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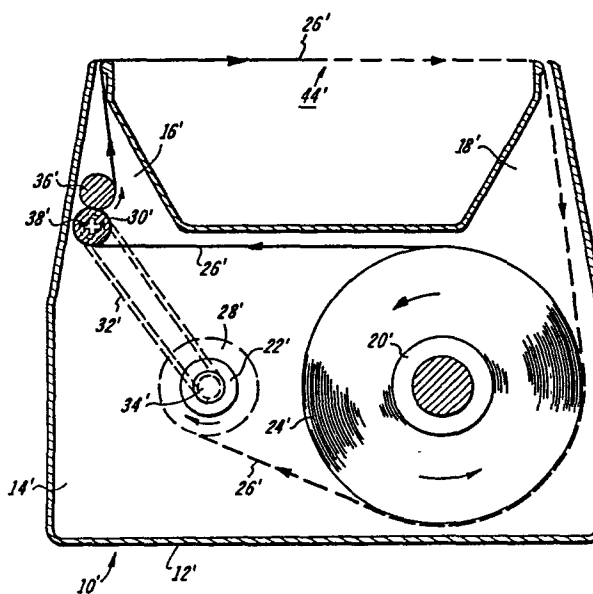
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Loop tension ribbon cartridge.

An improved ribbon cartridge for imparting uniform and controlled tension to the ribbon (26') in the print area (44') and for preventing despooling of the ribbon supply (24'). A unique ribbon path allows a tension loop to be provided solely by the conventional ribbon drive mechanism (30', 36', 22'). A portion of the used ribbon (26'), returning to the take-up spool (28') through the interior of the cartridge, is moved into contact with a portion of the periphery of the ribbon supply spool (24').



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LOOP TENSION RIBBON CARTRIDGE

This invention relates to a ribbon cartridge, for use in impact printers and typewriters. The ribbon cartridge is of the kind which is arranged in use, to move a marking ribbon past a print area, said cartridge including a housing having substantially planar opposed walls between which there is enclosed supply means, a length of marking ribbon mounted upon said supply means, ribbon take-up means, and ribbon drive means for removing ribbon from said supply means and collecting it on said take-up means.

Conventionally, ribbon cartridges comprise a housing within which is disposed a supply of thin ribbon material, often plastic film such as Mylar (Trade Mark), bearing an ink coating on one surface. The ribbon originates upon a supply spool comprising a pancake-like pack of material wrapped around a hub. One end of the supply spool is payed off and is fed out of the housing across an impact printing area and is then returned into the housing for collection upon a take-up hub, to form the take-up spool as the ribbon builds up thereon. Both the supply and take-up hubs are mounted for rotation upon fixed centres within the housing.

Suitable driving elements on the printer or typewriter are coupled with the cartridge to move elements of the cartridge for feeding ribbon along its path of travel from the supply spool to the take-up spool, past the impact printing area. Most commonly, the printer drive mechanism is coupled to a feed roller connected to an internal drive capstan through suitable gearing. The capstan acts together with a mating idler roller to pull ribbon off of the supply spool, and an O-ring drive usually connects the capstan to the take-up spool for accumulating the spent ribbon thereon. A driving force of a sufficient magnitude to pull the ribbon along its entire path of travel and off of the supply spool will exert a tension on the thin ribbon. Since the ribbon film is thin, it is desired to maintain a low drawing tension force. However, in the conventional cartridges there has been corresponding need to introduce a drag force on the ribbon as it leaves the supply spool in order to prevent free rotation of the supply spool, which will allow spillage therefrom and increase the probability of ribbon jamming and interference with the printing element.

Numerous arrangements for applying a drag force to the supply spool of a ribbon cartridge have been suggested in the patent literature. For example, foam drag pads in direct contact with the supply spool pancake are disclosed in US Patent Nos 4 026 492, 4 058 197 and 4 079 827 and supply spool hub brakes are taught in US Patent Nos 4 010 839 (ratchet wheel 32 fixed to hub 29), 4 336 911 (frictional tensioner 14), 4 347 008 (spring clamp 46), 4 350 454 (pivotal expansion brake 16), and 4 408 913 (O-ring drag element 25). It should be clear that in each of these approaches structural elements have been introduced into the cartridge to retard the free unspooling of the supply spool, resulting in an increase in cost of the cartridge in proportion to the complexity of the device.

