

[54] **SPRING-RETURNED POWER DRIVEN RIBBON**

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197/165

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[58] Field of Search 197/126, 126 A, 133, 134, 151, 197/160, 161, 162, 163, 164, 165; 101/336

[56] **References Cited**

UNITED STATES PATENTS

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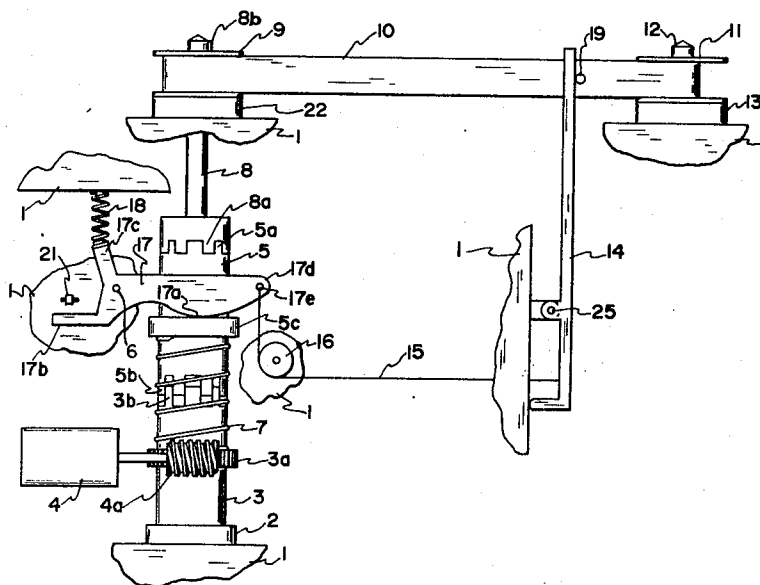
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[57]

ABSTRACT

A spiral spring coupled to a first spool is wound when ribbon from that spool is pulled onto a second spool by operation of a disengageable drive mechanism. When a predetermined amount of ribbon has been paid out, an eyelet on the ribbon trips a lever disengaging the drive mechanism and the spiral spring unwinds. The unwinding of the spring simultaneously causes the paid-out ribbon to be taken up on the first spool. The cycle repeats when the drive mechanism is recoupled to the second spool.

