United States Patent

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[54] **REVERSIBLE RIBBON FEED DEVICE**
8 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **242/67.4,** 197/160, 242/187, 242/201
[51] **Int. Cl.** **B65h 17/02**
[50] **Field of Search** 242/55, 187, 192, 201, 67.1, 67.4; 197/160

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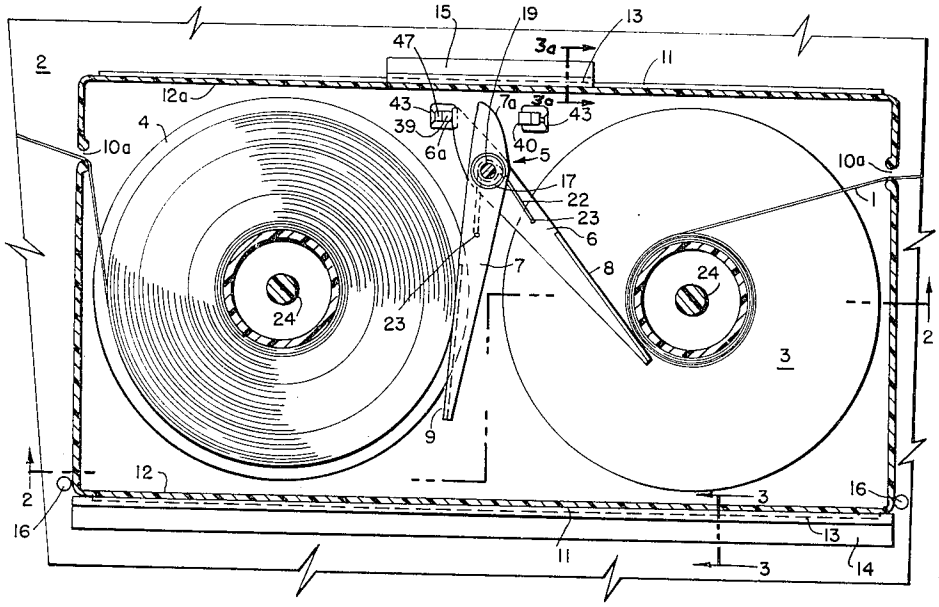
ABSTRACT: A device for reversing the direction of feeding of an inked ribbon which is bidirectionally fed between a pair of reels by selectively causing one or the other of the reels to rotate and takeup the ribbon thereon. A scissorlike member is located between the two reels with its arms biased against the peripheries of the rolls of ribbon on the reels. A pair of pressure-actuated switches, each of which is responsive to the position of one of the scissor arms, is provided to effect selective engagement of the reels with a motor by controlling electrically operated clutches. When a scissor arm becomes positioned to indicate that a predetermined low amount of ribbon is on one of the reels, one of the switches responds by drivingly engaging that reel with the motor while substantially disengaging the other reel from the motor. In this manner, the direction of ribbon feed is reversed. Preferably, the device also comprises a detachable cartridge within which the scissorlike member and reels are mounted.



