United States Patent [19]

Korb et al.

[11] **3,724,633**

[45] **Apr. 3, 1973**

[54] **FEED SYSTEM FOR AN ADHESIVE RIBBON OR THE LIKE**

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[21] Appl. No.: **102,695**

[52] U.S. Cl. **197/151,** 197/167, 197/175, 197/181

[51] Int. Cl. **B41j 33/14**

[58] Field of Search.....197/151, 154, 155, 167, 16, 197/181, 175; 242/55

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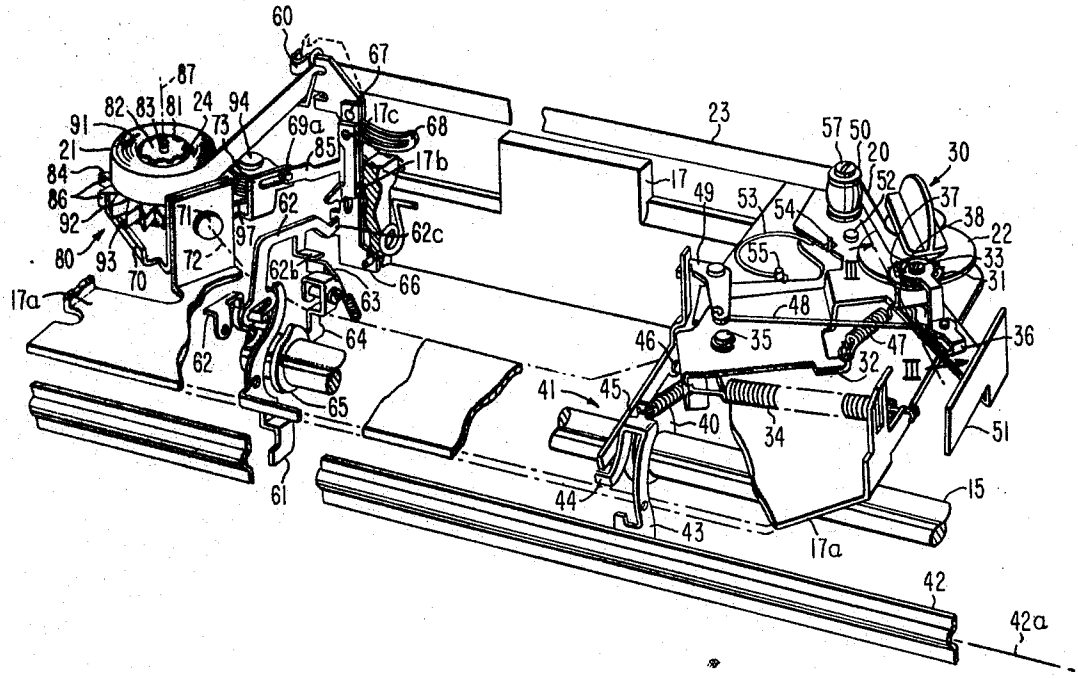
[57] **ABSTRACT**

An adhesive erasing ribbon employed in a typewriter is reliably tracked and fed by a supply and takeup mechanism that positively maintains resilient tension on the ribbon. A spring device acting against a cam in the form of a multi-toothed ratchet, positively maintains continuous tension on the ribbon regardless of any tendency caused by vibrations and continued stress for the ribbon to loosen during extended periods of non-feeding operation. The tension maintaining mechanism and the ribbon supply spool are mounted on a tilting platform to minimize the exposed length of adhesive ribbon and thereby minimize its deterioration.

