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Mogtader

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[54] **ELECTRIC SWITCH ACTUATED PRINTER RIBBON REVERSING MECHANISM**

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[52] **U.S. Cl.** **197/160;** 101/336; 242/190

[51] **Int. Cl.** **B41j 33/40**

[58] **Field of Search** ..... 197/151, 160, 161, 162, 197/163, 164, 165; 101/96, 96 RC, 100, 102, 107, 336; 242/67.4, 189, 190

[56] **References Cited**

UNITED STATES PATENTS

1,115,493	11/1914	Bonham	197/161 X
2,672,092	3/1954	Beattie	101/336
2,714,850	8/1955	Kistner	101/96
2,723,741	11/1955	Carlson	197/161
2,724,332	11/1955	Schlessiger et al.	101/336
2,972,402	2/1961	Howard	197/165
3,185,083	5/1965	Pensavecchia et al.	101/96 RC
3,291,043	12/1966	Bernard	101/96 RC
3,334,585	8/1967	Moran et al.	101/336
3,354,822	11/1967	Dollot	197/151 X
3,632,052	1/1972	Read	197/160 X
3,633,506	1/1972	Mumma et al.	197/160 X
3,677,176	7/1972	Foley et al.	101/96
3,759,456	9/1973	Moneagle et al.	197/160 UX

FOREIGN PATENTS OR APPLICATIONS

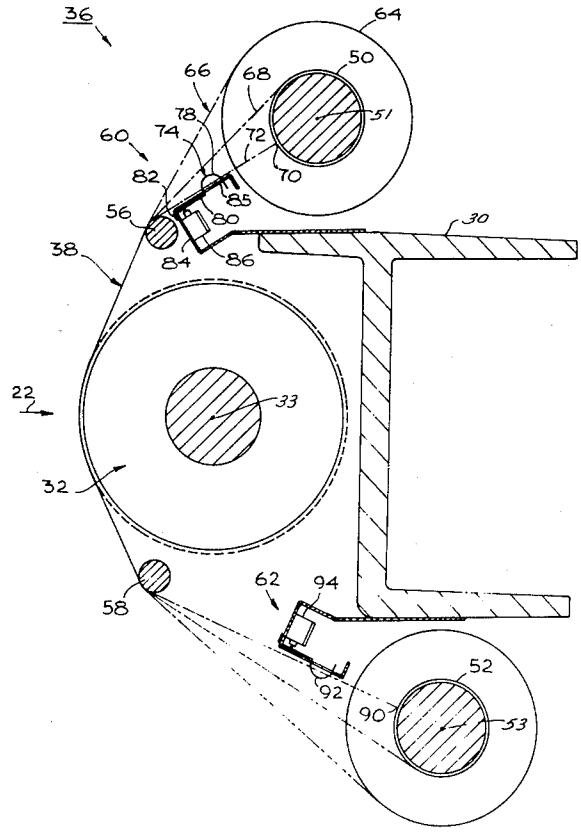
1,206,391	8/1959	France	242/190

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Attorney, Agent, or Firm—Lindenberg, Freilich, Wasserman, Rosen & Fernandez

[57] **ABSTRACT**

An impact printer utilizing a ribbon mounted to be drawn past a print station and including means for reversing the direction of ribbon movement. The ribbon is terminally secured to first and second rollers mounted on opposite sides of said print station and of sufficient length to be wound around each of said rollers through many turns. Drive means are provided for selectively driving either the first or second roller. When the first roller is driven, it draws the ribbon from the second roller past the print station. Similarly, when the second roller is driven, it draws the ribbon from the first roller past the print station. The ribbon normally unrolls from the nondriven roller along a path tangential to the circumferential surface thereof. As the ribbon continues to be drawn from the nondriven roller after the last turn has been unrolled, its path changes to substantially perpendicular to a tangent to the roller circumferential surface, i.e., in line with a diameter of the roller. Means mounted adjacent to each of the rollers is able to sense the path change and thereafter reverse the roles of the driven and nondriven rollers to thus reverse the direction of ribbon movement past the print station.