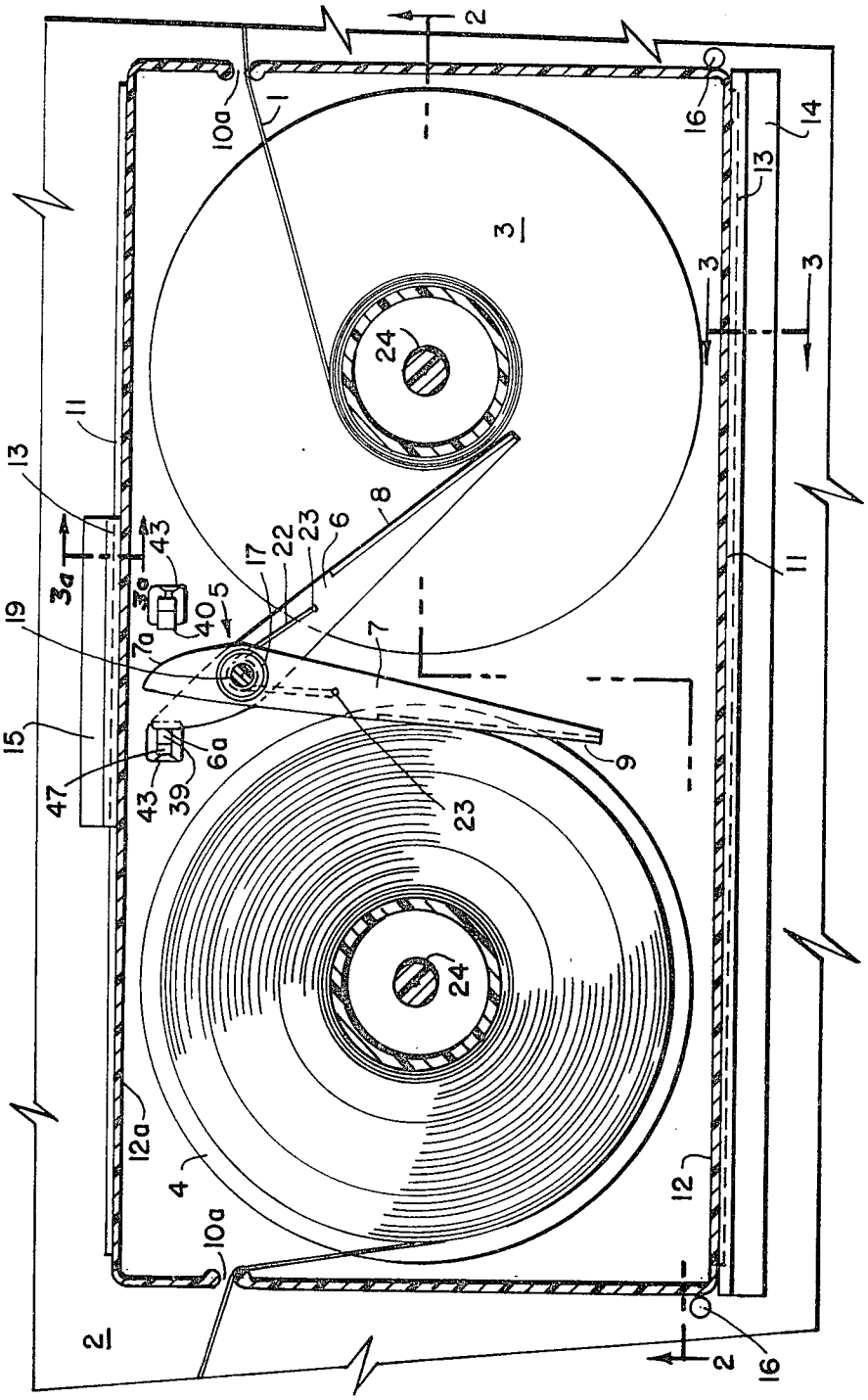


FIG. 1

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PATENTED JAN 4 1972