13 Claims, 8 Drawing Figures



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SHEET 1 OF 2

FIG-1

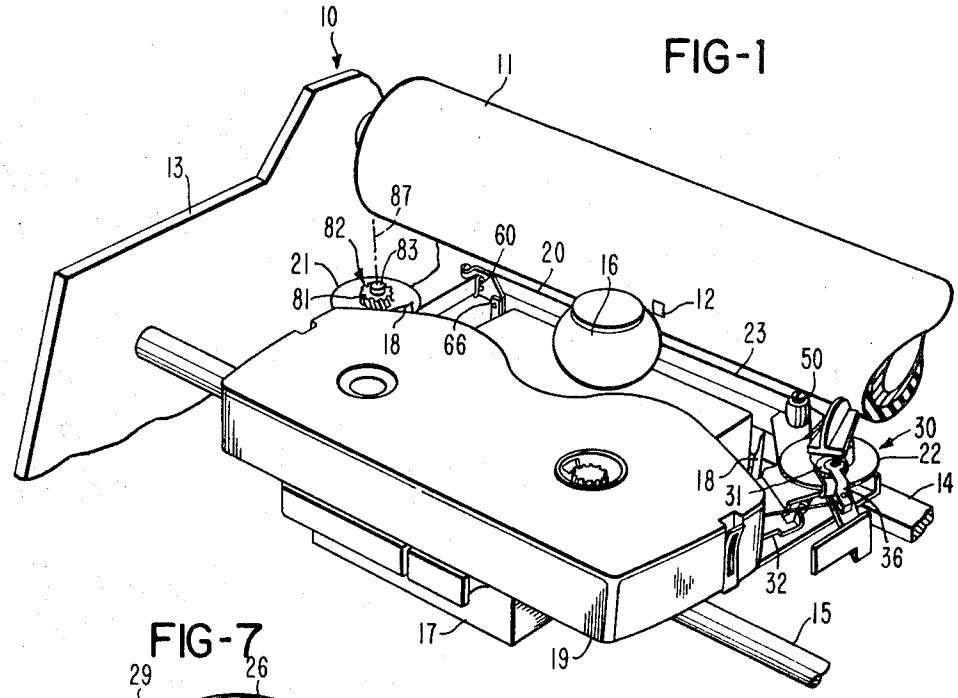


FIG-6

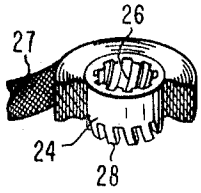


FIG-7

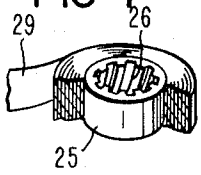


FIG-5

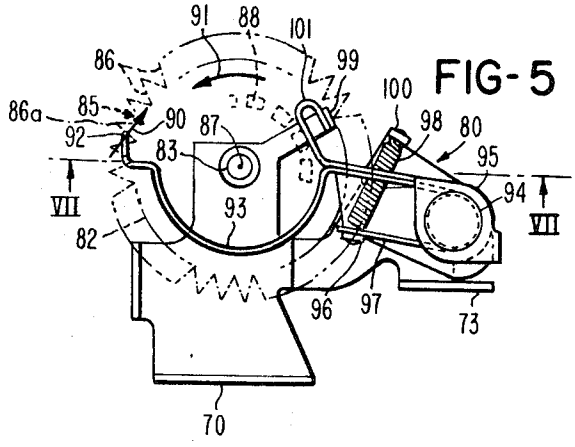
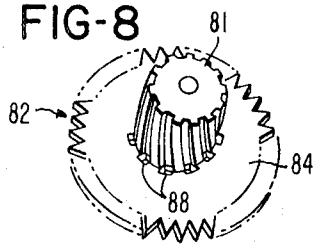


FIG-8



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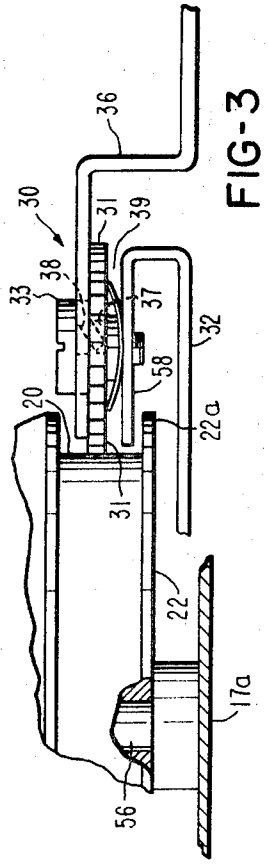

