United States Patent [19]

Kranz

[11] 3,857,527

[45] Dec. 31, 1974

[54] **PRECISION PAPER TAKE-UP DEVICE FOR HIGH SPEED WEB FEED PRINTER**

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[73] Assignee: **Extel Corporation,** Chicago, Ill.

[22] Filed: **Sept. 13, 1972**

[21] Appl. No.: **288,486**

[52] **U.S. Cl.** ..... **242/75.5,** 242/67.3 R

[51] **Int. Cl.** **B65h 17/02,** B65h 25/22

[58] **Field of Search** ..... 242/75.51, 75.3, 75.5, 242/67.1 R, 189, 75, 67.3 R, 190

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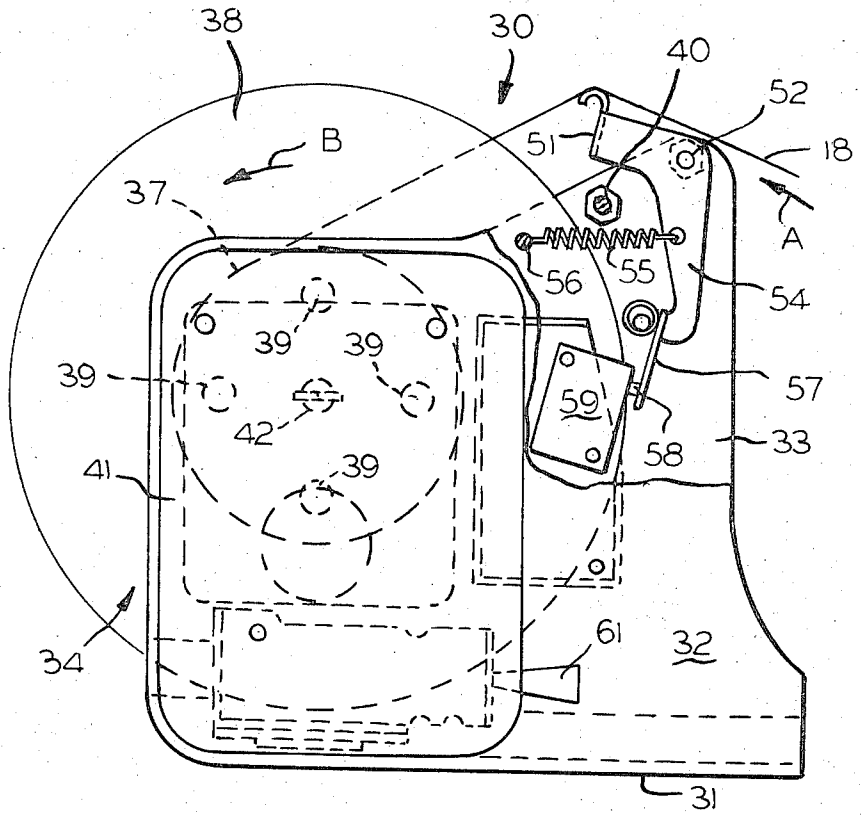
[57] **ABSTRACT**

A precision paper take-up device for a high-speed web feed printer, including a web storage reel, a normally energized motor for driving the reel in a take-up direction, a tensioning bail engaging the web ahead of the reel, and a resilient bias mechanism normally maintaining the bail in a home position. When the printer advances the web, producing slack in the web, the motor rotates the reel; the abrupt tightening of the web over the bail overcomes the bias and the bail moves away from its home position, de-energizing the motor. The bias on the bail pulls a limited length of the web back off the reel, until the bail reaches its home position, again energizing the motor and restoring equlibrium until the next advance of paper from the printer.