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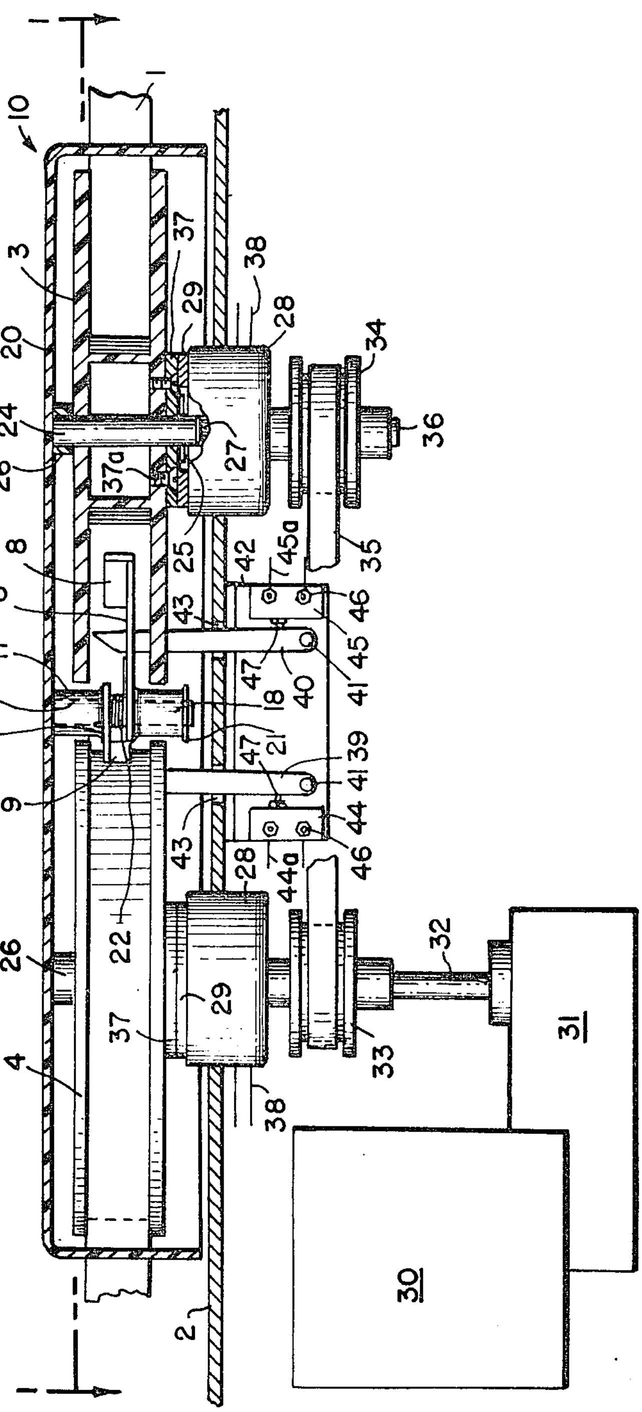
FIG. 2