FIG-3

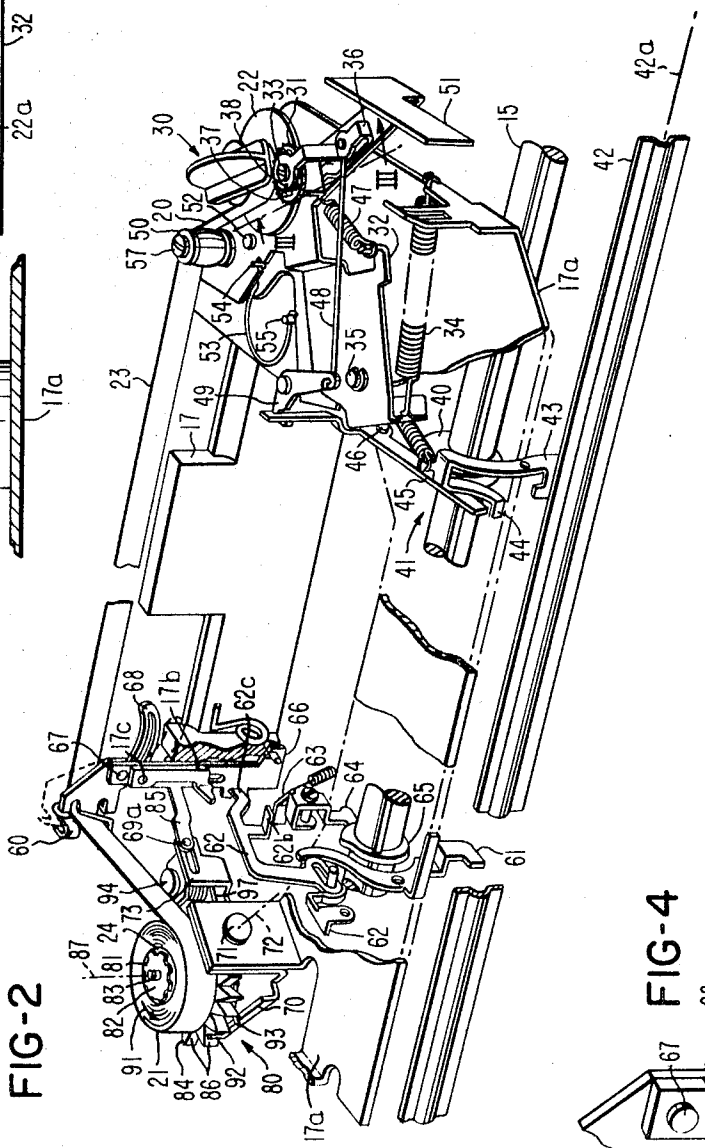

FIG-2

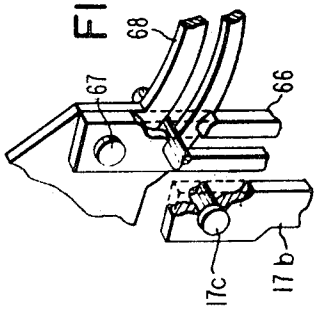

FIG-4

FEED SYSTEM FOR AN ADHESIVE RIBBON OR THE LIKE

BACKGROUND OF THE INVENTION

Typewriters having an erase ribbon mechanism employing either an adhesive, character lifting surface or an overprint, character cover-up surface have been proposed in various forms. The use of an adhesive material to lift an erroneous character from paper has the distinct advantage over a cover-up erasing material in that the color of the paper printed on is of no consequence. An adhesive ribbon however represents a potential danger to the adjacent mechanism if it becomes loose or untracked so as to brush against adjacent mechanism or the paper being typed.

Conventional tension control systems for ribbon feed mechanisms provide various forms of reaction drag that depends upon repetitive feeding for its effectiveness. A feed system for an erasing ribbon does not ordinarily operate in a repeat feed mode but instead sits idle for long random periods of time. While sitting idle, the erase ribbon supply is subject to vibration of the machine and when feeding occurs usually only one or two feed steps are required. During periods of normal typing, an erase ribbon feed has no feed force applied by which a reaction can be developed to tension the ribbon. The differences between the requirements of a printing ribbon and an erasing ribbon thus making the ordinary printing ribbon tension systems inappropriate or inadequate for addressing the problems of feeding an adhesive erase ribbon.

These differences while accentuated in the case of an adhesive erase system, also exist to a lesser degree where a cover-up erase ribbon is employed. If a cover-up type of ribbon loses tension, a failure of the erase mechanism may result, whereas a loss of tension on an adhesive ribbon could foul the copy being typed or could foul the machine.

DISCLOSURE OF THE INVENTION

Our invention provides a positively connected spring bias on the supply spool of an erase ribbon to completely insure continuous tension on the erase ribbon in spite of tendencies for the ribbon to lose tension due to vibration induced movement of the parts of the feed mechanism or creep of the ribbon material. The bias is provided by a spring arm that acts against a cam in the form of a multi-tooth ratchet. The cam is configured such that there is a positive geometrical relationship between movement of the supply spool and flexure of the spring. This is to be distinguished from a permissive relationship through frictional connection between a supply spool and a bias spring where slippage can occur between the spring bias and the biased spool to relax the spring and thereby eliminate the bias. In our system there is no possibility of slippage.