The present invention is intended to provide a simplified ribbon cartridge, and provides a cartridge of the kind specified which is characterised by including means for retarding the unspooling of said supply means by moving a portion of the used ribbon against the surface of the ribbon on said supply means.

The present invention achieves an improved, positive feeding of the ribbon film while completely eliminating all internal drag elements. The desired results are obtained by a unique wrapping and despooling of the ribbon film in a manner to maintain constant positive control on the ribbon while significantly reducing the tension applied to the ribbon.

A more complete understanding of the invention and its advantages will be clear from the following description and claims taken with the accompanying drawings, wherein

Figure 1 is a schematic representation of one embodiment of the improved ribbon cartridge of this invention showing the relationship of the supply spool and the take-up spool at the beginning of ribbon usage,

Figure 2 is a view similar to that of Figure 1 with the ribbon having been about one half used,

Figure 3 is a schematic representation of another embodiment of the improved ribbon cartridge of this invention showing the relationship of the supply spool and the take-up spool at the beginning of ribbon usage, and

Figure 4 is a view similar to that of Figure 3 with the ribbon having been about one half used.

There is illustrated in Figure 1 a ribbon cartridge 10 comprising a

molded plastic housing made up of known mating upper and lower housing halves. Only the lower housing half 12 is shown. Each housing half includes a major body portion 14 from which extend exit and reentry horn portions, 16 and 18, respectively. Integrally molded turnaround posts 40 and 42 extend into the interior of the housing. Within the housing there is positioned and confined a supply spool 24 including a hub 20 on which is wound a supply of inked ribbon 26, to form what is commonly referred to as a pancake. Also confined within the housing is a take-up hub 22 upon which used ribbon is wound to form the take-up spool 28 in a unique manner to be described. Either integral with or passing through the take-up hub and extending therefrom through a suitable opening in the upper housing half is a pulley spindle 34 grooved to receive a driving O-ring 32. The O-ring is shown in phantom lines in order to represent that it is located at the exterior of the housing. A second pulley spindle 30 is captured in the housing for rotation therein. Its upper end is also grooved to receive the O-ring 32. An idler pulley 36 is captured in the housing for rotation therein, its peripheral surface being in driving engagement with the peripheral surface of the second pulley 30 for driving ribbon therebetween.

Driving may be accomplished by the introduction of a printer drive element into the cruciform opening 38 in the underside of the second pulley 30 (shown in dotted lines). Alternatively, driving may be accomplished through a suitable gear train in order to obtain the desired incremental movement of the ribbon.

The convention adopted herein has been to indicate new, i.e. unused, ribbon by solid lines and used ribbon by dotted lines. Thus, the supply spool 24 is represented by solid lines and the take-up spool 28 is represented by dotted lines. New ribbon from the supply spool is routed internally in a counterclockwise direction, around the take-up spool 28 (initially around the take-up hub 22), around the turnaround post 40, between the mating surfaces of the second pulley 30 and idler 36 and out the exit horn 16 to the print area 44. Once the ribbon has been acted upon by the print element to transfer a portion of the ink from the ribbon to a receptor sheet, the ribbon is used as shown by the dotted lines. The used ribbon passes to and into the reentry horn 18, around the turnaround post 42, against the periphery of the supply spool and is finally wound upon the

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take-up spool.

As can be readily seen, this unique ribbon feeding and tensioning arrangement eliminates all tensioning elements found in the prior art approaches, relying solely upon the usual take-up elements to positively meter out ribbon and to pull the ribbon across the printing area. Metering out takes place between the second pulley 30 and idler 36, drawing unused ribbon off the supply spool 24 and along the surface of the take-up spool 28. Simultaneously, the used portion of the ribbon is being drawn over the surface of the supply spool and is being wound upon the take-up spool by means of the O-ring 32 passing over second pulley spindle 30 in the manner of a slip clutch drive. The supply spool is restrained by the returning, used ribbon, thus eliminating despooling in operation. Furthermore, as opposed to the known tensioning devices described above, there are no tensioning or drag variations which cause variations in ribbon length and possible fouling of the ribbon in the printing element.