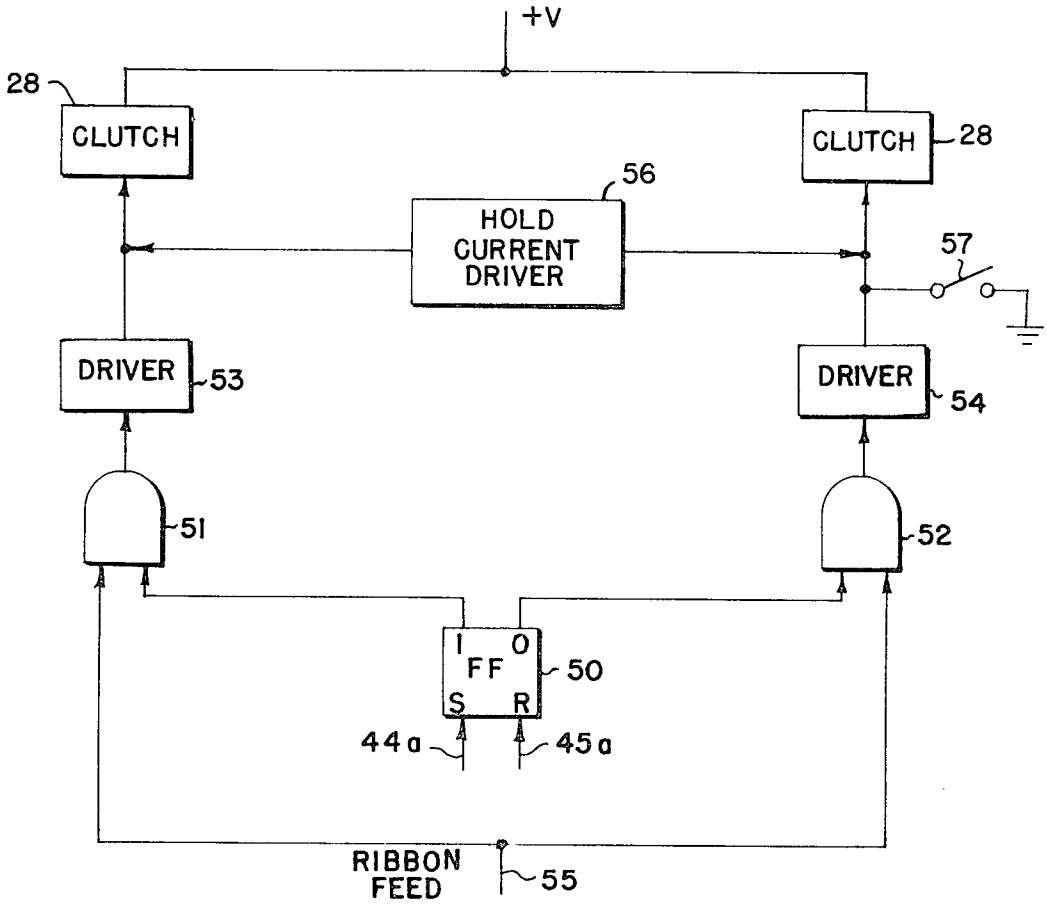

+V
28
CLUTCH
CLUTCH
28
56
HOLD CURRENT DRIVER
57
DRIVER
53
DRIVER
54
51
52
I
O
FF
S
R
50
44a
45a
RIBBON FEED
55

FIG. 4

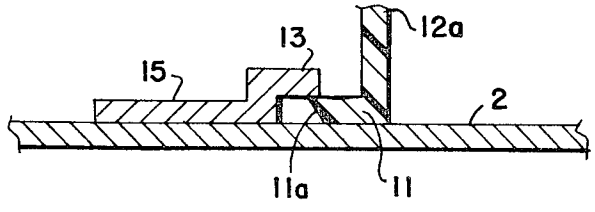

13
12a
15
2
11a
11

FIG. 3a

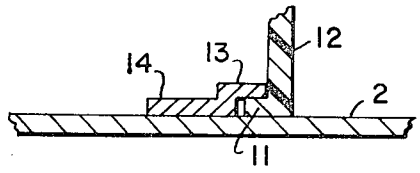


FIG. 3

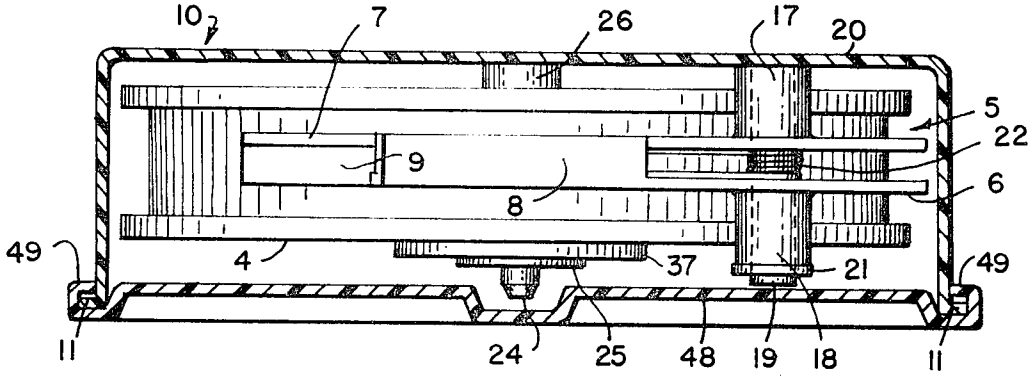


FIG. 5

REVERSIBLE RIBBON FEED DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to a reversible device for bidirectionally feeding an elongated web between a pair of reels and, more particularly, to such a device for feeding the inked ribbon of a high-speed printer or similar machine.