Our system also includes a unique mechanism for selecting either of two spring rates for tensioning the ribbon to a lower tension if it is of the cover-up type. The ribbons themselves are wound on characteristically different spools that provide for the automatic selection of spring rate by selectively anchoring a spring mounting part.

Erasing ribbons are only used occasionally and adhesive ribbons particularly are subject to deterioration upon prolonged exposure of the adhesive surface to the atmosphere. Our feed mechanism provides for a compact feed path that minimizes the amount of ribbon unspooled prior to the print point while avoiding interference with required ribbon lift motion. This feed path is accomplished by mounting the supply spool on a tilting platform that follows the ribbon lift movement. The ribbon life itself is simplified by including a single lift guide member mounted to one side of the print point such that the erase ribbon is lifted in a tilted fashion across the print point when erasing is desired.

These and other objects, features and advantages of our ribbon feed system will be apparent to those skilled in the art from reading and understanding the following more detailed description of a specific illustrative embodiment of our invention, wherein reference is made to the accompanying drawings of which:

FIG. 1 is a fragmentary perspective view of a typewriter having an erase ribbon feed system constructed in accordance with out invention.

FIG. 2 is an enlarged fragmentary perspective view of numerous details of the ribbon feed system constructed in accordance with our invention.

FIG. 3 is a detail vertical cross-sectional view of the erase ribbon takeup mechanism taken along lines III — III of FIG. 2.

FIG. 4 is an enlarged broken away perspective view of a detail of construction of the ribbon lift mechanism shown in FIGS. 1 and 2.

FIG. 5 is a detail top plan view of the erase ribbon supply mechanism within a supply ribbon support member shown in phantom lines.

FIGS. 6 and 7 are perspective views respectively of ribbon supply rolls of an adhesive erase ribbon and a cover-up erase ribbon.

FIG. 8 is a detail perspective view of a supply spool support member employed in the erase ribbon feed system.

Referring now more specifically to the drawings, in FIG. 1 there is shown a typewriter **10** which, for purposes of illustration is shown as being of the type described generally in U. S. Pat. No. 2,919,002. The typewriter **10** includes a type element **16** that opposes a paper support platen **11** to form a print position or impact point **12** therebetween. A frame portion **13** of the typewriter **10** supports the platen **11** and also supports an escapement rack **14** and a rotatable print shaft **15** which together form a pair of track forming rails that extend along the length of the platen **11**. The type element **16** is mounted in a print element carrier **17** which in turn is slidably mounted on the rails **14** and **15** to enable movement of the printing position **12** laterally along the platen **11**. Normal typing is accomplished through the use of an ink ribbon **18** which for purposes of illustration can be packaged in a cartridge **19** and fed by an appropriate incrementing mechanism (not shown) all as completely disclosed in copending U. S. Pat. No. 3,604,549. The ribbon **18** is broken away in FIG. 1 so as to not cover other mechanism of a greater consequence to the present invention.

In accordance with our invention, an erase ribbon **20** attached at its opposite ends to a supply roll **21** and a disposable takeup spool **22** is assembled on the carrier **17** to expose an active span **23** adjacent the print point **12**. The erase ribbon **20** is fed in character-size increments by a feed mechanism **30** (see also FIGS. **2** and

3). The ribbon 20 is threaded at the right of the print point 12 past a non-lifting, barrel shaped guide member 50 to a disposable ribbon takeup spool 22 and to the left of the print point 12 through a ribbon lift guide 60.

The ribbon feed mechanism 30 drives the ribbon takeup spool 22 in counterclockwise direction by engagement of a toothed drive wheel 31 with the periphery of the ribbon 20 wound on the spool 22. Drive wheel 31 is rotatably mounted on a pivoted platform 32 by shouldered screw 33. Spring 34 urges platform 32 counterclockwise about its pivot stud 35 so as to resiliently urge the drive wheel 31 into contact with the ribbon 20. A U-shaped drive wheel actuating arm 36 is pivotally mounted on the head of shoulder screw 33 and coaxially at another point not shown. The drive wheel 31 has a plurality of spaced windows 37 extending therethrough for receiving a bent tab pawl part 38 of the drive arm 36 which is urged downwardly by the resiliency of drive arm 36. A flexed washer 39 urges the drive wheel 31 upwardly against the head of the screw 33 and creates a frictional drag therebetween. The configuration of pawl 38 and the frictional drag provided by washer 39 creates a one-way drive that is effective upon oscillation of the drive arm 36 to incrementally rotate drive wheel 31 clockwise and takeup spool 22 counterclockwise to wind a character-sized increment of the ribbon 20 thereon.