5 Claims, 2 Drawing Figures



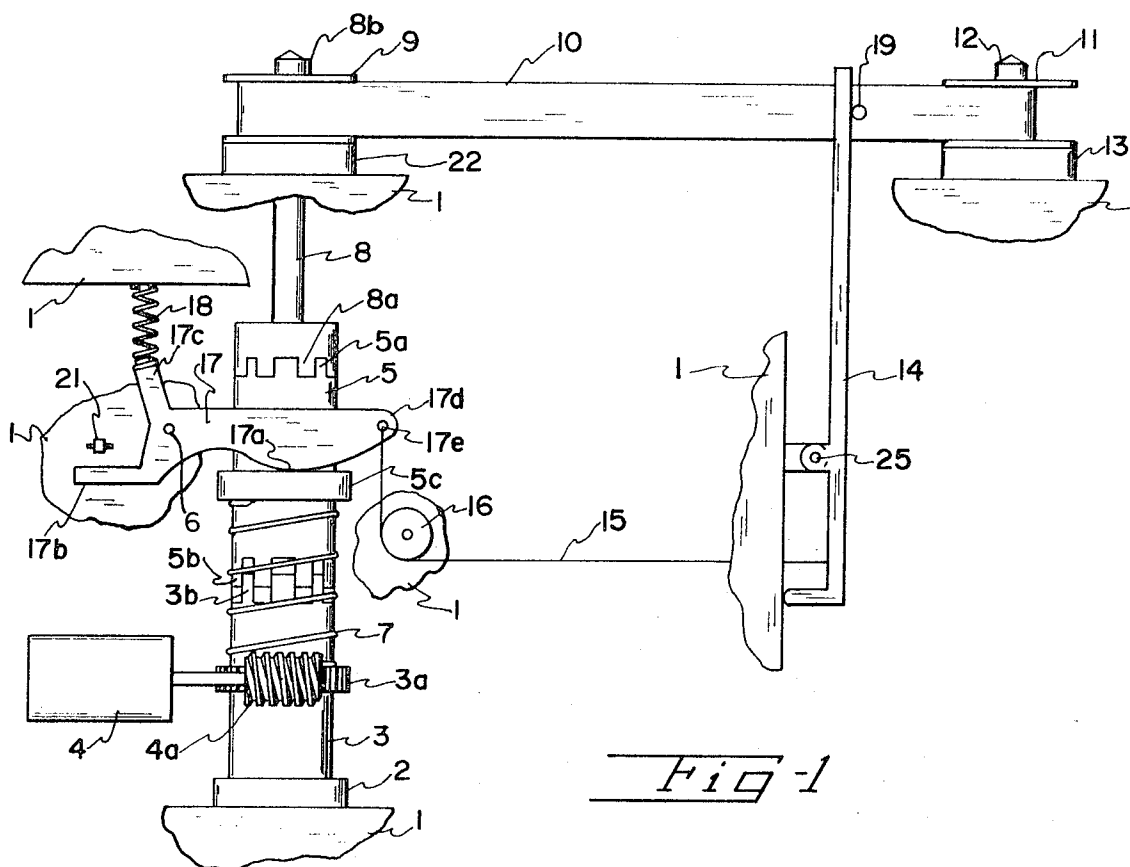


Fig-1

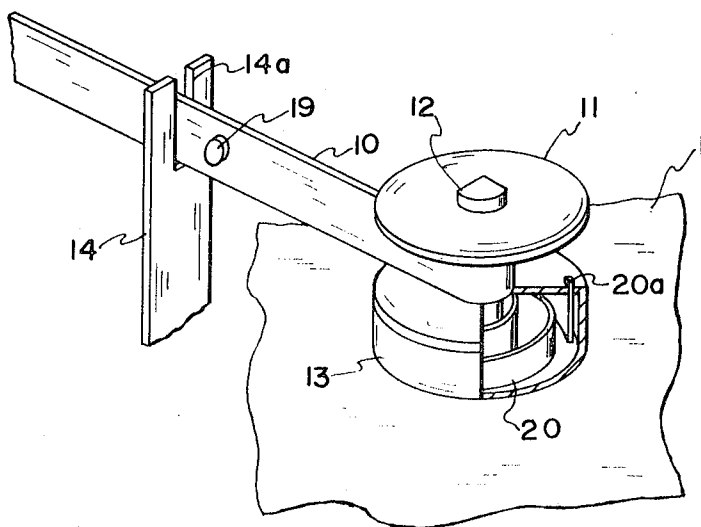


Fig-2

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SPRING-RETURNED POWER DRIVEN RIBBON

BACKGROUND OF THE INVENTION

1. Field of the Invention

The subject invention relates generally to ribbon winding apparatus and more particularly to apparatus where the direction of winding is automatically reversed.

2. Description of the Prior Art

Printer ribbon mechanisms of one known type are incrementally driven bi-directionally, with reversing being automatically controlled. Such mechanisms — an example being the device disclosed in U.S. Pat. No. 2,627,965 — have been generally satisfactory, but do require complex mechanisms with a considerable number of parts for switching the drive from one direction to the other. Also, when the ribbon direction is reversed, printing occurs next on the areas of the ribbon most recently used, those were redistribution of the ink supply in the ribbon may not have occurred, and thus result in uneven darkness of the print. Further, when the ribbon is worn out, the operator may have to rewind the ribbon by hand in order to place all the ribbon on one of the usual pair of spools for easy removal and replacement with a fresh ribbon.

In ribbon mechanisms of another type — exemplified by U.S. Pat. No. 3,146,708 — a single spool holds the ribbon and the printer mechanism provides for withdrawing a relatively short ribbon from the spool, bringing it before the print heads for the duration of a print cycle and then returning the ribbon to its spool. Because of the required speed of business machines, the withdrawal and return of the ribbon is accomplished at an appreciable speed. These latter mechanisms generally perform well also, but have been found unsatisfactory because of excessive wear, the same piece of ribbon being exposed to the print heads in each cycle, and because the high rate of cycling results in a tendency to snarl the ribbon after the machine has been in use over an extended period, presumably because gumming of the lubricants makes for erratic return rates and consequent ribbon backlash.

Another known type of structure which avoids concentration of wear in limited areas of the ribbon depends upon use of endless ribbon bands — as shown, for example, in U.S. Pat. No. 3,050,172 — but the bands have to be seamless to avoid variations in darkness of the characters when printed at a seam. The seamless bands have problems too — raveling of cut edges leads again to jamming.