In many of the high-speed printers used in data processing, characters are imprinted by selectively forcing a ribbon and paper against type characters on a rotating drum or chain. The ribbon is fed across the paper from a first to a second reel so that a new area of the ribbon is continually being made available during the printing operation. Since the used areas of the ribbon regain ink from other areas by capillary action, the ribbon's direction of feeding is reversed and the ribbon is again used while being fed back across the paper. This process of alternately reversing the direction of feeding the ribbon continues until an insufficient amount of ink remains. The ribbon is then removed and replaced.

SUMMARY OF THE INVENTION

According to the invention, a device is provided to reverse the direction in which an inked ribbon or other elongated web is fed between a pair of reels by selectively rotating one of the other of the reels to takeup the ribbon thereon. The device comprises a scissorlike member whose arms are biased against the peripheries of the rolls of ribbon on the reels. Electrically controlled means is provided to selectively rotate either of the reels in response to the positions of the scissor arms. The direction of ribbon feeding may be reversed when a predetermined low amount of ribbon occurs on one of the reels. Preferably, the reels and scissorlike member are mounted within a cartridge which may be easily removed and replaced when the ink on the ribbon has been used.

The ribbon-reversing device of the invention is simple in design, reliable in use and inexpensive to manufacture. With the reels and scissorlike member mounted within a cartridge, an easily replaceable, transportable and storable device is provided.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 shows a preferred embodiment of a reversible ribbon feed device according to the invention.

FIG. 2 is a section taken along line 2—2 of FIG. 1.

FIGS. 3 and 3*a* are sections taken along lines 3—3 and 3*a*—3*a* 1 in FIG. 1 respectively and illustrate the manner in which the cartridge is mounted.

FIG. 4 is a schematic diagram of a suitable control circuit for the ribbon feed device.

FIG. 5 is an elevation view of the cartridge as stored with one of the reels removed.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, a device for bidirectionally feeding an inked ribbon 1 is shown mounted on a panel 2 which may, for example, be part of the housing for a high-speed printer. The device contains a pair of reels, 3 and 4, between which the ribbon is fed. Both reels payout ribbon when rotating clockwise and takeup ribbon when rotated counterclockwise. Initially, the ribbon may be fed from the right-hand reel 3 to the left-hand reel 4 and, when a predetermined amount of ribbon has been thus fed and the ribbon on the right-hand reel 3 is almost depleted, the direction of feeding is reversed. A scissorlike member 5 having a pair of scissor arms, 6 and 7, is located between the reels with the scissor arms maintained in contact with the peripheries of the rolls of ribbon on the reels. Flanges, 8 and 9, are located on the scissor arms at the points of contact.

Referring to both FIGS. 1 and 2, the reels and scissorlike member are contained within a cartridge which is detachably mounted on the panel 2 of the printer housing. The cartridge comprises an open-bottomed, preferably plastic, rectangular

housing 10 whose bottom edges adjoin the panel. Holes 10*a* are provided in the short sides of the housing to allow the ribbon to pass from one reel, out of the cartridge, past the printer's typing mechanism (not shown) and across the paper (not shown), back into the cartridge, and onto the other reel. Preferably, the ribbon has a short noninked end section which may be placed over the proper path from one reel to the other by the printer's operator without soiling his hands with ink when mounting the cartridge on the printer.

Flanges 11, shown in FIGS. 3 and 3*a*, are attached to the bottom edges of the housing's long sides, 12 and 12*a*. These flanges cooperate with lips 13 on a pair of mounting members, 14 and 15, which are permanently secured to the panel. One of the mounting members 14 extends along the entire length of one of the housing's long sides 12, while the other mounting member 15 is shorter and abuts the housing's opposite side 12*a*. When mounting the cartridge on the panel, the flange 11 on side 12 is initially placed under the lip 13 of the linger mounting member 14 as indicated in FIG. 3. The flange 11 on side 12*a* is then placed under the lip 13 of the shorter mounting member 15 by merely pushing down on the housing 10 adjacent side 12*a*. As shown in FIG. 3*a*, a beveled end on this flange slides over the lip 13 to allow such ease of placement. To remove the cartridge, the side 12*a* adjacent the shorter mounting member 15 is deflected sufficiently for its flange 12 to clear the lip 13 of the shorter mounting member 15. A pair of pegs 16 is located on the panel to maintain, and aid in, correct placement of the cartridge.