6 Claims, 3 Drawing Figures



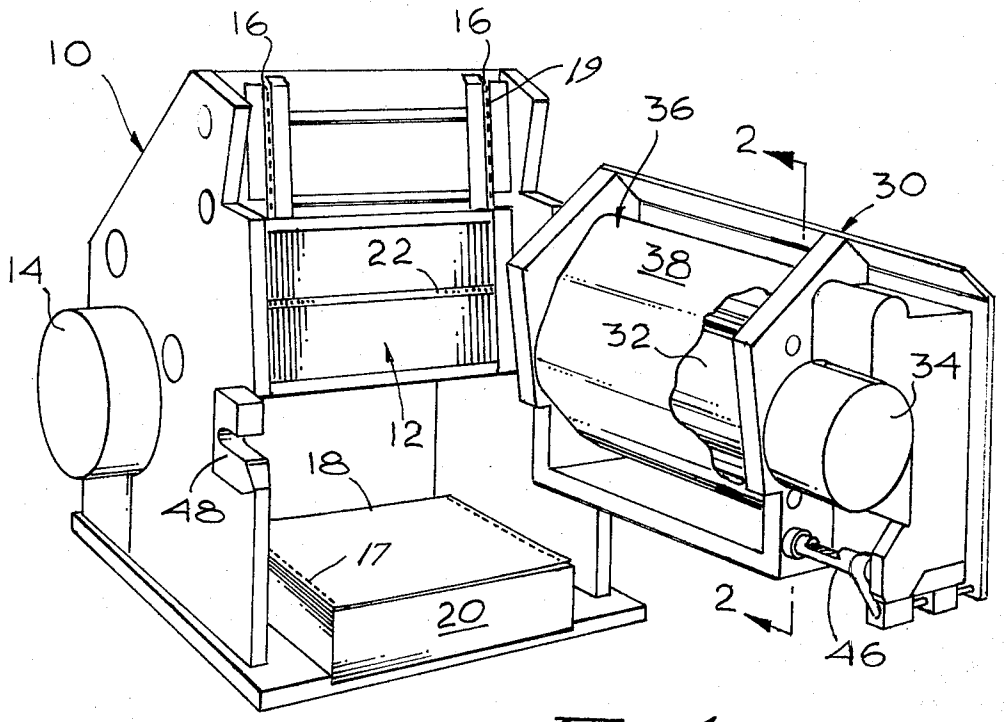

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2
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Fig. 1

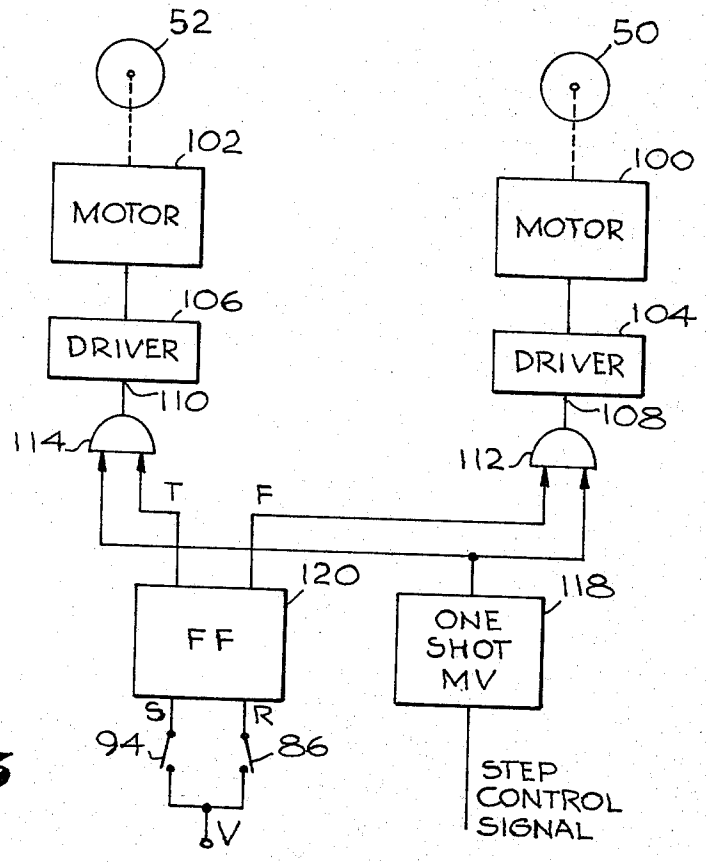

52
50
102
100
MOTOR
MOTOR
106
104
DRIVER
DRIVER
110
108
114
112
T
F
120
118
FF
ONE SHOT MV
S
R
94
86
V
STEP CONTROL SIGNAL