SUMMARY OF THE INVENTION

It is an object of the invention to provide an improved winding apparatus.

It is another object of the invention to provide a reversible ribbon winding apparatus which is reliably jam-free and has relatively few parts.

It is yet another object of the invention to provide a ribbon apparatus which distributes ribbon wear in fashion similar to an endless ribbon, but with use of a reversing mechanism.

According to the present invention there is provided apparatus for reversibly transferring ribbon between first and second spools comprising: a chassis; a reverse winding indicator coupled to the ribbon; disengageable drive means for winding the ribbon on the second spool, disengagement being responsive to the reverse winding indicator; and stored energy means for winding the ribbon on the first spool.

BRIEF DESCRIPTION OF THE DRAWING

The above-mentioned and other objects of this invention will become apparent by reference to the following description in conjunction with the accompanying drawing in which:

FIG. 1 is a partial illustration of apparatus for reversibly transferring ribbon; and

FIG. 2 is a perspective illustration of a spiral spring and spool arrangement.

DESCRIPTION OF A PREFERRED EMBODIMENT

As shown in FIG. 1, a shaft 3 has splines 3b at one end and a flange gear 3a substantially between its ends. Shaft 3 is coupled through flange gear 3a and a worm gear 4a to a motor 4 and is rotatably mounted on a chassis 1 by means of a bearing arrangement 2. Motor 4 rotates counterclockwise in the embodiment of FIG. 1 and may operate continuously or intermittently under control of print cycle initiating means (not shown, but well known in the art). The splines 3b of the rotatable shaft 3 are continuously coupled with the splines 5b of an axially aligned, slidable clutch 5. Clutch 5 has additional splines 5a located at its upper end and has a flange 5c between its ends. The clutch splines 5a are caused to engage the matching splines 8a of a spool drive shaft 8, also axially aligned with clutch 5, by a compression spring 7. Spring 7, wound about rotatable shaft 3 and clutch 5, is located in between the flange gear 3a and the clutch flange 5c, thus urging upper clutch splines 5a away from shaft 3 and toward the spool drive shaft splines 8a. The spool drive shaft 8 is supported on chassis 1 by a bearing arrangement 22, well known to those reasonably skilled in the mechanical arts. The other end of the spool drive shaft 8 includes a key 8b which engages a spool 9 to rotate it therewith (clockwise when viewing the top of shaft 8 in FIG. 1). When the spool 9 is being driven, a ribbon 10 is wound thereon. The winding action creates a tension in the ribbon 10 which in turn exerts a torque on another spool 11, causing the latter to rotate about a fixed shaft 12.

As shown in FIG. 2, spool 11 is mounted on shaft 12 above a spring housing 13 containing a spiral spring 20. One end of spring 20 is coupled to shaft 12 and the other end 20a is coupled to spool 11. When spool 11 is caused to rotate by the previously mentioned torque, spring 20 is wound and energy stored in it; consequently, if the upper clutch splines 5a and drive shaft splines 8a are disengaged, the energy stored in spring 20 reverses the direction of rotation of spool 11 and rewinds ribbon 10 thereon. The rewound ribbon 10 is then ready to be taken up by spool 9 as it was originally, there having been no printing during the rewind action as in prior art ribbon mechanisms of the first-mentioned type.

In this example, the direction of travel of the ribbon 10 is determined by whether clutch splines 5a and 8a are engaged or disengaged. This function is controlled by a mechanical switch 17.

As shown in FIG. 1, switch 17 is coupled to chassis 1 by means of a pin 6 and is free to rotate partially thereabout. The switch 17 includes an engage lever 17b, a disengage lever 17d, and an equilibrium member 17c, which is coupled to the chassis 1 by a detent or over-center spring 18 of the compression type. The relative alignment of equilibrium member 17c and spring 18 creates a pair of stable positions for switch 17, one of the pair corresponding to the position shown in FIG. 1. Disengage lever 17d includes a cam surface 17a which rests against that side of flange 5c nearest spline 5a, and also includes a hole 17e to which a cord 15 is attached for the purpose of applying a disengage torque to switch 17. The application of a disengage torque to lever 17d sufficient to overcome the torque applied through member 17c by spring 18 together with the cam torque due to the force exerted by spring 7 against cam surface 17a, causes switch 17 to rotate clockwise from its equilibrium position of FIG. 1 and thus causes splines 5a and 8a to move apart. After switch 17 rotates a predetermined amount, the torque exerted through compressed spring 18 reverses its sense, and aids the disengage torque in opposing the cam torque. When the disengage torque has ceased and the second equilibrium position of switch 17 — defined, say, by the bottoming of the splines 5b against the splines 3b — is reached, upper clutch splines 5a and drive shaft splines 8a are disengaged.