It has been found that the drawing torque requirements has been reduced from about 250 gm.cm to about 180 gm.cm, an improvement of about 70%. Two advantages may be obtained by a torque reduction of this magnitude. First, a smaller and less expensive drive motor may be used and second, the ribbon material may be made thinner without risk of stretching or rupturing. If made thinner, more ribbon material may be stored, giving the user a significant benefit.

Turning now to the embodiment illustrated in Figures 3 and 4, it should be noted that the same convention is used relative to new ribbon (solid lines) and used ribbon (dotted lines). Similar elements have been identified by the same numbers with a prime (') added.

New ribbon payed out from the supply spool 24' is routed internally through the body cavity 14', to and around the capstan 30', between the capstan and the idler pulley 36' and out the exit horn 16' to the print area 44'. After the ribbon has been impacted by the print element, the used ribbon passes to and into the reentry horn 18', around the periphery of the supply spool 24' and is finally wound upon the take-up spool 28'.

Tension is provided solely by the capstan drive assembly. At one end of the tension loop, the capstan 30' and idler pulley 36' meter out the

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ribbon, and at the other end of the tension loop, the O-ring 32' and follower pulley 34' draw ribbon onto the take-up spool 28'. As the used ribbon is pulled in and is loaded upon the take-up spool, and the spool diameter increases, there would be a tendency to increase the take-up speed. However, since the O-ring drive connection to the follower pulley 34' is in the nature of a slip clutch, a constant speed ribbon take-up is preserved.

In order to apply a positive retard force to the supply spool, to prevent its freely unspooling, the returning, used portion of the ribbon, is brought into intimate contact with a portion of the periphery of the supply spool. The used ribbon moves in a direction opposite to the feed direction of the supply spool. In so doing, the tendency is to rewind the supply spool. A large wrap angle of about 90° is maintained, further insuring that the drag force will prevent uncontrolled rotation of the supply spool.

Claims:

1. A ribbon cartridge for use in impact printers for moving a marking ribbon past a print area, said cartridge including a housing (12) having substantially planar opposed walls (14) between which there is enclosed supply means (24), a length of marking ribbon (26) mounted upon said supply means, ribbon take-up means (28), and ribbon drive means (30, 22) for removing ribbon from said supply means (24) and collecting it on said take-up means (28), said cartridge being characterised by including

means for retarding the unspooling of said supply means by moving a portion of the used ribbon (26) against the surface of the ribbon on said supply means (24).

2. The ribbon cartridge as defined in claim 1 characterised in that said used ribbon is moved against the surface of the ribbon on said supply means in a direction opposite to the unspooling direction of said supply means.

3. The ribbon cartridge as defined in claim 2 characterised in that said drive means includes means (30', 22') for pulling ribbon off said supply means (24') and for collecting ribbon on said take-up means and said ribbon defines a path extending in serial order from said supply means (24') to said pulling means (30'), out of said cartridge, past said print area (44'), into said cartridge, against said supply means (24'), and to said collecting means (22').

4. The ribbon cartridge as defined in claim 1 characterised in that said used ribbon is moved against the surface of the ribbon on said supply means in the unspooling direction of said supply means.