2 Claims, 7 Drawing Figures



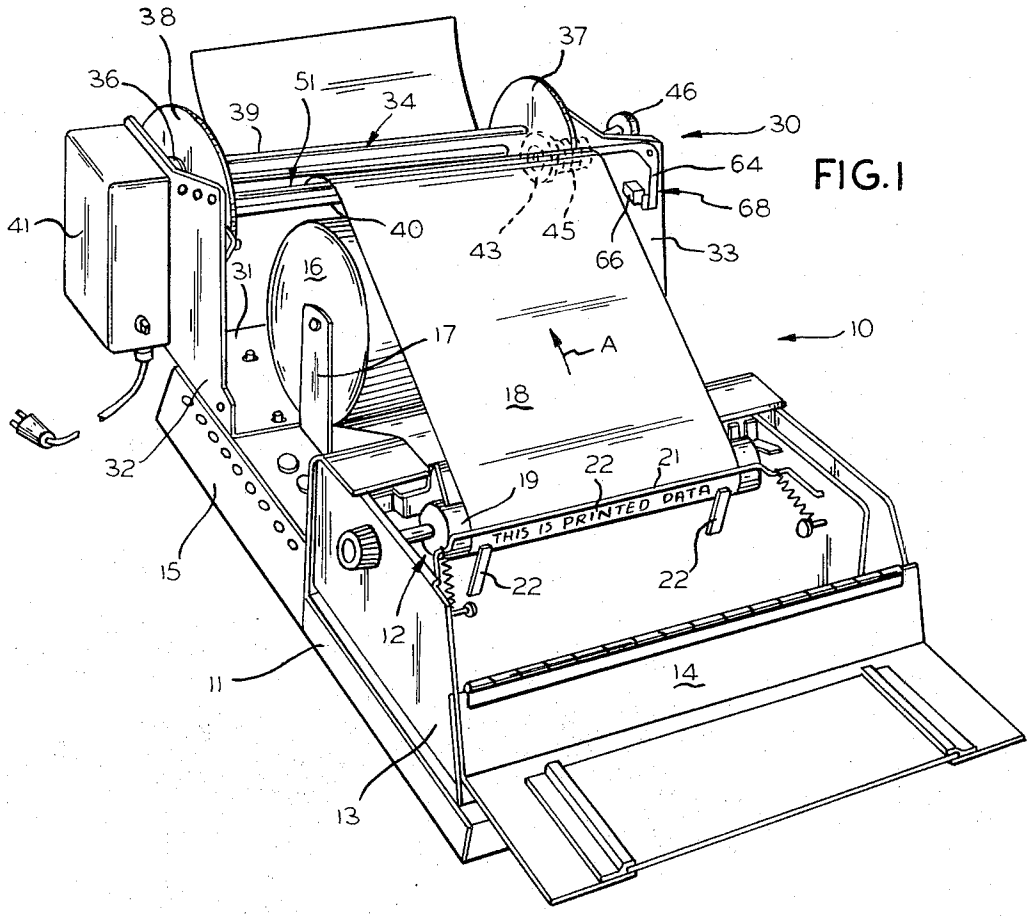


FIG.1

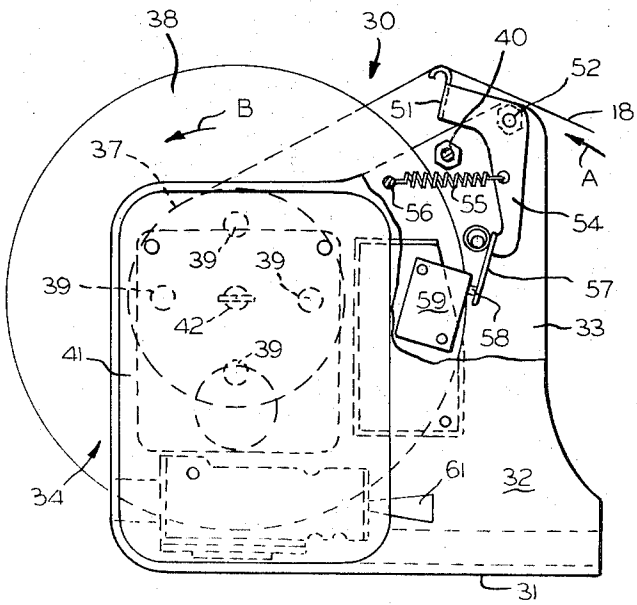


FIG.2

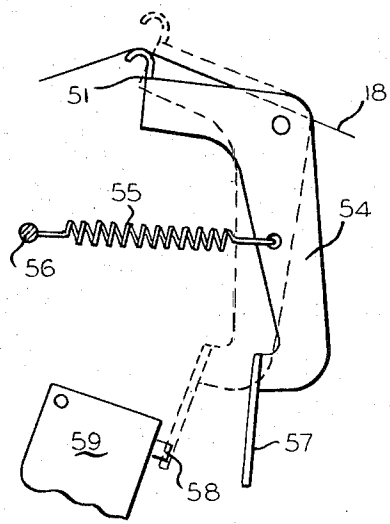


FIG.2A

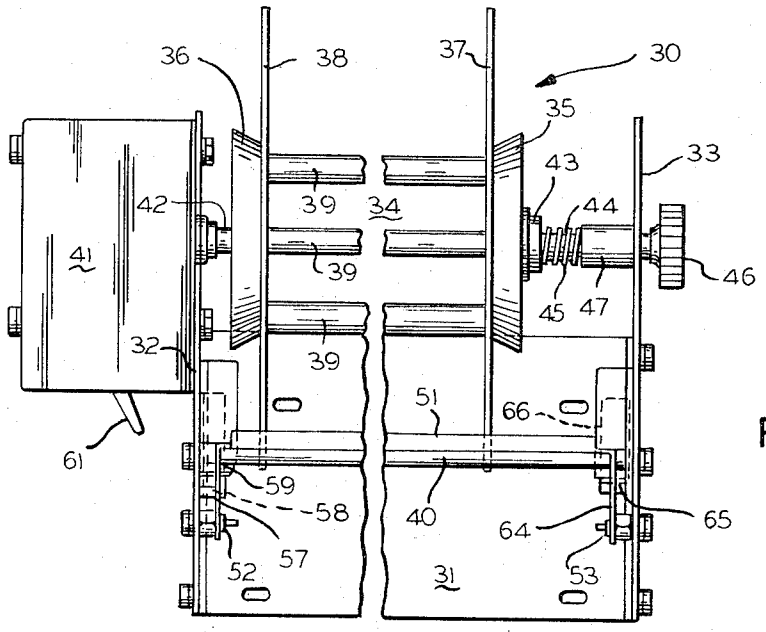


FIG. 3

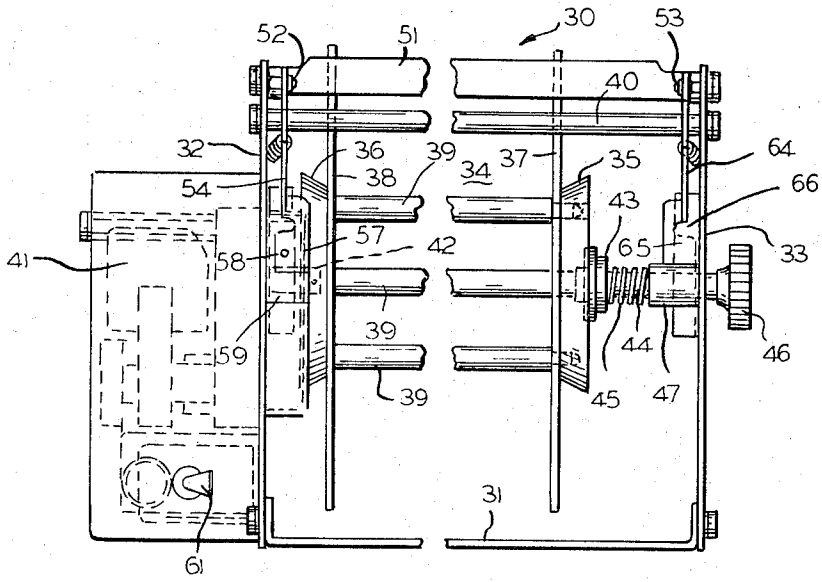


FIG. 4

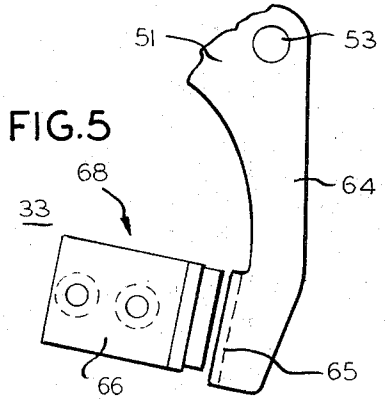


FIG. 5

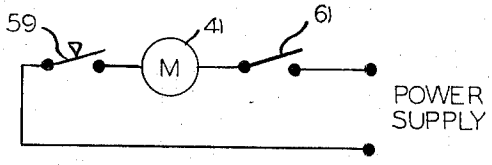


FIG. 6

PRECISION PAPER TAKE-UP DEVICE FOR HIGH SPEED WEB FEED PRINTER

BACKGROUND OF THE INVENTION

There are a variety of different types of high speed printer in which the printed information is produced upon an elongated paper web rather than on individual sheets. A particularly efficient and effective printer of this kind is the dot matrix printer described and claimed in Zenner and Kranz U.S. Pat. No. 3,670,861. In a printer of this general kind, the web is advanced by a short line increment during a brief time interval constituting a fractional part of the time required to return the printer carriage to begin a new line of characters. Printing is resumed as rapidly as possible, once the carriage return operation has been completed.

In many applications, particularly where the printer is used only intermittently or is subject to frequent attention from an operator who strips away the printed portion of the web, little or no difficulty is encountered in storing the printed portion of the web as it is fed out of the printer. In other applications, however, it may be necessary or desirable to store the printed paper web in substantially continuous and uninterrupted form for record purposes. The addition of a take-up reel or other web storage device to a high-speed printer of the kind under discussion can present substantial problems and may have an appreciable adverse effect upon operation of the printer itself.