Fig. 3

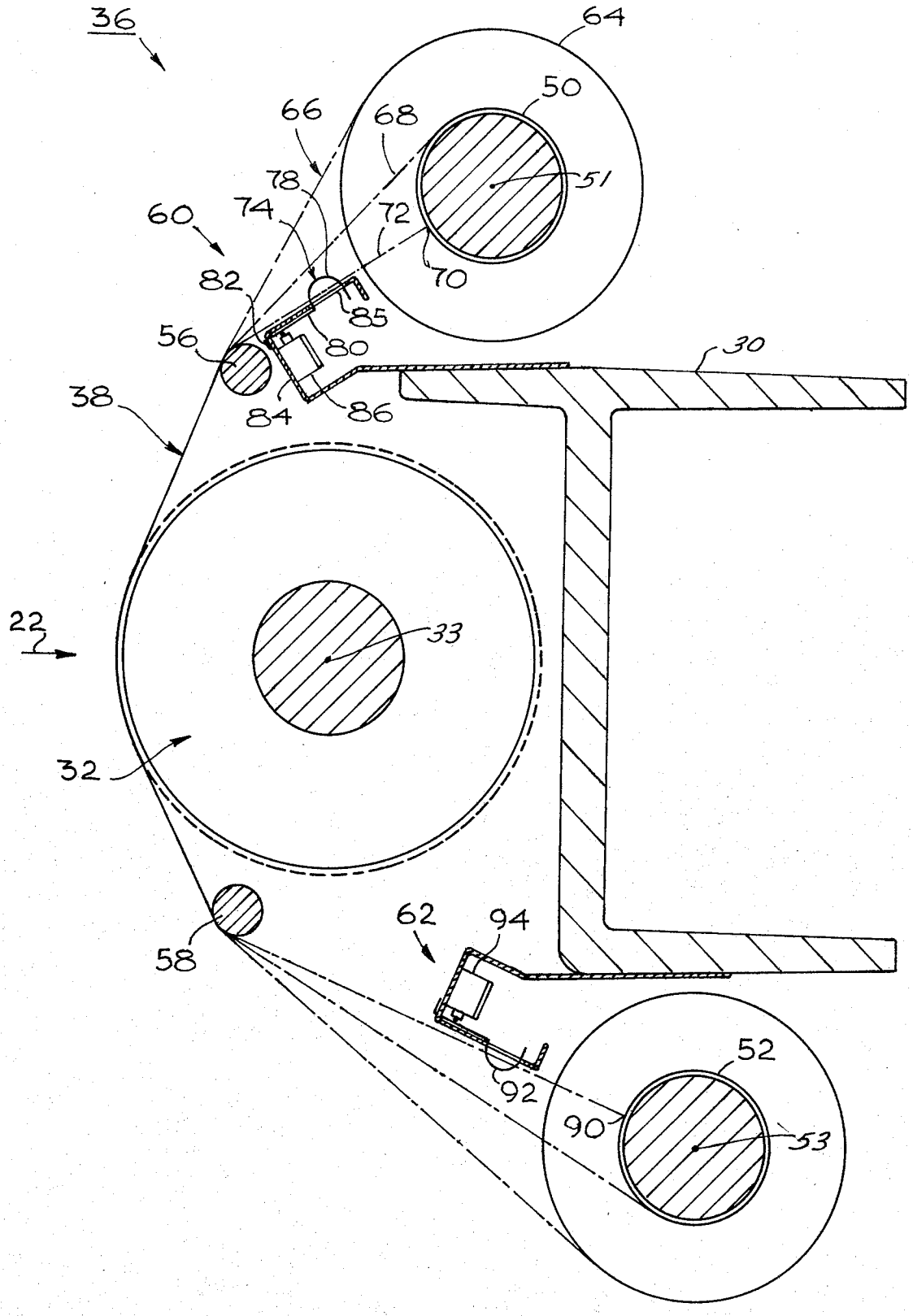

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62
94
52
92
90
53

Fig. 2

ELECTRIC SWITCH ACTUATED PRINTER RIBBON REVERSING MECHANISM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to impact printers and more particularly to an improved ribbon reversing means for use therein.