As best shown in FIGS. 2 and 5, the scissorlike member 5 has a pair of sleeves, 17 and 18, each of which is integral with one of the scissor arms concentric about the scissorlike member's pivot point. The sleeves surround a member 19 projecting from the top 20 of the housing 10. The scissorlike member is retained on the member 19 by a retaining ring 21 and thereby mounted from the top 20 of the housing. The projecting member 19 is also surrounded by a torsional spring 22 located between the two scissor arms, 6 and 7. The two ends of the spring 22 are bent to project through holes 23 (FIG. 1) in the scissor arms so that the spring biases the arms away from each other and in contact with the peripheries of the rolls of ribbon on the reels.

As illustrated in FIG. 2, the reels are mounted from the top 20 of the housing by projections 24 which extend through openings at their centers and about which the reels are rotatable. The reels are held in place between retaining rings 25 secured at the bottom of the projections 24, and bosses 26 surrounding the projections adjacent the top 20 of the housing.

These projections extend past the reels and locate in bores 27 within electromagnetic clutches 28 of well-known construction. Although primarily located under the panel 2, the clutches project through holes in the panel to adjoin the reels and receive the projections 24. Each clutch contains a rotor 29 which is continually driven by a motor 30 located beneath the panel 2. The motor and clutches are connected via appropriate gearing in gearbox 31 and a driving shaft 32. The driving shaft is connected directly to one of the rotors with the rotor of the other clutch being driven via pulleys 33 and 34, a belt 35 and another shaft 36.

The clutches 28 electromagnetically control the driving connection between the reels and the motor. Each reel has an armature plate 37 which is secured to its bottom with screws 37*a* and located adjacent a clutch. When a clutch is electrically energized, via leads 38, a magnetic field is set up which flows through the rotor and its adjacent armature plate. The plate is attracted and thus magnetically connected to the rotating rotor. In this manner, the clutches drivingly engage the reels with the motor. The motor supplies a torque of such direction that when either of the reels is engaged to the motor that reel rotates in the takeup direction.

Preferably, during those periods when the ribbon cartridge is mounted on the printer but the ribbon is stationary a small current is fed to both clutches to maintain tension in the ribbon by applying slight counterclockwise takeup torques on both reels.

As also shown in FIGS. 1 and 2, the device includes a pair of control arms, 39 and 40, which are pivotally mounted with pins 41 on an L-shaped bracket 42 having one of its legs secured to the underside of the panel 2. The control arms project through holes 43 in the panel to locations adjacent those portions of the scissor arms designated 6a and 7a in FIG. 1. These locations are such that each control arm, 39 or 40, is displaced by a scissor arm and pivoted about a pin 41 when the scissor arm becomes positioned to indicate that a predetermined low amount of ribbon is in the roll of ribbon which the scissor arm contacts.

When one of the scissor arms becomes located in such a position to pivot a control arm, the control arm contacts and actuates a pressure-actuated switch, 44 or 45. The switches are mounted on the L-shaped bracket 42 with fasteners 46. Each switch includes a spring-loaded contact button 47 which is adapted to be depressed by a control arm to actuate the switch. Each switch controls suitable circuitry via leads, 44a and 45a, for energizing one of the clutches while substantially deenergizing the other. That clutch which controls the rotation of the reel which is in a low ribbon condition is energized to cause this reel to rotate and takeup the ribbon. The other clutch is substantially deenergized to allow the reel it controls to rotate and payout ribbon.

A small current (much less than that fed to the clutch controlling the takeup reel) is preferably fed to the clutch which controls the payout reel. This applies a slight takeup torque to the payout reel and maintains tension in the ribbon to keep it taunt during feeding.