The disengage torque hereinabove referred to is provided in this example by coupling cord 15 around pulley 16 to a lever 14 rotatably mounted on chassis 1 by means of a pivot 25. Lever 14 is responsive to a reverse winding indicator. In this

embodiment, the reverse winding indicator includes an eyelet 19 attached to ribbon 10. The ribbon 10 normally passes through a slot 14a in lever 14; however, eyelet 19 cannot pass therethrough and in its attempt to do so turns the lever 14 counterclockwise, which in turn pulls cord 15 to exert the previously described clockwise torque on switch 17 until splines 5a and 8a disengage.

To engage splines 5a and 8a, a "start" or trigger member 21 is pushed momentarily against the engage lever 17b to create an appropriate engage torque. The trigger member 21 may be operated by the print cycle initiating controls mentioned previously (the print bail shown in U.S. Pat. No. 3,146,708, for example). The engage torque — aided by the cam torque, i.e., the force of spring 7 urging flange 5c against the cam surface 17a of lever 17d — is sufficient to overcome the torque exerted through the spring 18 and thus rotates switch 17 counterclockwise, i.e., away from its second equilibrium position. After a predetermined amount of rotation the torque exerted by the spring 18 reverses its sense and switch 17 is then urged even more strongly to rotate counterclockwise to its original equilibrium position, that of FIG. 1, where splines 5a and 8a are engaged (assuming the splines 5a, 8a to be in matching alignment, the engagement otherwise being delayed until rotation of motor 4 brings the clutch splines 5a into such alignment by rotation of shaft 3 — and, therefore, clutch 5 — through worm gear 4a and flange gear 3a, as explained previously). Counterclockwise rotation of switch 17 is limited by contact between the lower end of lever 14 and chassis 1, as shown in FIG. 1, although appropriate stops could be provided on chassis 1 for direct cooperation with switch 17, as is known.

It is clear, of course, that by manual operation of switch 17 to its second equilibrium position (either directly or through suitable known linkage to a key, say), the paid-out ribbon 10 on spool 9 can be caused to rewind onto spool 11 quickly and simply to facilitate easy replacement with a spool of fresh ribbon.

As will be evident to those skilled in the art, the above-described embodiment of the invention is subject to various modifications. The detailed description is therefore given merely by way of illustration and example, with the intention that the spirit and scope of the invention be limited only by the appended claims.

I claim:

1. In a business machine having cyclically operable print members and including a printing ribbon reversibly transferable between first and second spools, the improvement comprising:

- a. a single reverse-winding indicator affixed to said ribbon,
 - b. a power driven shaft,
 - c. a further shaft coupled to said second spool,
 - d. a clutch slidably coupled to said driven shaft and engageable with said further shaft to thereby wind the ribbon on said second spool,
 - e. a switch cooperating with said clutch, said switch being movable to a first position wherein said clutch is engaged with the further shaft and movable to a second position wherein the clutch is disengaged from the further shaft,
 - f. means operable to move the switch to said second position in response to sensing said reverse-winding indicator,
 - g. stored energy means operable to rewind the ribbon onto said first spool when the clutch is disengaged from the further shaft, and
 - h. means for effecting movement of the switch from said second to said first position in response to said print member cycle of operation.
2. The business machine defined in claim 1, wherein said clutch is spring-urged into engagement with said further shaft, and further including detent means for retaining said switch in said positions.
3. Apparatus, according to claim 1, wherein said stored energy means for winding said ribbon onto said first spool includes;
- a third shaft
 - a spiral spring coupled to said third shaft; and
 - means coupling said spiral spring to said first spool.
4. Apparatus, according to claim 2, wherein said means responsive to said reverse winding indicator includes:
- a pivotable lever; and
 - a cord coupling said lever to said switch, the pivoting of said lever pulling said cord to move said switch from the said first to said second position thereby.
5. The business machine defined in claim 4, wherein the reverse-winding indicator is an eyelet and said lever has two ends, there being a slot in one said end, said slot straddling said ribbon and being dimensioned to cooperate with said eyelet.

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