2. Description of the Prior Art

Impact printers of varying designs are well known in the art. They are widely used in diverse applications including data processing systems where they may print at speeds up to 2,400 lines per minute. Generally, such printers include a bank of hammers disposed along a common row opposite to a moving type bearing surface such as a drum or chain. The paper to be printed upon is stepped one line at a time along a path between the hammer faces and the type bearing surface. An ink ribbon is disposed between the paper and type bearing surface so that when a hammer face impacts against the paper, it urges the paper against the ribbon and the ribbon against a selected character on the type bearing surface. As a result, the character is printed on the side of the paper facing the ribbon.

The ink ribbon is usually in the form of a web, moun ted between first and second rollers, to provide a large ribbon area. The ribbon is usually stepped past the hammer faces so that it is substantially uniformly worn over the entire ribbon area. Various means are known in the prior art for sensing when an end of the ribbon has been reached in order to reverse its direction of movement. For example only, one technique utilizes a metal bar secured close to the end of the ribbon to actuate a switch as it peels from the roller.

SUMMARY OF THE INVENTION

The present invention is directed to an improved means for reversing the direction of ribbon movement in an impact printer and more particularly, to a means for sensing when the ribbon has been substantially completely unrolled from one of its rollers.

In a preferred embodiment of the invention, first and second switch actuators are respectively mounted adjacent to first and second rollers. An ink ribbon, of sufficient length to be wound around each roller several turns, is terminally secured to each roller. As the ribbon is drawn from a roller, it moves along a path tangential to the roller's circumferential surface and in so doing avoids contact with the adjacent switch actuator. However, as the ribbon continues to be drawn after the last turn peels from the roller, the ribbon pulls the roller around to a position such that the ribbon path is essentially in line with a diameter through the roller and thus perpendicular to a tangent to the roller's circumference. In moving toward this path, the ribbon engages a switch actuator to thereby cause a drive motor to rotate the empty roller thus drawing the ribbon from the full roller.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a typical impact printer in which an embodiment of the invention can be advantageously employed;

FIG. 2 is a sectional view taken substantially along the plane 2—2 of FIG. 1 showing a preferred ribbon reversing assembly in accordance with the present invention; and

FIG. 3 is a block diagram of the circuit means for controlling the ribbon rollers in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Attention is now called to FIG. 1 which illustrates an impact printer exemplary of the type generally employed for data processing applications. Briefly, the printer of FIG. 1 is comprised of a first frame **10** supporting a hammer bank assembly **12** and a paper stepping system generally comprised of motor **14** driving tractor chains **16.** The chains **16** pull edge perforated paper **18** from a supply stack **20** past the hammer faces **22** of the hammer bank assembly **12.** The printer of FIG. 1 also includes a second frame **30** which is hinged with respect to the frame **10.** The frame **30** supports a moveable type bearing surface such as a multitrack drum **32** which is normally horizontally oriented and rotated about its axis **33** by a motor **34.**

A ribbon assembly **36** in accordance with the present invention is carried by the frame **30** for passing a printing ribbon **38** between the type bearing surface **32** and the hammer faces **22.** The details of the ribbon assembly **36** in accordance with the invention will be discussed hereinafter in connection with FIGS. **2** and **3.**

In the operation of the printer of FIG. **1,** the edge perforations **17** of the paper **18** are engaged with the sprockets **19** of chains **16** to thus enable the motor **14** to pull the paper **18** past the hammer faces **22.** Normally the motor **14** steps the paper **18** one line at a time. Printing of course can be accomplished only when the frame **30** is pivoted to a closed position, relative to the frame **10,** and locked thereto as by cooperating latch portions **46** and **48.** In this closed operative position, the hammer faces **22** will be disposed very close to the paper **18** which in turn will be disposed very close to the printing ribbon **38.** As the character drum **32** rotates, it cyclically passes different raised characters in front of each hammer face **22.** By actuating a hammer at an appropriate time, the hammer face **22** is propelled against the back side of the paper **18,** forcing the paper **18** against the ribbon **38** and drum **32** to thus print a character on the front side of the paper **18.**