As an example illustrating the operation of the apparatus, in the state shown in FIGS. 1 and 2, the ribbon is almost depleted from the right-hand reel 3 and fully wound on the left-hand reel 4. Since the right-hand reel 3 is in a low ribbon condition and the scissor arm 6 is in a position indicating this condition, the apparatus is ready to reverse the direction of ribbon feed. The scissor arm 6 becomes positioned such that its portion designated 6a contact and pivots the control arm 39. The control arm 39 actuates the switch 44 to energize the clutch 28 which is connected to the right-hand reel 3 while substantially deenergizing the clutch 20 connected to the left-hand reel 4. This drivingly engages the right-hand reel 3 with the motor and causes it to rotate in the takeup direction (counterclockwise in FIG. 1) while the left-hand reel is allowed to rotate (clockwise in FIG. 1) to payout ribbon.

Circuitry for selectively energizing and substantially deenergizing a pair of clutches by pressure-actuated switches in this manner is well known. One possible circuit is illustrated schematically in FIG. 4. The leads 44a and 45a from switches 44 and 45 are respectively connected to the "set" inputs of a flip-flop 50. When actuated, each switch causes a positive going transition to occur on its lead, 44a or 45a. Such a transition on lead 44a applied to the flip-flop's "set" input causes the flip-flop to assume its "1" state and provide a steady signal at its "1" output. A transition on lead 45a applied to the flip-flop's "reset" input causes the flip-flop to assume its "0" state and provide a steady signal at its "0" output. Only one of the flip-flop's two outputs is active at any particular time and this output is determined by the input to which a pulse was last applied.

Each of the flip-flop's outputs is connected to an input of one of a pair of AND-gates, 51 and 52. Each AND gate normally has a "ribbon feed" signal fed over line 55 to its other input and, when enabled by an output signal from the flip-flop, feeds a signal to activate one of a pair of current-driving circuits, 53 and 54. Each of the clutches 28 is connected between a positive potential V and one of the current-driving circuits. Thus, each current-driving circuit energizes one of the clutches in response to a signal from the flip-flop.

When the ribbon feed device is operating, the flip-flop 50 is either in its "0" or "1" state. One of the flip-flop's outputs is active and providing a signal to the driving circuit, 53 and 54, which is energizing the clutch controlling that reel onto which the ribbon is being wound. To reverse the direction of ribbon feed, one of the switches, 44 or 45, is actuated to change the state of the flip-flop 50. This causes the previously active current driving circuit to become inactive and the previously inactive current-driving circuit to become active.

Before removing the ribbon feed device from the printer, the "ribbon feed" signal on line 55 is terminated to block the signals from the flip-flop 50 to the driving circuits, 53 and 54. This essentially disengages the reels from the driving motor 30. During a ribbon feed operation, a "ribbon feed" signal from the printer's control circuit is fed over line 55 to the AND-gates, 51 and 52. This signal is provided before printing is initiated and after the ribbon feed device has been mounted on the printer with the scissorlike member 5, reels and other parts properly situated. Since the state of the flip-flop 50 is only changed by actuation of one of the switches, 44 or 45, when a "ribbon feed" signal is fed to the AND gates the ribbon will be fed in the same direction as it was before the "ribbon feed" signal was terminated. Feeding in this direction occurs irrespective of the amounts of ribbon on the reels until one of the reels is in a low ribbon condition. At this time the direction of ribbon feed is reversed.

FIG. 4 also illustrates another current-driving circuit 56 which continually feeds a small hold current to both clutches to maintain tension in the ribbon. This driver causes very slight takeup torques to be applied to the reels. Of course, when ribbon is being fed, the small takeup torque on the reel paying-out ribbon is overpowered by the pull exerted on the ribbon by the reel taking it up. However, the small takeup torque on the payout reel serves to keep the ribbon taunt during feeding.

A spooling switch 57 is also provided. By closing this switch, the ribbon is automatically wound on the reel controlled by that clutch illustrated on the right in FIG. 4. The spooling switch 57 is connected between that clutch and ground potential so that closing the switch causes a greater current to be fed to the clutch illustrated on the right than to the one illustrated on the left. Such an automatic winding operation could be used, for example, when it is desired to remove and replace the cartridge.

