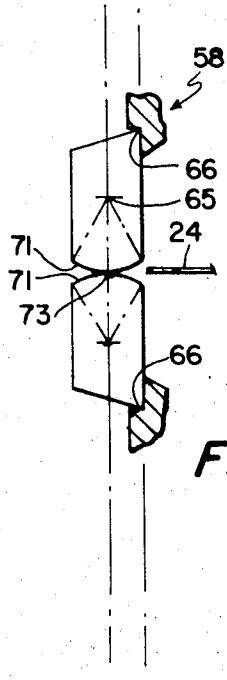


FIG. 7

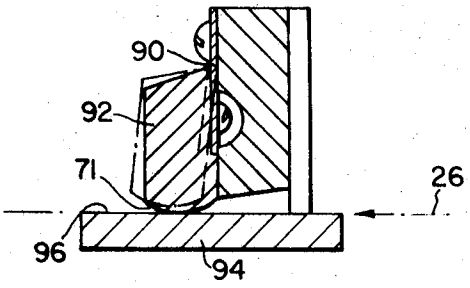


FIG. 10

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BOOSTER ROLL FOR INTERMITTENT FEEDS

It is therefore, an object of this invention to provide an auxiliary drive for intermittent feeds to supply additional force to drive the ribbon in addition to the intermittent feed drive necessary to advance a ribbon or web, fed by the device.

It is a further object of this invention to provide such additional drive means in the form of a booster roll cooperating with mechanical filter means to improve the drive of an intermittent feed device.

Further objects and advantages will appear in the specification hereinbelow. The invention is illustrated in the accompanying drawings in which:

FIG. 1 is a side elevation of the invention;

FIG. 2 is a sectional view along the lines 2–2 of FIG. 1;

FIG. 3 is an end elevation of a brake assembly as seen from arrows 3–3 in FIG. 1;

FIG. 4 is a top plan view of the brake assembly of FIG. 3;

FIG. 5 is a sectional view along the lines 5–5 of FIG. 3;

FIG. 6 is an enlarged sectional view along the lines 6–6 of FIG. 3, showing the brake elements in a different position;

FIG. 7 is a diagrammatic view of the brake elements of FIGS. 3 through 6 inclusive showing the forward end of a ribbon 24 about to be fed through;

FIG. 8 is a diagrammatic view similar to FIG. 7 showing the brake elements in position with a ribbon in the ribbon path;

FIG. 9 is a sectional view similar to FIG. 6 showing an alternate form of brake assembly; and

FIG. 10 is a sectional view similar to FIG. 9 showing a third alternate form of brake assembly.

Similar numerals refer to similar parts throughout the several views.

The booster roll of the present invention is an improvement for intermittent feed mechanism for webs or ribbons. The intermittent feed mechanism may be of any type known to the art such as that shown in my prior U.S. Pat. No. 3,013,368 or in my copending application for Label Feed, Ser. No. 475,220, filed July 27, 1965. The booster roll of the present application is also an improvement on devices such as the web tension control disclosed in my U.S. Pat. No. 3,013,740.

A reciprocating intermittent feed mechanism **20** comprising a carriage **21**, and a pair of jaws **22** or other means for pulling, advancing or feeding a web or ribbon **24** through a ribbon pathway **26** is shown in FIG. **1** of the drawings. The reciprocating mechanism **20** is driven by a link **28** and a crank **30** driven by a shaft **32**. This intermittent feed mechanism **20** is shown merely for purposes of illustrating the invention, and may be any type of intermittent feed having means to intermittently advance a ribbon or web **24**. For example, in my mentioned copending application for Label Feed, there is a crank-link-carriage arrangement, and in my prior U.S. Pat. No. 3,013,368, there is a roller type of feed in which there is means to cause the roller to advance the ribbon intermittently.

The booster means of this invention is for use in applications of intermittent feeding where it is desirable to minimize the tension necessary to pull the ribbon through the intermittent feeding stage. Examples of such situations are where a thin paper ribbon, being advanced by feed jaws, might tear unless the tension was reduced to a minimum.

One object of this invention is achieved by the booster means, such as a driven roll **40** mounted on a shaft **42** mounted on the main frame **44** of the device. The booster roll is driven at a speed proportional to the speed of the main drive of the device by means of a transmission means **46** which, in this case, is shown as a round transmission belt. However, any gear train or other transmission means from the main drive of the device to the booster roll may be employed to drive it at a constant speed ratio. I have found that the booster roll **40** should be driven at a speed where its circumferential surface **52** travels in the direction of the arrow at a speed greater than the speed of the ribbon **24** as it unreels from supply or storage means, such as supply reel **50**. I will explain this more fully hereinbelow.