The ribbon assembly **36** in accordance with the present invention steps the ribbon **38** past the printing station defined by hammer faces **22,** preferably one line at a time in synchronism with the movement of paper **18.** The ribbon **38** is moved for the purpose of substantially uniformly distributing the hammer impacts over the entire ribbon area. As will be seen hereinafter, the ribbon **38** is terminally secured to first and second rollers **50, 52** and is drawn from the first roller **50** to the second roller **52** until the first roller **50** is empty, and then back from the second roller **52** to the first roller **50.** A significant aspect of the present invention is the provision of reliable low cost means for sensing when there is substantially no more ribbon **38** on one of the rollers **50, 52** and for reversing the direction of the ribbon movement in response thereto.

Attention is now called to FIG. **2** which illustrates a cross-sectional view of the ribbon assembly **36** taken substantially along plane **2—2** of FIG. **1.** The ribbon assembly **36** includes first and second cylindrical rollers **50** and **52** mounted with their longitudinal axes **51** and **53** respectively essentially parallel to one another and

parallel to the longitudinal axis 33 of the type bearing drum 32. The rollers 50 and 52 are mounted for rotation on opposite sides of the print station defined between the hammer faces 22 and the drum 32.

The ribbon 38 is terminally secured to each of the rollers 50 and 52 along lines on the circumferential surfaces of the rollers 50, 52 extending parallel to the longitudinal axes 51, 53 thereof. The ribbon 38 is sufficiently long so as to be wound around each of the rollers 50 and 52 through several turns. For example, only, the ribbon 38 may be 20 feet in length and each of the rollers 50 and 52 may have a diameter of approximately 1 ½ inches. Typically, the spacing between the longitudinal axes 51, 53 of rollers 50 and 52 along the path followed by the ribbon 38 may be on the order of 2 feet.

Idler rollers 56 and 58 are respectively mounted between the print station and the rollers 50 and 52 for guiding the ribbon 38.

In accordance with the present invention, switch assembly means 60 and 62 are respectively provided for determining when the ribbon 38 has been substantially and completely unrolled from one of the rollers 50, 52. In order to understand the operation of the switch assemblies 60 and 62, initially assume that the maximum length of ribbon 38 is rolled on roller 50, as represented by the large diameter circle 64 around roller 50 in FIG. 2. By drawing the ribbon 38 downward in FIG. 2, the roller 50 will be rotated counterclockwise to unroll the ribbon 38 therefrom initially along a path 66 tangential to the ribbon roll 64 and substantially tangential to the circumferential surface of roller 50. As the ribbon 38 continues to be drawn, by counterclockwise rotation of roller 52, from the roller 50, the amount of turns of ribbon 38 on roller 50 will decrease until the ribbon 38 assumes the path 68 which is essentially tangential to the circumferential surface of roller 50. Note that the ribbon paths 66 and 68 are spaced from and do not engage any part of the switch assembly 60.

After the last turn of ribbon 38 has been unrolled from roller 50 the end of the ribbon 38 terminally secured to roller 50 will move down to the point 70 with the ribbon 38 assuming the path 72 between the roller 50 and idler roller 56. In moving from the path 68 to the path 72 during approximately the last quarter turn of the roller 50, the ribbon 38 will engage switch actuator 74 of the switch assembly 60. The actuator 74 is preferably formed of resilient stock and is generally comprised of an arcuate end portion 78, a straight intermediate portion 80 and a perpendicular end portion 82. The actuator 74 is mounted on bracket 84 with the straight portion 80 cantelevered from end 82 secured to the bracket 84. The arcuate portion 78 projects toward the ribbon path through an opening 85 in the bracket 84.

When the supply of ribbon 38 on the roller 50 becomes exhausted, the ribbon path changes from path 68 to path 72 and in so doing engages the arcuate portion 78 of the actuator 74 to depress it through the bracket opening 85. The actuator 74 is constructed of spring material so that after the ribbon 38 disengages the actuator 74, the actuator 74 is able to return to its position illustrated in FIG. 2.