Oscillation of drive arm 36 is selectively produced by power taken from a cam 40 that is slidably keyed to the print shaft 15 which is rotated during each print cycle of the typewriter 10 (FIG. 1). Since it is not desired to feed the erase ribbon 20 with each print operation, a control mechanism 41 is provided to select operation of drive arm 36 only when an erase operation is desired. The control mechanism 41 includes a frame mounted selection or control bail 42 pivotally positioned about its axis 42a that is positioned by the typewriter mechanism, as taught in a copending U. S. Pat. application Ser. No. 102,696, filed Dec. 30, 1970 entitled "Automatic Erase Mechanism" filed simultaneously herewith and is not otherwise shown herein, to indicate whether a normal print or erase cycle is desired. Bail 42 is pivoted clockwise from its position as shown when an erase operation is desired. Pivoting of bail 42 displaces link 43 that is pivoted to the carrier 17 to move tail 44 from under cam follower arm 45. These events occur when cam 40 presents its high point to the follower 45. Follower 45 is thus free to follow cam 40 downwardly and pivot about its axis 46 under the influence of a spring 47 connected to the drive arm 36 which in turn is connected to the cam follower 45 through a tie rod 45 and bellcrank 49 that is pivoted to a mounting plate 17*a* on the carrier 17. When cam 40 drives follower 45 upwardly toward its original position, drive arm 36 is powered clockwise about the shoulder screw 33 and pawl 38 drives wheel 31 clockwise to rotate the takeup spool 22 counterclockwise thus feeding an increment of the ribbon 20. When normal printing is desired, link 43 is not provided by bail 42 and its ends 44 prevents follower 45 from moving downwardly upon rotation of the cam 40, thus no ribbon 20 is fed.

Takeup spool 22 can be removed when full for replacement by pivoting a control handle 51 counterclockwise about its pivot axis 52. An over-center bow spring 53 is connected at its opposite ends to the control handle 51 through notch 54 and to a stud 55 on the platform 32. Pivoting of control handle 51 thus causes spring 53 to drive platform 32 clockwise about its pivot stud 35 overcoming the force of spring 34 and moving the drive wheel 31 outwardly away from the periphery of ribbon 20 on the takeup spool 22. Takeup spool 22 now can be lifted vertically off its mounting stud 56 (see FIG. 3) for replacement. The pivotal movement of control handle 51 also moves the right hand guide member 50 forwardly from its position as shown to release tension in the ribbon 20 as this guide member 50 is mounted to the control handle 51 by a stud 57. When a new takeup spool 22 is placed on mounting stud 56 and ribbon 20 is threaded around guide member 50, the control handle 51 is pivoted clockwise about its axis 52 to return the parts to the position shown in FIGS. 2 and 3. Note that in this position the platform 32 includes a flange part 58 that overlies a flange 22*a* of the spool 22 thus retaining the spool 22 on the stud 56. Also during the movement of control handle 51 to its position as shown in FIG. 2, the guide member 50 will be moved rearwardly against the ribbon 20 to provide an initial tension in the ribbon span 23.

The control bail 42 also controls operation of the ribbon lift guide 60 by displacing a carrier mounted control link 61 counterclockwise about its pivot axis to move an intermediate member 62 against spring 62*a* forwardly to a position where a tab portion 62*b* thereof overlies a drive part 63 of a cam follower 64 that is pivotally mounted on the carrier 17. In this forward position, intermediate member 62 is driven upwardly by counterclockwise pivoting of follower 64 when driven by cam 65 that is slidably keyed to the print shaft 15. The right end 62*c* of the intermediate member 62 engages a vertically reciprocable member 66 that is slidably mounted on a carrier portion 17*b* as best shown in FIG. 4. Member 66 is connected to the ribbon lift guide 60 by a stud 67. The lift guide 60 includes a cam slot portion 68 that slidably receives a fixed stud 17*c* whereby upon vertical movement of the member 66, lift guide 60 is both lifted and pivoted clockwise about its pivot axis 67. This motion brings the erase ribbon span 23 into operative alignment with the print point 12 (see FIG. 1) to cause a character erasure upon impact of the type element 16.