Perhaps the simplest form of take-up device for a web feed printer is a continuously biased take-up reel. However, if the take-up reel applies substantial tension to the web at the time the web is advanced through the printer in a line feed operation, skewing or other displacement of the web can occur in the printer, which may lead to an appreciable misalignment of the printing. This effect, sometimes referred to as "paper drift," occurs because the printer requires the maintenance of a balance between the forces on the paper entering the printer and the forces applied to the web as it passes through and is advanced beyond the printing area, a balance that is extremely difficult to maintain if there is a substantial take-up tension on the paper web during the line-feed operation. Stated differently, the forces tending to hold the paper on center in the printer must be greater than the forces tending to twist the paper or slide it off center at all times.

The braking of a paper take-up device for a high-speed printer also tends to create paper drift in the printer, with resultant deterioration in the quality of the imprinted material. That is, the paper take-up device must provide some means for absorbing the energy involved in stopping the movement of the take-up reel, once the line-feed operation of the printer is completed. Effective and rapid absorption of this energy is also necessary because a heavy pull on the paper web, occurring after completion of a line-feed operation, may cause substantial distortion in the printed copy.

Many of these problems can be overcome by specific design of the printer itself to accommodate a paper take-up mechanism. However, this entails matching the operating characteristics of the take-up device to those of the printer, and may require the use of special construction in the printer. This is particularly undesirable if a given type of printer is being used in some instances with a take-up device and in others with no take-up device.

SUMMARY OF THE INVENTION

It is an object of the invention, therefore, to provide a new and improved precision paper take-up device for a high-speed printer that utilizes a paper web as a record medium and feeds the web from the printer in intermittent steps, which take-up device effectively and inherently eliminates or minimizes the technical problems of paper drift discussed above.

A particular object of the invention is to provide a new and improved precision paper take-up device for a high-speed web feed printer which effectively allows for a rapid, free advance of paper from the printer, with the take-up operation applying only minimum tension to the web during a line-feed operation of the printer.

Another object of the invention is to provide a new and improved precision paper take-up device for a high-speed web feed printer that can be utilized on printers of varying construction without requiring modification of the printer and without disturbing the printer operation.

A specific object of the invention is to provide a new and improved precision paper take-up device for a high-speed web feed printer that is simple and economical in construction and that is self-contained, requiring no electrical or mechanical control connections to the printer.