I also provide mechanical filter means which includes tension member means comprising a thin curved plate **54** mounted on elastic means such as springy wires or springs **56**. The elastic mounting means **56** are mounted in turn on the main frame **44** of the device adjacent the ribbon pathway **26**. Finally, I provide ribbon holding means, or brake means **58** along the ribbon pathway **26** to insure that the ribbon will not back up due to reaction of tension plate **54**, and yet to provide for a minimum resistance to motion of the ribbon **24** in the forward direction.

As the ribbon **24** unwinds from the supply reel **50**, it advances tangentially to the circumference of the booster roll **40** where it wraps around in contact with the circumferential surface of the booster roll. The ribbon then proceeds to the spring-mounted tension plate **54** in a direction which forms an angle of approximately 90° with the relaxed position of the springs **56**. The spring-mounted tension plate **54** is usually adjusted, in its relaxed position, so that the ribbon **24** departs from the plate **54** in a direction in line with that part of the ribbon path **26** which includes the brake **58** and the feed jaws **22**. The path followed by the web or ribbon **24** from unwind at reel **50** to jaws **22** is the ribbon pathway **26**.

The reason for the bends in the ribbon pathway is to provide for the deflection of the plate **54** against reaction of springs **56**, and also to provide means to wrap the ribbon **24** around the friction surface **52** of booster roll **40** for as great a contact angle as practical so that the friction force imparted to the ribbon **24** by the booster roll **40** may be an effective friction drive means to help advance the ribbon **24** as I will describe hereinbelow.

Referring to FIG. **1** of the drawings, the carriage **21** near the first end of the ribbon pathway **26** is caused to reciprocate with approximately harmonic motion by action of the link **28** and crank **30** connected to the main drive shaft **32** which rotates at a selected constant speed when the device is in operation. Jaws **22** engage a perforation such as a cross cut, or any other form of engaging means, of the web or ribbon to feed forward a length of ribbon **24** constituting a label, to be cut off by a severing mechanism, not shown here, but described in either of my prior U.S. Pat No. 3,013,368 or U.S. Pat. No. 3,174,371, or in my copending application for Label Feed Ser. No. 475,220. The ribbon **24** is held stationary by a brake or holding means **58** during the next half cycle while the jaws **22** return to engage the ribbon **24** for the next forward stroke.

A roll of labels connected together in a continuous web or ribbon **24** is on the supply reel **50** at the second end of the ribbon pathway **26**. Ribbon **24** contains anywhere from 1,000 to 100,000 labels wound in a roll which may be as large as 2 feet or more in diameter. Since there is considerable weight to the label roll and supply reel **50** combination, it is obviously impractical to attempt to feed label lengths intermittently, at high speed, directly from the supply reel, by the jaw motion described hereinabove, unless a free loop is maintained, by electric eye control or otherwise, between the feed jaws **22** and the supply reel **50**, or unless a mechanical filter is provided to convert the forward intermittent motion of the ribbon at the feed jaws **22** to smooth continuous forward motion at the supply reel **50**.

Such a mechanical filter is disclosed in my prior U.S. Pat. No. 3,013,740 which shows the combination, in that patent, of a supply reel **24** with a nonlubricated friction bearing **28**, a spring mounted tension plate **30** and a brake **44**. These three elements are shown in the instant invention in FIG. **1**, namely supply reel friction bearing **51**, spring mounted tension plate **54** and ribbon holding or brake means **58**. The ribbon holding means or brake **58** shown herein presents marked improvements over the brake of the prior art in that it exerts substantially less resistance to forward motion of the ribbon **24** and positively prevents backward motion. The booster roll **40** constitutes a very important addition in that it supplies most of the power necessary to advance the web or ribbon **24**, thereby greatly reducing the tension force imparted by the intermittent feed to the ribbon **24** to intermittently advance the ribbon **24**. This is important because the web or ribbon of labels is

usually paper two- to four-thousandths of an inch thick, weakened by the aforesaid perforations such as cuts or other engaging means. Reducing stresses in the web **24** at the point of jaw engagement reduces the likelihood of tearing.

The booster roll **40** functions in the following manner: when the label feeding device shown in FIG. **1** is started, the jaws **22** engage the ribbon **24** and advance or feed a label length forward. Immediately, the spring supports **56** of the tension plate **54** bend up by an amount sufficient to allow one label to feed. The amount of the upward motion of the tension plate **54** from its relaxed position **54** to position **54***a* is a measure of the tension in ribbon **24** at that point in the ribbon pathway **26**. The tension in the ribbon **24** starts the supply reel **50** to rotate causing the ribbon **24** to unwind. The supply reel **50** loaded with ribbon **24** continues to rotate due to its inertia, allowing the tension plate **54** to return to its original relaxed position (as at reference numeral **54**) and, due to its inertia, to continue downward past its original relaxed position to position **54***b* which is closer to position **54** than was position **54***a*. As the machine continues to run, the tension plate **54** is in the upper phase (**54***a*) of its oscillation cycle while the jaws **22** are advancing the ribbon **24** forward, and in the lower phase (**54***b*) of its oscillation cycle while the jaws **22** are returning to engage the next length of the ribbon **24**. At the top position of the tension plate (**54***a*), the ribbon **24** is in tension and bears against the booster roll **40** which, turning at its circumference **52** faster than the ribbon motion, helps to advance the ribbon **24** by friction force. At the bottom position of the tension plate (**54***a*), the ribbon **24** is not in tension, so there is no friction force at the circumference **52** of the booster roll **40** and, therefore, no friction driving force by the booster roll **40**.