To maintain as short a length as possible of the erase ribbon 20 between the supply roll 21 and the print point 12 and still accommodate the large motion required by the vertical reciprocation of the lift guide 60, the supply roll 21 is mounted on a platform 70 that is pivoted by stud 71 about an axis 72 to the mounting plate 17*a*. An arm 69 of the vertically reciprocable member 66 is connected by a pin 69*a* to a slotted arm 73 of the platform 70 whereby lifting of the guide 60 also pivots the platform 70 and the ribbon supply roll 21 carried thereby, counterclockwise from their rest position to an active position to maintain a reasonably direct feed path for the ribbon 20 from the supply roll 21 to the lift guide 60.

Ribbon Tension Mechanism

A mechanism 80 for maintaining reliable resilient tension on the span 23 of ribbon 20 is best shown in FIG. 5. The supply roll 21 includes either a core 24 (see

FIG. 6) or a core 25 (see FIG. 7) depending upon whether an adhesive erase ribbon or cover-up erase ribbon is employed. Both cores 24 and 25 include internal curved spline configurations 26 that are dimensioned to engage a vertically extending complementary curved spline shaped spindle 81 of a supply roll support member 82 (see especially FIG. 8). A stud 83 carried by platform 70 rotatably supports member 82 on the platform 70. The mutually complementarily configured splines 26 and spindle 81 provide a drive connection that tends to force the supply roll 21 downwardly by the application of ribbon tension thereby holding the ribbon supply roll 21 firmly in place against a bottom flange part 84 of the support member 82.

The mechanism 80 applies a resilient rotational bias force 90 to the rotatable support member 82 to tension the ribbon 20. The force 90 has a tangential component in the direction opposite to the normal movement of the ribbon 20 during a feed operation as indicated by arrow 91. The tensioning mechanism 80 includes a multi-toothed ratchet wheel like cam surface 85 on support member 82 that is engaged by a surface follower member such as pawl end 92 of an elongated, cantilever supported, stiff wire spring 93. The cam surface 85 is made of a plurality of inclined tooth-like contoured surface portions 86 having outer release edges 86*a*. Pawl end 92 is small relative to the length of surface portions 86 and is constrained by pivot post 94 to move on a path out wardly along the tooth surface portion 86 toward the tooth release edge 86*a* upon rotation of member 82 is direction 91. This rotation is yieldingly opposed by either the stressing of the spring wire 93 or of spring 98 as hereinafter described. The surface portions 86 thus are successively engaged by the pawl end 92 as the ribbon 20 is fed by mechanism 30. When the erase mechanism stand idle, spring 93 exerts a rotational force 90 against a cam surface portion 86 tending to rotate the supply roll 21 in the direction opposite to the feed direction. Pawl part 38 (FIGS. 2 and 3) positively prevents unwinding of takeup spool 22 during idle conditions. Thus reverse rotation of supply roll 21 tensions the ribbon span 23. Any tendency for the ribbon 20 to stretch or for other parts of the mechanism to yield or vibrate may result in slight rotation of the supply roll 21 about its axis 87, however, pawl 92 will remain in positive contact with cam surface parts 86. Spring 93 thus remains effective to apply force 90 throughout a wide range of such movement. Note particularly that the resilient force by spring 93 is not capable of being lost or dissipated through slippage between the connection of pawl 92 and cam surface portions 86.

As explained above, a ribbon 20 having an adhesive surface 27 on a core 24 as shown in FIG. 6. This core 24 is characterized by having its internal splines 26 extend downwardly therefrom to provide a plurality of adjacent cylindrical segments or spline extensions 28. These extensions 28 are employed to control the tension applied to the ribbon span 23. Wire spring 93 is wrapped at its right hand end (see FIGS. 2 and 5) about the pivot post 94 that is carried by the platform 70. Also mounted on the post 94 is an intermediate bracket 95 that includes a tab 96 against which an end 97 of the spring wire 93 bears. A light tension spring 98 is anchored at one end to the tab 96 and at its opposite end to a tab 100 that is formed integrally with the platform 70. The bracket 95 also includes a control arm 101 that extends to a position under the bottom flange part 84 of the spindle 81 adjacent a stop part 99 formed integrally with the platform 70 and openings 88 that selectively receive the spline extensions 28.

When an adhesive ribbon mounted on a core 24 is employed, spline extensions 28 are received in openings 88 and project downwardly to a position adjacent the control arm 101 to trap the control arm 101 in its position as shown against the stop or tab 99. Bracket 95 thus is prevented from pivoting about its post 94, spring 98 is made ineffective, and spring wire 93 is flexed to accommodate the camming motion of cam teeth 86 past the pawl end 92 of the wire spring 93.