FIG. 5 shows the ribbon cartridge as stored. The scissorlike member 5 and reels are permanently secured within the cartridge. The right-hand reel 3 has been removed in FIG. 5 for better illustration. As shown, a bottom cover 48 is provided to protect the ribbon and allow easy storage and transportation of the cartridge. The bottom cover contains lips 49 which cooperate with the flanges 11 of the housing 10 in the same manner as do those lips 13 used for mounting the cartridge on the panel.

As previously described, the cartridge is easily removed from and mounted on the printer. During removal, the projections 24 on which the reels are mounted easily slide out of the bores 27 in the clutches 28. When placing the cartridge on the printer, the housing 10 is mounted on the panel as already described.

Generally, when the cartridge is being mounted on the printer it will contain a new ribbon, substantially fully wound on one of the reels. One of the scissor-arms, 6 or 7, will thus be in a position denoting the low ribbon condition of the opposite reel. Since this scissor-arm will contact a control arm, 39 or 40, when the cartridge is being mounted, a control arm might easily interfere with proper placement of this scissor-arm. As best seen in FIG. 2, the top portion of each control arm, 39 and 40, is shaped to provide a slanted camming surface down which a scissor-arm indicating a low ribbon condition may slide when the cartridge is being mounted. The surface extends from a point on the control arm which the scissor-arm cannot contact when biased against a roll of ribbon on one of the reels (irrespective of how much ribbon is on the reel) to a point which the scissor-arm contacts when the reel is in a low ribbon condition. Thus, the scissor-arm slides in place without interference.

I claim:

1. In a apparatus which bidirectionally feeds an elongated web between a pair of reels by rotating one or the other of the

reels in a direction to takeup the elongated web thereon and which reverses the direction of feeding when a predetermined low amount of web is on one of the reels, the improvement comprises:

a. a movable open-bottomed housing;
b. a scissorlike member having a pair of scissor arms located within the housing:
c. means for mounting the scissorlike member within the housing;
d. means for rotatably mounting the reels within the housing;
e. biasing means for urging the scissor arms against the peripheries of the rolls of web on the reels;
f. a pair of control arms, each of which is adapted to be displaced by one of the scissor arms when the scissor arm is located in a position to indicate that a predetermined low amount of the web is in the roll against which it is urged;
g. a pair of switches, each of which is adapted to be activated by one of the control arms when the control arm is displaced; and
h. drive means, responsive to the switches, for selectively rotating either of the reels in a direction to takeup the web thereon when a predetermined low amount of the web is on the reel.

2. The apparatus as recited in claim 1 further including a stationary panel and wherein the drive means, control arms, and switches are located on a first side of the panel, the panel having apertures through which project portions of the drive means control arms.

3. The apparatus as recited in claim 2 and further including means for detachably mounting the housing on the side of the panel opposite to its first side such that the open bottom of the housing is placed adjacent the panel.

4. The apparatus as recited in claim 3 wherein a portion of each control arm is shaped to provide a camming surface over which one of the scissor arms, when in a position indicating that a predetermined low amount of web is in the roll against which it is urged, may slide when mounting the housing on the panel, whereby the control arms do not interfere with the scissor arm when the housing is being mounted.

5. The apparatus as recited in claim 1 wherein the biasing means urges the scissor arms away from each other.

6. The apparatus as recited in claim 1 wherein the biasing means comprises a torsional spring mounted at the pivot point of the scissorlike member.

7. The apparatus as recited in claim 1 wherein the means for mounting the scissorlike member within the housing comprises a member projecting from the top of the housing and jointed to the scissorlike member at its pivot point.

8. The apparatus as recited in claim 1 wherein the drive means comprises a motor and a pair of electrically controlled clutches each of which is connected between the motor and one of the reels and adapted to drivingly engage the motor with the reel in response to displacement of one of said control arms by one of the scissor arms to activate one of the switches.

* * * * *