5. The ribbon cartridge as defined in claim 4 characterised in that said ribbon drive means comprises means (30, 36) for metering out said ribbon (26) to said print area (44), means (22) for collecting said ribbon, in driven engagement with said means for metering, and including slip clutch means (32) for allowing said ribbon to be accumulated on said ribbon take-up means at the metering rate regardless of the diameter of ribbon wound

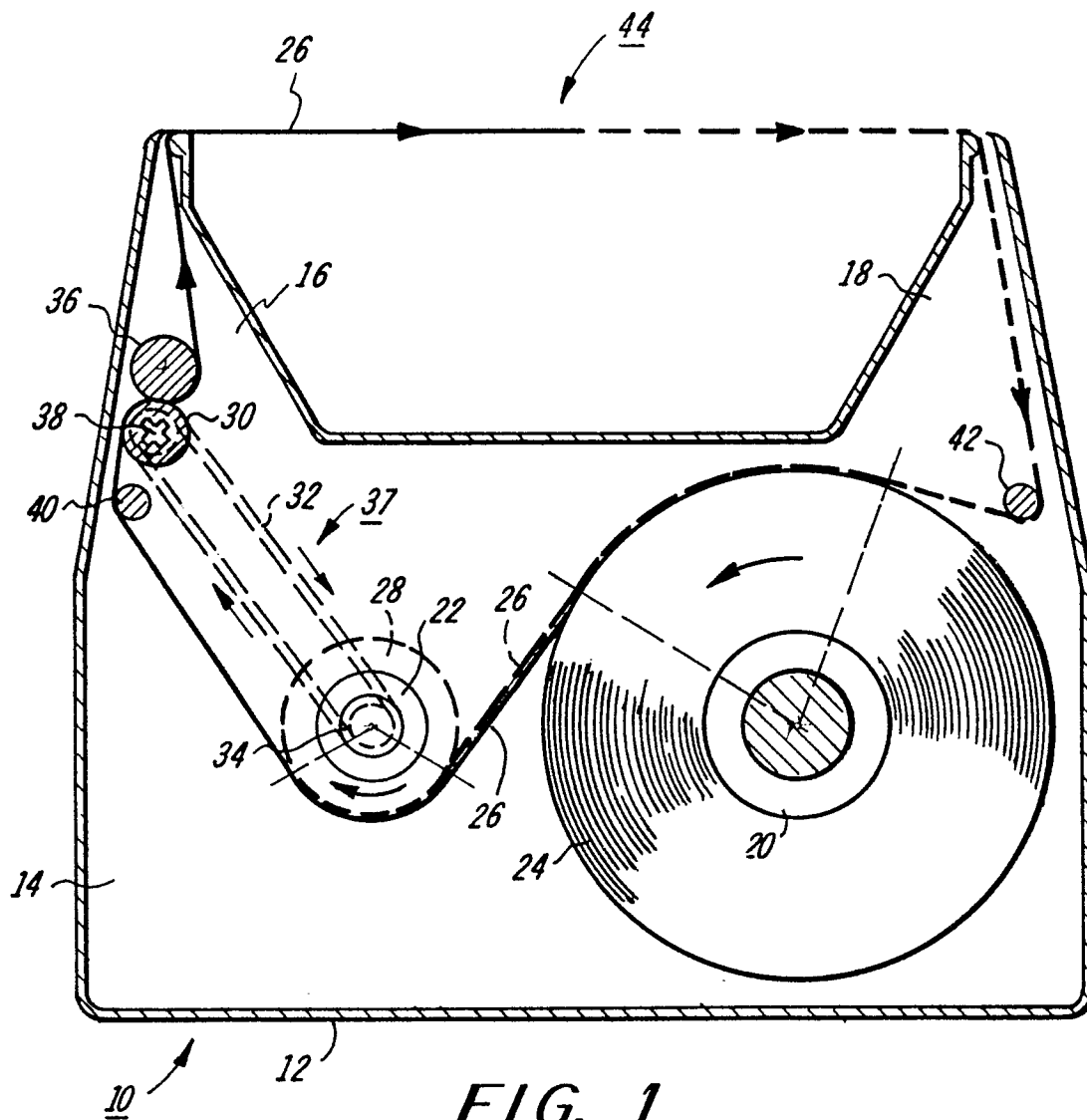
on said take-up means, and said ribbon is maintained under tension in a path extending from said means for metering, past said print area, and to said means for collecting.