The net effect is to cause the ribbon **24** to unreel slightly faster than average speed when the tension plate **54** is at the top (**54***a*) and at slightly slower than average speed when the tension plate is at the bottom (**54***b*). During each feed cycle the force to increase the unreeling speed is supplied mostly by the booster roll **40** and the force to decrease the unreeling speed is supplied by the friction bearing **51**. The diameter of the bearing **51** determines the friction torque and it is just large enough to prevent "overshooting" which would cause slack to appear in the ribbon. When the machine is running at its normal operating speed, the rotation of the reel **50** appears to be "smooth." The slight change in its speed during each cycle is imperceptible to the eye.

In the above description, the term "up" and "down," "top" and "bottom," and "upper" and "lower" phases, referring to the motion of the tension plate **54** are relative and are used for clarity in referring to FIG. **1**. Actually, the feed mechanism described can run on its side or upside-down or in any other position and function satisfactorily.

Experiments have shown that the deflection of the spring supported tension plate **54**, in the instant application, with the booster roll working, is much less than in its deflection without benefit of the booster roll. In fact, the deflection of the tension member **54** with the booster roll **40** operating is less than one-half what it is without the booster roll, indicating that the tension in the web is reduced more than 50 percent by using the booster roll.

The web tension is further reduced by using the new type of band holding means **58** which reduces the friction when the web is being moved forward to almost zero, but at the same time is so constructed that if there is an attempt to move it backwards by virtue of any residual tension in the springs **56** actuating the tension plate **54**, the new band holding means **58** will act to hold the web or ribbon so there is no reverse motion whatsoever. The combination of these two devices, the booster roll and the new ribbon holding means, insures that ribbons that might be fragile on account of being made of thin paper or being of such a shape as to make them tear easily than others, can be successfully fed without damage.

While I have described the tension plate **54** of the tension member means as a plate which may be a thin curved steel plate, the tension plate portion of the tension member means may be any form of body portion on the tension members means comprising a curved surface. It may also take the form of a wheel or roller mounted on spring means, or other elastic means.

The ribbon holding means, or brake **58**, is in an assembly which is provided with a frame comprising a pair of frame members **62** which are situated on either side of the ribbon pathway **26**. Knife edge bearings **68** on bearing blocks **69** are provided within the frame members **62** to support a pair of brake elements **64** each having a knife edge **66** at one end thereof adapted to turn through a small angle within the knife edge bearings **68**. At the other end of each brake element **64**, there is a cylindrical surface **71** at a radius from a point **65** to provide for movement of the ribbon **24** in a forward direction, and to block movement of the ribbon **24** in a rearward direction. The brake elements **64** are held in place with relation to the bearing blocks **69** by light springs **72**, and screws **74**, in any appropriate manner which would hold them in a normal position as shown in FIG. **5** or FIG. **7**, and will yet permit them to swing out through a small angle when the ribbon is between them, as in FIG. **8**.

The action of the ribbon holding means **58** with the ribbon **24** between its elements provides for a minimum of friction in the forward direction because as the ribbon moves forward, the cylindrical surfaces **71** are caused to rotate outwardly by the ribbon friction against the weak action of springs **72** to permit the gap between cylindrical surfaces **71** to widen and permit the ribbon to pass through. When the ribbon stops its forward motion and, by action of tension plate **54** and springs **56**, there is a rearward pull on the ribbon, the cylindrical surfaces **71** rotate in a backward direction by brake elements **64** rotating on their knife edge bearings **66** against the angle bearings **68**, thereby reducing the gap between cylindrical surfaces **71** and clamping the ribbon **24** between them. When the ribbon is pulled forward again, the brake elements **64** again rotate toward the forward part of the ribbon pathway opening the gap between cylindrical surfaces **71** to substantially reduce the friction of the forward movement.

The brake locking action described hereinabove is dependent on the position of contact of ribbon **24** between surfaces **71** of brake blocks **64** being at a point forward of the knife edge bearings **66** with relation to the ribbon pathway **24**. This is accomplished by providing the cylindrical surfaces **71** with an axis such as point **65** as shown in FIG. **7** of the drawings farther forward in ribbon pathway **26** than knife edge bearing **66**. Thus, the point of contact **73** between the cylindrical surfaces **71** in offset in a forward direction with relation to bearings **66**.