On the other hand if a ribbon having a cover-up surface 29 and a core 25 is mounted on the spindle 81, there are no spline extensions 28 and thus the control arm 101 is not trapped against stop 99 and the bracket 95 is free to pivot about the post 94. Rotation of the spindle 81 causes pawl end 92 of the wire 93 to pivot counterclockwise about the post 94 as before, however due to the freedom of the bracket 95, this pivotal movement is accommodated by stretching of light spring 98 instead of flexing of the relatively stiff spring wire 93. It will thus be seen that the configuration of the ribbon supply core 24 or 25 is effective to select one of two tension levels by control of the freedom of bracket 95.

While a specific preferred embodiment of our invention has been shown and described herein for purposes of illustration, it will be recognized by those skilled in the art that various modifications, additions, and substitutions can be made in applying the concepts disclosed to various workable systems. These concepts thus are to be limited only by the language of the appended claims:

We claim:

1. Ribbon feed mechanism having means for supporting
   - a supply roll of ribbon for rotation about an axis, means drivingly engaging ribbon threaded from said supply roll for advancing increments of said ribbon at random intervals thereby rotating said supply roll in one rotational direction wherein the improvement comprises:
     - means for applying a rotational force to said supply roll at substantially all times during feeding of the ribbon to tend to rotate said supply roll in the direction opposite to said one rotational direction and comprising:
     - cam means mounted for rotation about said axis and being drivingly connected with said supply roll, said cam means having a contoured surface thereon that faces at least partially tangentially with respect to the rotational axis of said supply roll and thereby is capable of positively receiving force having a tangential component, and
     - resilient means engaging said contoured surface for applying a resilient urging force to said contoured surface in said opposite direction.

2. The combination of ribbon feed mechanism as defined in claim 1 wherein a supply roll of ribbon having an exposed adhesive material on one surface thereof is assembled on said supply roll supporting means.

3. Ribbon feed mechanism as defined in claim 1 wherein said cam means comprises a ratchet wheel wherein said contoured surface comprises a plurality of inclined tooth-like surfaces formed circumferentially of said ratchet wheel, each of said tooth-like surfaces terminating in a release edge, and

wherein said resilient means comprises a follower member that is small in relation to said tooth-like surfaces and wherein said follower member path is angularly oriented with respect to said tooth-like surfaces so that said follower member is displaced toward the release edge of said tooth-like surfaces by movement thereof in said one rotational direction.

4. Ribbon feed mechanism as defined in claim 3 wherein said resilient urging means comprises an elongated cantilever supported wire spring and said follower member is a pawl device mounted at the free end of said wire spring.

5. Ribbon feed mechanism having means for supporting a supply roll of ribbon for rotation about an axis and comprising a base member, a platform member pivotly connected to said base member about a substantially horizontal axis for movement thereabout from a rest position to an active position, and spindle means rotatably mounted on said platform member for receiving said supply roll thereon, ribbon positioning means for moving a span of said ribbon threaded from said supply roll from a normal rest position to an elevated active position, means connecting said ribbon positioning means with said platform member so that lifting of said ribbon span by said ribbon positioning means pivots said platform member to its active position, and means drivingly engaging ribbon threaded from said supply roll for advancing increments of said ribbon at random intervals thereby rotating said supply roll in one rotational direction, wherein the improvement comprises:

means for applying a bias force to said supply roll at substantially all times during feeding of the ribbon to tend to rotate said supply roll in the direction opposite to said one rotational direction and comprising:

cam means mounted for rotation about said axis and being drivingly connected with said supply roll, said cam means having a contoured surface thereon that faces at least partially tangentially with respect to the rotational axis of said supply roll and thereby is capable of positively receiving force having a tangential component, and

resilient means engaging said contoured surface for applying a resilient urging force to said contoured surface in said opposite direction.

6. Ribbon feed mechanism as defined in claim 5 wherein said ribbon positioning means comprises:

first and second guide members respectively positioned on opposed lateral sides of an impact point, said supply roll being mounted on one side of the impact point adjacent said first guide member, means mounting said second guide member substantially stationarily upon said base member,

a vertically reciprocating member, and

means pivotally mounting said first guide member on said reciprocating member for pivotal motion about a horizontal axis so that said first guide member is lifted upon reciprocation of said reciprocating member.