Accordingly, the invention pertains to a precision take-up device for a high-speed printer of the kind utilizing a web as a record medium and advancing the web from the printer in intermittent line-feed steps. The take-up device comprises a reel for storing a paper web and a bail which engages the paper web at a location adjacent the reel, the bail being pivotally movable between a home position and an actuated position. A normally energized electric motor is operatively connected to the reel and applies a torque to the reel tending to rotate the reel in a take-up direction to wind the web on the reel and maintain the web under limited tension. The take-up device includes sensing means, responsive to movement of the bail, for de-energizing the motor whenever the bail moves from its home position toward its actuated position. Bias means are included in the device, biasing the bail toward its actuated position in response to an abrupt engagement of the web with the bail during a take-up movement of the web. The force applied to the bail by the bias means is sufficient to pull a limited portion of the web back off of the reel, with the motor de-energized, thereby returning the bail to its home position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a precision paper take-up device, constructed in accordance with one embodiment of the present invention, mounted upon a high-speed web feed printer;

FIG. 2 is a side elevation view of the paper take-up device shown in FIG. 1;

FIG. 2A is a detail view illustrating an alternate operating condition for the mechanism as shown in FIG. 2;

FIG. 3 is a plan view of the precision paper take-up device of FIG. 1;

FIG. 4 is a front elevation view of the paper take-up device;

FIG. 5 is a detail elevation view of a retainer mechanism incorporated in the paper take-up device; and

FIG. 6 is a schematic illustration of the operating circuit for the motor of the paper take-up device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a high-speed web feed printer **10** comprising a base **11** upon which a printing mechanism **12** is mounted. The printer mechanism **12** is enclosed in a housing **13** that includes a hinged cover **14**, cover **14** being shown in open position to afford a view of some of the components of the printing mechanism **12**. The control circuits for printer **10** are mounted within an enclosure that constitutes a rearward extension **15** of base **11**.

A paper supply roll **16** is mounted in brackets **17** on the rear housing **15** of printer **10**. A paper web **18** extends from supply roll **16** around a roller platen **19** that is a part of the printing mechanism **12**. A spring-biased bail **21** holds the paper web **18** on platen **19**; additional guides **22** are provided to retain the paper web **18** in centered relation on the roller platen. Printing mechanism **12** includes a line-feed apparatus (not shown) for rotating the roller platen **19** through relatively short angular increments to effect a line-feed advance of the paper web. The remainder of printing mechanism **12** has been omitted from FIG. **1** because it is not essential to explanation or understanding of the present invention. Printing mechanism **12** may include a dot matrix printer head and carriage of the kind described in the aforementioned Zenner and Kranz U.S. Pat. No. 3,670,861; on the other hand, an entirely different mechanism for applying a printed impression to web **18** may be incorporated in printer **10** if desired.

A precision paper take-up device **30**, constructed in accordance with the present invention, is mounted upon the rear base extension **15** of printer **10**. Take-up device **30** comprises a frame of U-shaped configuration, including a horizontal base plate **31** and two vertically extending side frame members or arms **32** and **33**. The frame may also include additional bracing, such as the transverse rod **40**.

A reel **34** for storing the paper web **18** as the web is advanced from printer **10** is mounted between the side frame members **31** and **32** of take-up device **30**. Reel **34** includes two reel hubs **35** and **36** (FIGS. **3** and **4**). Two web retainer discs **37** and **38** are mounted upon hubs **35** and **36**, respectively. A plurality of rods **39** are incorporated in reel **34**; the rods **39** form the central portion of reel **34**, joining the two hubs **35** and **36**.

An electric motor **41**, which may comprise a split phase gearmotor of conventional construction, is mounted on the side frame member **32** of take-up device **30**. The output shaft **42** of motor **41** is operatively connected to reel hub **36** so that the reel hub is supported upon the motor shaft **42** and rotates in response to operation of the motor. At the opposite side of reel **34**, hub **35** is journalled on and supported by the end of a cantilever reel support shaft **44** which is aligned coaxially with motor shaft **42**. The reel support shaft **44** is journalled in and supported by a bearing **47** mounted upon the side frame member **33**, bearing **47** allowing axial movement of shaft **44**. A shoulder element **43** is affixed to shaft **44**, adjacent hub **35**, and a spring **45** is mounted on shaft **44** between shoulder **43** and the end of bearing **47**, biasing shoulder **43** toward hub **35**. The end of shaft **44** remote from hub **35** extends through an aperture in frame member **33**, and a knob **46** is affixed to the outer end of the shaft.