While I have described the surfaces **71** as being surfaces of cylindrical wedges or curved in a circular fashion, it is not necessary that the curves be arcs of circles. There are many satisfactory ways in which the surfaces can be curved so long as the contact point **73** is offset in a forward direction from the bearings **66**.

It is desirable that both brake blocks **64** swing in unison for the device to function in the most satisfactory manner. In order to accomplish this, I have provided at least one pin **80** with a hemispherical protrusion **82** adapted to fit into a recess opening **84**, the pin **80** being in one of the brake blocks **64** and the recess opening **84** being in the other cooperating brake blocks. Hemispherical protrusion **82** will ride within opening **84**, and thus both brake blocks will be kept at the same angle of displacement during the operation of the brake **58**. It is necessary, of course, to have pin **80** at the side of the ribbon pathway rather than in the middle in the type of installation shown in the drawings. I have, therefore, provided two of such pins, one on each side of the ribbon pathway **26**. Any gear tooth arrangement or similar means could be used instead of the pin and recess construction just described.

I also show in FIG. **9** an alternate form of brake block construction in which the knife edge bearings are replaced with an elastic connection such as a spring **90** which bends and acts as a hinge for brake element **92**. In all other respects, this al-

ternate form works in the same manner as the construction described hereinabove.

In FIG. 10, I show another form of holding means. In this form of holding means, the part above the ribbon pathway 26 is identical to the part above the ribbon pathway in the form of holding means shown in FIG. 9. Below the ribbon pathway, I provide a brake element 94 which cooperates with brake element 92 when a ribbon 24 is fed between the said elements. When the ribbon runs in a forward direction, element 92 will turn forwardly on its elastic connection 90 so that surface 71 will move away from surface 96 of brake element 94. When there is back tension on the ribbon 24, element 92 will move backwardly to clamp the ribbon between its surface 71 and surface 96.

While I have described my invention in its preferred forms, there are other forms which it may take without departing from the spirit and scope of the invention, and I, therefore, desire to be protected in all forms coming within the claims hereinbelow.

I claim:

1. Supply means for a feed device for a web, ribbon, or the like, said device including a main frame, a ribbon in a ribbon pathway having a first end and a second end, and intermittent feed means to feed the ribbon at the first end of the ribbon pathway; with said supply means comprising ribbon storage means at the second end of said ribbon pathway, mechanical filter means associated with said ribbon pathway between said ribbon storage means and said intermittent feed means, said mechanical filter means converting the intermittent motion of the ribbon at the feed means into continuous motion of the ribbon where it leaves the ribbon storage means; and booster means positioned along said ribbon pathway between said ribbon storage means and at least a portion of said mechanical filter means, said booster means comprising friction drive means including a moving friction surface portion normally positioned to contact the ribbon when placed in tension by the feed means, said moving friction surface moving at a speed greater than the speed of the ribbon; the contact between the ribbon and the moving friction surface being provided by pull of the ribbon by the feed means and pressure of the filter means.

2. Supply means for intermittent feed means as defined in claim 1, including ribbon holding means associated with the ribbon pathway positioned between the intermittent feed means and at least a portion of the mechanical filter means.

4. Supply means for intermittent feed means as defined in claim 2, in which the ribbon holding means is movably positioned to apply friction to the web, being movable with relation to the web to apply less friction in a forward direction of web motion than in a backward direction.

4. Supply means as defined in claim 1, in which the intermittent feed means and the friction drive means are driven by main drive means of the device with the speed of said friction surface being greater than the speed of the ribbon as it leaves the ribbon storage means.

5. Supply means as defined in claim 4, in which the friction drive means is substantially cylindrical in form with said friction surface portion being the circumference thereof.

6. Supply means as defined in claim 5, in which the mechanical filter means comprises tension member means mounted in association with the ribbon pathway by means of a mounting which comprises elastic means.

7. The supply means as defined in claim 6, in which the tension member means includes a body portion comprising a curved surface.

8. The supply means as defined in claim 6, in which the elastic means of the tension member means comprises at least one spring.

9. The supply means as defined in claim 6, in which the ribbon pathway runs from the ribbon storage means around a portion of the circumference of the friction surface portion, thence toward said tension member means of said mechanical filter means, thence along a surface of said tension member means, and thence to said intermittent feed means.

10. The supply means as defined in claim 9, including ribbon holding means associated with the ribbon pathway positioned between the intermittent feed means and the tension member means of the mechanical filter means.

11. The supply means as defined in claim 10, in which the ribbon holding means is friction activated and comprises at least one movable element adapted to generate friction against the ribbon during the forward movement of the ribbon, and generate increased friction against the ribbon on a rearward movement of the ribbon.