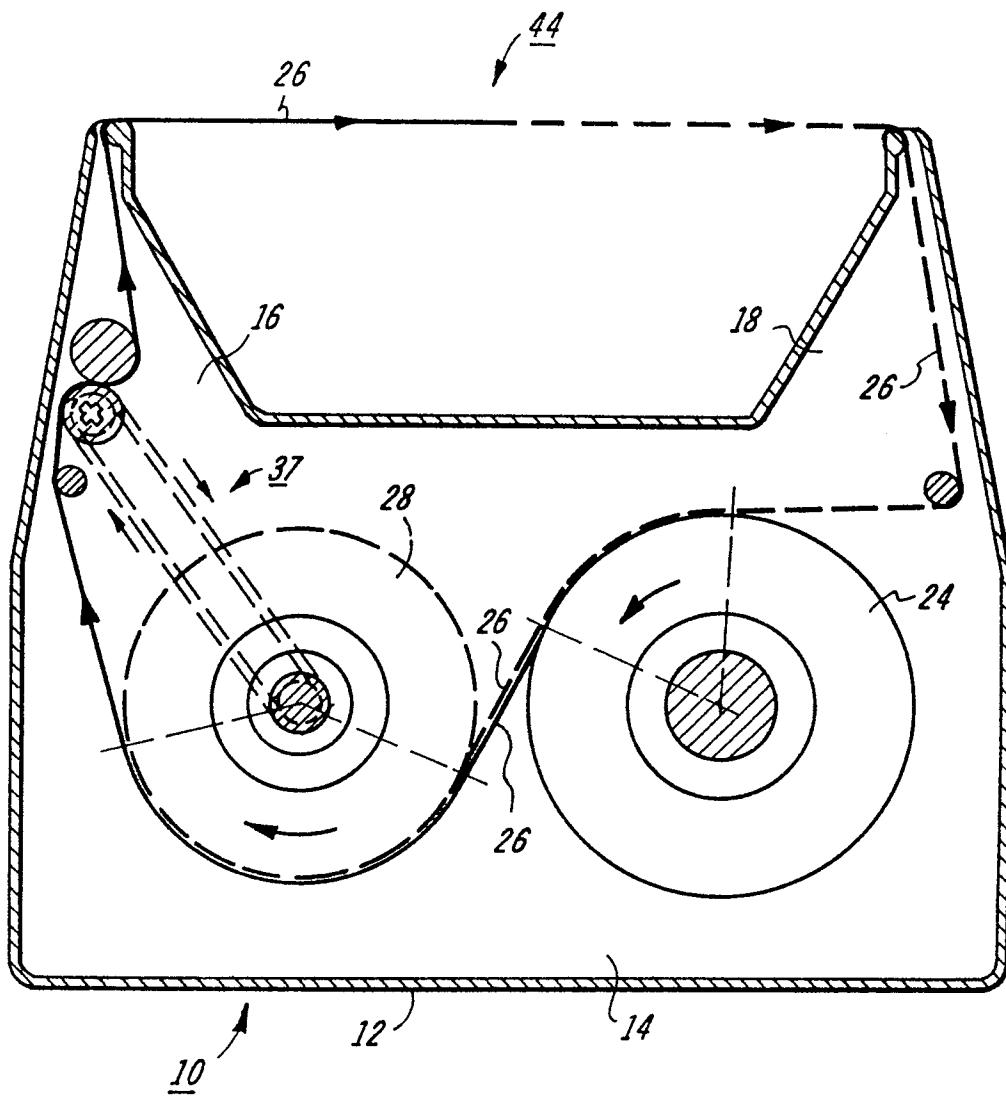
6. The ribbon cartridge as defined in claim 5 characterised in that said means for metering includes a drive pulley (30) and said means for collecting (22) includes a follower pulley (34) secured to said take-up means, and a flexible ring (32) coupled around and stretched between said drive pulley and said follower pulley, said ring being tensioned in an amount so as to allow for slippage of said ring relative to said follower pulley to a degree which increases as the diameter of ribbon wound on said take-up means increases.