The precision paper take-up device **30** further comprises a bail **51** that extends transversely across the upper front end of the paper take-up device, adjacent reel **34**, shown in FIGS. **2**, **3** and **4**. Bail **51** engages the paper web **18**. The bail is pivotally mounted upon two pivot pins **52** and **53** which are mounted on the side frame members **32** and **33**, respectively. The end of bail **51** adjacent pivot pin **52** includes a downwardly projecting crank arm **54**. The intermediate portion of the crank arm **54** connected to one end of a bias spring **55**, the other end of spring **55** being anchored to a pin **56** mounted on side frame member **32** (FIG. **2**).

The lower end of the bail crank arm **54** terminates in a contact element **57**. In the "home" position for bail **51**, as illustrated in FIG. **2**, contact element **57** engages the actuator element **58** of a sensing switch **59**. Sensing switch **59** and a main on-off switch **61** constitute the only controls necessary for motor **41**. The operating circuit for motor **41** is illustrated in FIG. **6**. As shown therein, the two switches **59** and **61** are connected in a series energizing circuit for motor **41**, the energizing circuit connecting the motor to a suitable power supply. The power supply may constitute a power outlet provided on printer **10**, or may comprise an independent external power source. In any event, there is no electrical control connection from printer **10** to take-up device **30**, nor is there any mechanical control linkage between the printer and the take-up device.

The end of bail **51** adjacent pivot pin **53** comprises a downwardly extending crank arm **64** terminating in a bail stop member **65**. As best shown in FIG. **5**, the bail stop member **65** is aligned with a fixed stop member **66** that is mounted upon side frame member **33**. Preferably, an adjustable mounting is provided for the fixed stop member **66**. In the illustrated construction, the fixed stop member **66** comprises a permanent magnet and the bail stop member **65** is formed of magnetizable material to afford a magnetic latch keeper. The two stop members **65** and **66** comprise a retainer mechanism for releasably retaining the bail in its home position, the position illustrated in FIG. **2**. It is not essential that a magnetic retainer mechanism be employed; a resilient friction retainer or other readily releasable retainer mechanism can be utilized if desired.

When a new paper supply roll **16** is installed in printer **10** (FIG. **1**) the paper web is threaded through the printer around platen **19**. A substantial length of the paper web **18** is advanced through the printer and is guided over bail **51**. The end of web **18** is threaded between any two of the reel rods **39**. Pick-up device **30** is then ready for operation and the main control switch **61** is closed (FIGS. **2**, **3**, **4** and **6**).

During printing of a line of characters in printer **10**, take-up device **30** remains in the "home" condition illustrated in FIG. **2**. For this operating condition, the winder motor **41** is energized but is held in stalled condition. The paper web **18** is maintained in tension, extending across bail **51** and into reel **34**. The bias means comprising spring **55** (FIG. **2**) and retainer mechanism **68** (FIG. **5**) holds bail **51** in its home position and prevents rotation of the bail.

When the high speed printer **10** completes a line of characters (e.g., data line **22**, FIG. **1**), and is ready to initiate printing of a new line, platen **19** rotates to ad-

vance a short length of the paper web 18 outwardly of the printer in the direction of arrow A (FIGS. 1 and 2). The advance of web 18 from printer 10 causes the web to become slack. Because motor 41 is already energized, the motor starts to rotate reel 34 in a take-up direction, indicated by arrow B in FIG. 2, to wind the slack portion of the web onto the take-up reel. The take-up rotation of reel 34 does not apply appreciable tension to web 18 during the time interval in which the line feed movement occurs in printer 10, due to the delay in reel rotation caused by the inertia of the take-up mechanism, particularly the inertia of reel 34 and motor 41.

As the take-up rotation of reel 34 continues, web 18 contacts bail 51. The force applied to bail 51 by web 18, which engages the bail rather abruptly is sufficient to disengage the magnetic retainer members 65 and 66, so that bail 51 is pivoted in a counterclockwise direction away from its home position (FIG. 2) toward the actuated position illustrated in FIG. 2A. The movement of bail 51 from its home position to its actuated position disengages the bail contact member 57 from the switch contact element 58, opening sensing switch 59 (FIGS. 2 and 2A). As a consequence, motor 41 is de-energized (FIG. 6).