The switch assembly 60 includes a microswitch 86 which closes in response to the ribbon 38 bearing aganst the actuator 74 to press it through the opening 85. As will be discussed hereinafter in connection with FIG. 3, actuation of the switch 86, which of course occurs only after the supply of ribbon 38 on the roller 50 has been exhausted, causes the roller 50 to be thereafter driven in a clockwise direction to thus draw ribbon 38 from the roller 52 and roll it back on to the roller 50. The switch assembly 62 operates identically to the switch assembly 60. That is, it is mounted between the idler roller 58 and roller 52 so as to be spaced from the path of the ribbon 38 until the supply of ribbon 38 on the roller 52 is substantially exhausted at which time the end of the ribbon 38 secured to the roller 52 moves to point 90 which thereby defines a ribbon path intersecting the actuator 92 of switch assembly 62. Engagement of the ribbon 38 against the actuator 92 closes the switch 94 of the switch assembly 62 to thereafter drive roller 52 in a counterclockwise direction to draw the ribbon 38 so as to unroll it from roller 50 and back on to roller 52.

Attention is now called to FIG. 3 which illustrates a block diagram of a preferred control circuit in accordance with the present invention, for controlling the rotation of rollers 50 and 52 in response to actuation of the switches 86 and 94.

As shown in FIG. 3, the rollers 50 and 52 are respectively independently coupled to motors 100 and 102. The motors 100 and 102 are constantly supplied with low level drive current by driver circuits 104 and 106 respectively. The low level drive current to the motors 100 and 102 develops a torque tending to drive the roller 50 clockwise and the roller 52 counter clockwise to maintain the ribbon 38 taut therebetween. In order to move the ribbon 38, the current provided by one of the driver circuits 104 or 106 is increased to a higher level to thus produce a greater torque on motor 100 or 102.

The drivers 104 and 106 are implemented to provide a higher level output current in response to a control signal applied to their enabling input terminals 108 and 110 respectively. The outputs of AND gates 112 and 114 are respectively connected to the enabling terminals 108 and 110 of the driver circuits 104 and 106. In normal operation, either the AND gate 112 or the AND gate 114 will pass a pulse of fixed duration defined by the one-shot multivibrator 118, in response to the step control signal. Although the means for generating the step control signal is not illustrated in FIG. 3, it should be understood from what has been said thus far that the ribbon 38 is preferably stepped the equivalent of one line after each line has been printed. A signal generated at the completion of each line of print is utilized to activate the multivibrator 118 to briefly provide a high level current to one of the ribbon assembly motors 100 or 102.

As previously mentioned, the output pulse provided by the multivibrator 118 is directed through either AND gate 112 or AND gate 114 to the drivers 104 and 106 respectively. Which of the AND gates 112 and 114 is enabled is determined by the state of flip-flop 120. As shown, when flip-flop 120 defines a true state, AND gate 114 is enabled and when flip-flop 120 defines a false state, AND gate 112 is enabled. The previously mentioned switches 86 and 94, shown in FIG. 2, are respectively connected to the reset and set input terminals of flip-flop 120.

Thus, in operation, after all of the ribbon 38 has been unrolled from the roller 50, the displacement of the ribbon path during the final turn of roller 50 will close switch 86 to thereby switch flip-flop 120 to a false state.

This action will enable AND gate **112** so that as each step control signal is subsequently generated, it will cause the driver circuit **104** to supply a high level current to the motor **100.** This action will produce a torque on motor **100** which is greater than the torque continuously developed by motor **102** to thereby rotate roller **50** in a clockwise direction to roll the ribbon **38** thereon. After the ribbon **38** has been substantially completely unrolled from roller **52,** the displacement of the ribbon path occurring after the last ribbon turn is unrolled from roller **52** will act to close switch **94** to thus switch flip-flop **120** to a true state. This will enable AND gate **114** so that thereafter, the pulses provided by multivibrator **118** will cause driver circuit **106** to provide periodic high level current pulses to motor **102** to thereby produce a torque thereon exceeding the torque continually developed by motor **100.** As a consequence, the ribbon **38** will unroll from roller **50** and roll onto roller **52.**