7. Ribbon feed mechanism as defined in claim 6 wherein said cam means comprises a ratchet wheel wherein said contoured surface comprises a plurality of inclined tooth-like surfaces formed circumferentially of said ratchet wheel.

8. Ribbon feed mechanism as defined in claim 7 wherein said resilient means comprises an elongated cantilever supported wire spring having a pawl device mounted at its free end that engages the tooth-like surfaces of said ratchet wheel.

9. A typewriter comprising a print element carrier, a frame, track means on said frame for supporting said carrier for lateral movement thereon, means for supporting a supply roll of ribbon on said print element carrier comprising a platform member pivotly connected to said carrier about a substantially horizontal axis for movement thereabout from a rest position to an active position, and spindle means rotatably mounted on said platform for receiving said ribbon supply roll thereon, ribbon positioning means for moving a span of said ribbon threaded from said supply roll from a normal rest position to an elevated active position, means connecting said ribbon positioning means with said platform member so that lifting of said ribbon span by said ribbon positioning means pivots said platform member to its active position, and means drivingly engaging ribbon threaded from said supply roll for advancing increments of said ribbon at random intervals thereby rotating said supply roll in one rotational direction, where the improvement comprises:

means for applying a bias force to said supply roll at substantially all times during feeding of the ribbon to tend to rotate said supply roll in the direction opposite to said one rotational direction and comprising:

cam means mounted for rotation about said axis and being drivingly connected with said supply roll, said cam means having a contoured surface thereon that faces at least partially tangentially with respect to the rotational axis of said supply roll and thereby is capable of positively receiving force having a tangential component, and

resilient means engaging said contoured surface for applying a resilient urging force to said contoured surface in said opposite direction.

10. Ribbon feed mechanism as defined in claim 9 wherein said ribbon positioning means comprises:

first and second guide members respectively positioned on opposed lateral sides of an impact point, said supply roll being mounted on one side of the impact point adjacent said first guide member, means mounting said second guide member substantially stationarily upon said base member,

a vertically reciprocating member, and

means pivotally mounting said first guide member on said reciprocating member for pivotal motion about a horizontal axis so that said first guide member is lifted upon reciprocation of said reciprocating member.

11. Ribbon feed mechanism having means for supporting a supply roll of ribbon for rotation about an axis, means drivingly engaging ribbon threaded from said supply roll for advancing increments of said ribbon at random intervals thereby rotating said supply roll in one rotational direction, wherein the improvement comprises:

means for applying a rotational force to said supply roll to tend to rotate said supply roll in the direction opposite to said one rotational direction and comprising:

cam means mounted for rotation about said axis and being drivingly connected with said supply roll, said cam means having a contoured surface thereon that faces at least partially tangentially with respect to the rotational axis of said supply roll and thereby is capable of positively receiving force having a tangential component, and

resilient means engaging said contoured surface for applying a resilient urging force to said contoured surface in said opposite direction, said resilient means comprising first and second spring portions, said first spring portion having a substantially stiffer spring rate than said second spring portion and means for selectively rendering said second spring portion effective and ineffective so that said resilient urging force is of selectable greater or lesser magnitude dependent respectively upon the ineffectiveness or effectiveness of said second spring portion.

12. Ribbon feed mechanism as defined in claim 11 wherein said means for selectively rendering said second spring effective and ineffective comprises a control arm connected to said second spring portion and to said first spring portion, said control arm being positioned adjacent said means for supporting a supply roll spool of ribbon, and means carried by a supply roll of ribbon for engaging said control arm to prevent movement thereof that would accommodate stretching of said second spring portion so that said second spring portion is rendered ineffective.

13. Ribbon feed mechanism having means for supporting a supply roll of ribbon for rotation about an axis, means drivingly engaging ribbon threaded from said supply roll for advancing increments of said ribbon at random intervals thereby rotating said supply roll in one rotational direction, wherein the improvement comprises:

means for applying a rotational force to said supply roll at substantially all times during feeding of the ribbon to tend to rotate said supply roll in the direction opposite to said one rotational direction and comprising:

cam means mounted for rotation about said axis and being drivingly connected with said supply roll, said cam means having a contoured surface thereon that faces at least partially tangentially with respect to the rotational axis of said supply roll and thereby is capable of positively receiving force having a tangential component,

a follower member that is small in relation to said contoured surface, and

means resiliently urging said follower along a path that intersects said contoured surface and is angularly oriented with respect thereto so that said follower member is displaced against said resilient urging means by rotation of said supply roll in said one direction.

* * * * *