With motor 41 de-energized, the spring loaded bail 51 absorbs the remaining inertia load of the take-up device 30 and reel 34 is braked to a stop. From the actuating position illustrated in FIG. 2A, with motor 41 de-energized, the bias spring 55 pulls bail 51 back to its home position, again applying limited tension to paper web 18. In returning bail 51 to its home position, spring 55 applies sufficient force to bail 51 to pull a limited length of web 18 back off of reel 34. As bail 51 reaches its home position, contact member 57 again engages the contact element 58 of sensing switch 59, completing the energizing circuit for motor 41 in preparation for the next take-up operation. The return movement to the home position is limited by the engagement of the magnetic retainer members, stop members 65 and 66 (FIG. 5), which are adjusted to determine the home position for the spring-loaded bail.

When reel 34 is full, or when it is desired to remove the stored web for some other reason, switch 61 is actuated to its off position and knob 46 is pulled outwardly of frame member 33, disengaging shaft 44 from reel hub 35. Reel 34 can then be moved a short distance away from motor shaft 42, and removed from take-up device 30. Hub 35 and disc 37 are readily disengageable from rods 39, since the rods are merely inserted in sockets in hub 35 (see FIG. 4). Accordingly, it is a simple matter to remove disc 37 and hub 35 from the reel and to pull the stored web from the rods 39. Reel 34 can then be quickly re-assembled and mounted in take-up device 30. Web 18 is again threaded into reel 34, around rods 39, switch 61 is thrown on, and device 30 is again in operation.

From the foregoing description, it will be apparent take-up device 30 acts rapidly and precisely to take up the slack in web 18 whenever a line feed advance of the web from printer 10 occurs. Because motor 41 is continuously energized, the take-up operation is initiated promptly each time web 18 advanced from the printer. However, the take-up device does not exert substantial tension on the paper web during the actual line feed operation, due to the inertia of reel 34 and the maintenance of bail 51 in its home position at the beginning of the take-up operation. On the other hand, the kinetic energy of the take-up reel is effectively absorbed by the bias spring for bail 51, the energy-absorption operation being facilitated by shutting off motor 41 in response to movement of the bail from its home position to its actuated position. The take-up reel 34 is brought to rest rapidly and effectively, with no "bounce" because bail 51 is latched in its home position, once returned to that position, by the retainer mechanism comprising the magnetic latch 68 for bail 51.

Reel 34 can be readily and rapidly removed from device 30, and the reel can be emptied and returned to the take-up device in a short time, so that only one reel is required. Take-up device 30 is relatively simple and inexpensive in construction and requires no control connection, either electrical or mechanical, to printer 10, so that no modification of the printer is necessary and the same printer can be used with or without the take-up device.

I claim:

1. A precision paper take-up device for a high speed printer utilizing a web as a record medium and advancing the web from the printer in intermittent steps, comprising:

a reel for storing a web;

a bail for engaging the web at a location adjacent the reel, the bail being pivotally movable between a home position and an actuated position;

a bail stop member on the bail;

a fixed stop member positioned in the path of the bail stop member, the two stop members conjointly defining the home position for the bail;

a normally energized electric motor, operatively connected to the reel to apply a limited torque to the reel tending to rotate the reel in a take-up direction to wind the web on the reel and maintaining the web under limited tension;

sensing means, responsive to movement of the bail, for de-energizing the motor whenever tha bail moves from its home position toward its actuated position;

and bias means, comprising a spring connected to the bail, biasing the bail toward and tending to maintain the bail in its home position, but permitting movement of the bail toward its actuated position in response to an abrupt engagement of the web with the bail in a take-up movement of the web;

the bias means applying sufficient force to the bail to pull a limited portion of the web from the reel, with the motor de-energized, and return the bail to its home position, thereby again energizing the motor so that the motor is maintained energized continuously except for brief intervals when the bail is moved away from its home position as aforesaid;

the bias means further comprising a retainer device for releasably retaining the bail in its home position, preventing bouncing of the bail or reel on return of the bail to its home position.

2. A precision paper take-up device, according to claim 1, in which the retainer mechanism comprises a permanent magnet, mounted on one of the stop members, and in which the other stop member comprises a magnetic keeper element.

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