From the foregoing, it should be recognized that a ribbon assembly **36** has been disclosed herein for use in an impact printer for the purpose of reversing the direction of ribbon movement after the supply of ribbon **38** on one of two rollers **50, 52** has been substantially exhausted. The means provided for sensing when the ribbon **38** has been substantially completely unrolled from a roller (**50** or **52**) comprises switch actuators **74** appropriately placed so as to be normally out of the path defined by the ribbon **38** as it unrolls along a path substantially tangential to the roller circumference surface and within a path substantially in alignment with a diameter of the roller **50, 52** which latter path is assumed by the ribbon **38** after it is completely unrolled from a roller **50, 52.**

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In an impact printer including a ribbon assembly comprised of first and second cylindrical rollers mounted in spaced parallel relationship and an elongated ribbon formed of flexible ink carrying material and having its short edges terminally secured along longitudinal lines of the circumferential surfaces of said rollers and of sufficient length to form multiple turns around each of said rollers, the improvement comprising:

guide means mounted between said first and second rollers for engaging said ribbon material;

drive means for selectively rotating said first roller to roll said ribbon material between and draw said ribbon material from said second roller past said guide means. said ribbon material defining a path between said second roller and said guide means which is variable between being tangent to said second roller circumferential surface when there is at least a certain portion of a turn of ribbon material on said second roller and being substantially perpendicular to a tangent to said second roller circumferential surface when there is substantially no ribbon on said second roller; and

first switch actuator means mounted between said guide means and said second roller and positioned to directly engage said ribbon material between the long edges thereof only when the path thereof is essentially perpendicular to a tangent to said second roller circumferential surface.

2. The improvement of claim **1** wherein said drive means further includes means for selectively rotating said second roller to roll said ribbon material thereon and draw said ribbon material from said first roller past said guide means, said ribbon material defining a path between said first roller and said guide means which is variable between being tangent to said first roller circumferential surface when there is at least a certain portion of a turn of ribbon material on said first roller and being substantially perpendicular to a tangent to said first roller circumferential surface when there is substantially no ribbon material on said first roller; and

second switch actuator means mounted between said guide means and said first roller and positioned to engage said ribbon material only when the path thereof is essentially perpendicular to a tangent to said first roller circumferential surface.

3. The improvement of claim **2** wherein said drive means includes:

motor means for selectively rotating either said first or second rollers; and

control circuit means responsive to said first and second switch actuator means for controlling said motor means to rotate said first and second rollers in response to actuation of said second and first switch actuator means, respectively.

4. A ribbon assembly useful in an impact printer comprising:

first and second cylindrical rollers mounted for rotation in spaced substantially parallel relationship;

an elongated ribbon formed of flexible ink carrying material of sufficient length to form multiple turns around each of said rollers and having its short edges terminally secured to the circumferential surfaces of said first and second rollers;

guide means mounted between said first and second rollers for engaging said ribbon material;

drive means for selectively rotating either said first or second roller to roll ribbon material thereon drawing said ribbon material from the other of said rollers past said guide means, said ribbon material defining paths from each of said rollers to said guide means along lines tangent to said rollers when there is at least a certain portion of a turn of ribbon material on the rollers and defining a path from one of said rollers to said guide means substantially along a diameter of said one of said rollers when there is substantially no ribbon material on said one of said rollers;

first sensor means for sensing an abrupt transition of said ribbon material from said path along a line tangent to said first roller to said path substantially along a diameter of said first roller; and

second sensor means for sensing an abrupt transition of said ribbon material from said path along a line tangent to said second roller to said path substantially along a diameter of said second roller.

5. The ribbon assembly of claim **4** wherein said first and second sensor means respectively comprise first and second switch actuators; and

means mounting said first and second switch actuators for engagement with said ribbon material only when said ribbon material assumes a path substantially along a diameter of said second and first rollers, respectively.

6. The ribbon assembly of claim **5** wherein said drive means includes means responsive to engagement of said first switch actuator by said ribbon material for rotating said first roller and engagement of said second switch actuator by said ribbon material for rotating said second roller.

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