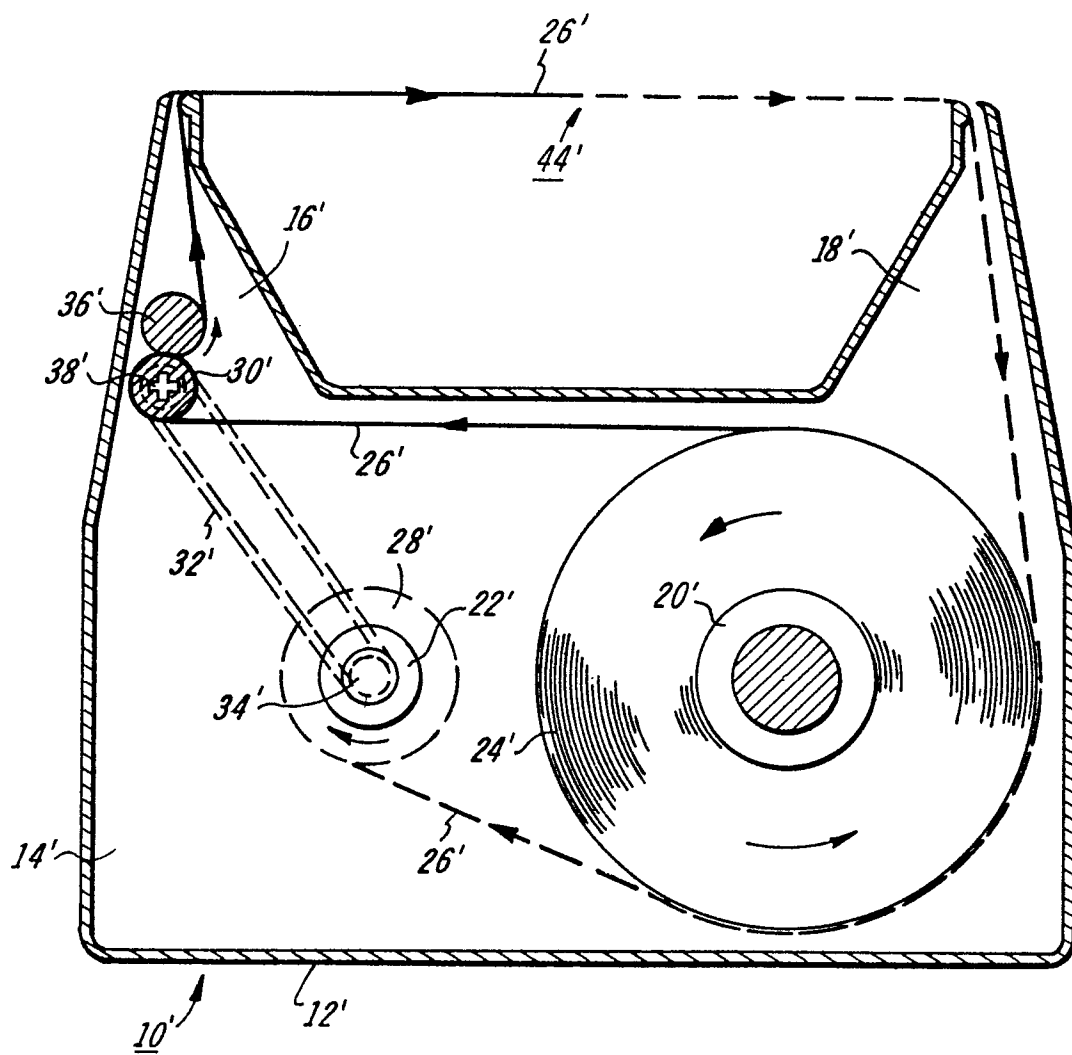
7. The ribbon cartridge as defined in claim 4 characterised in that said ribbon drive means comprises means (30, 36) for metering out said ribbon, means for collecting said ribbon, and means for directing said ribbon in a path extending in serial order from said supply means (24), into contact with a portion of the periphery of the ribbon on said take-up means (28), adjacent said means (30, 36) for metering out, out of said housing, through said print area (44), into said housing, into contact with a portion of the periphery of the ribbon on said supply means (24), and terminating at said means for collecting (22).

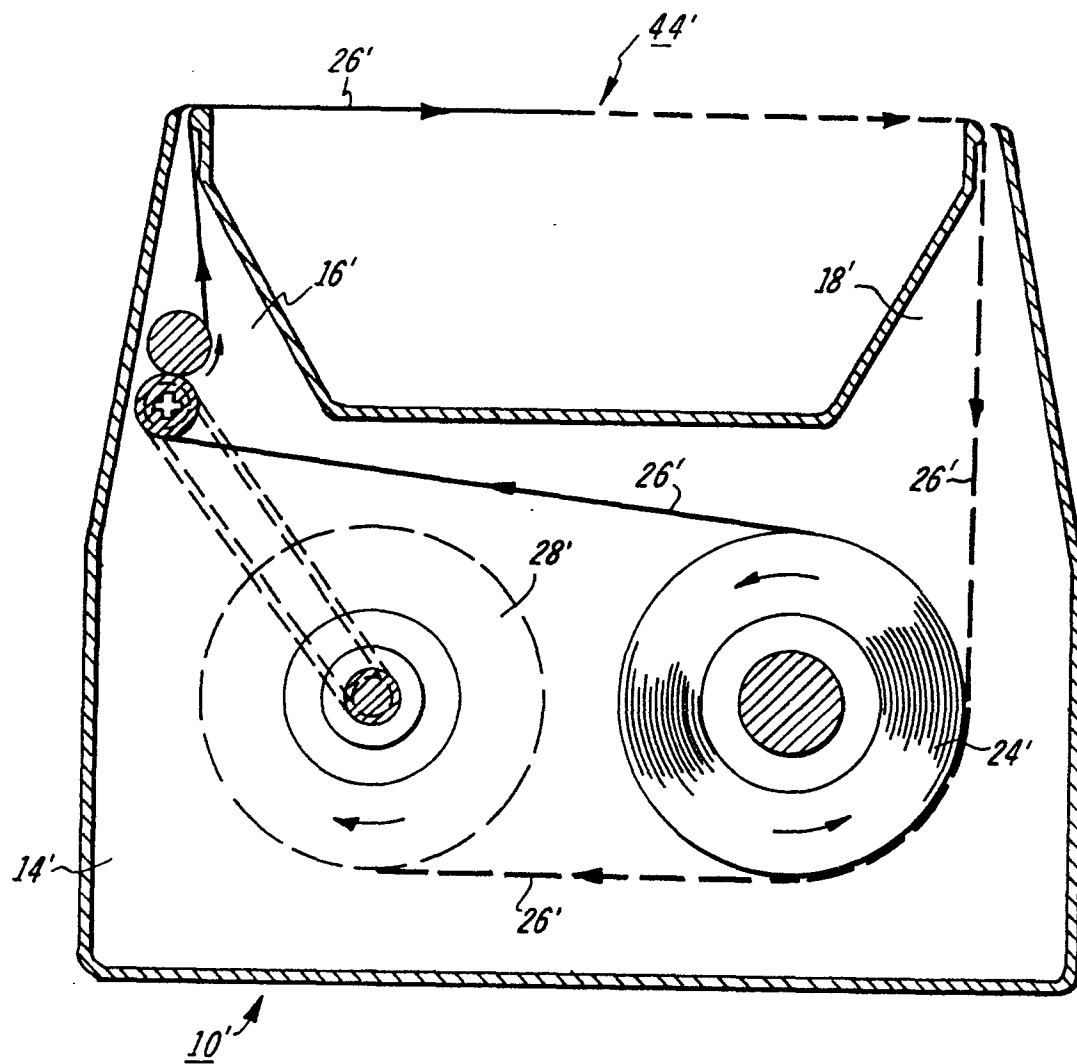
8. The ribbon cartridge as defined in claim 7 characterised in that said means for metering out comprises frictional drive elements (30, 36), and said ribbon is directed into engagement therewith.

9. The ribbon cartridge as defined in claim 8 characterised in that said means for metering out comprises a drive pulley (30) and an idler roller (36) in peripheral frictional contact.



*FIG. 2*

*FIG. 3*

**FIG. 4**