Dec. 5, 1967 W. GOFF, JR 3,356,202

TYPEWRITER RIBBON CARTRIDGE

Filed March 9, 1967

FIG. 1

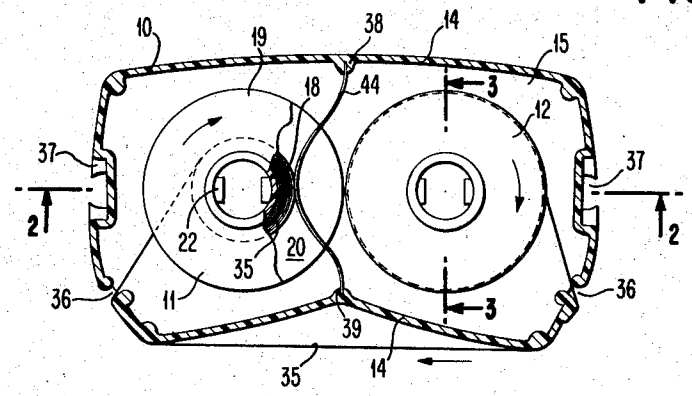


FIG. 2

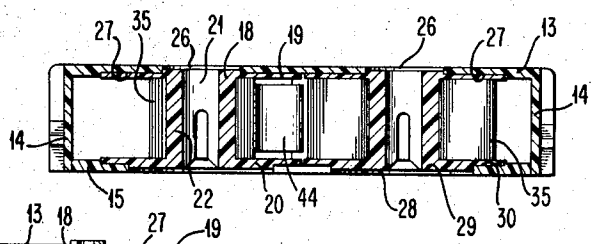


FIG. 3

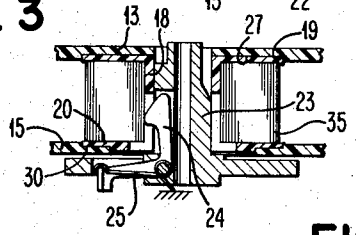


FIG. 4

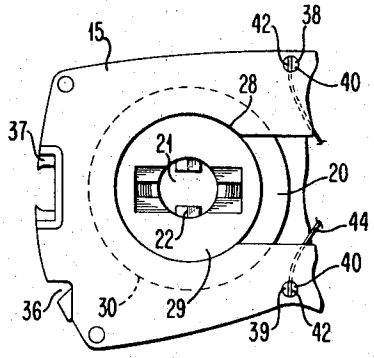


FIG. 6

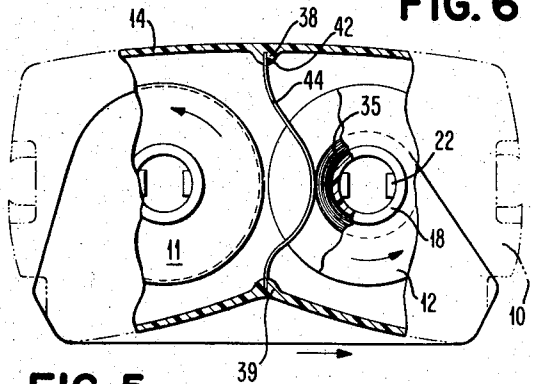
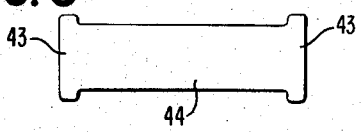


FIG. 5



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TYPEWRITER RIBBON CARTRIDGE

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7 Claims. (Cl. 197—151)

ABSTRACT OF THE DISCLOSURE

A cartridge for an inked printing ribbon or similar thin web material is provided. The cartridge comprises a pair of spools which alternately serve as supply and take-up spools as the inked ribbon or similar web material is fed back and forth. Disposed between the pair of spools is a resilient bistable member which, in the preferred form of the invention, is a bowed leaf spring held at both of its ends. The bowed portion of the leaf spring engages the outer convolutions of the ribbon or similar web material being wound on the spool serving as the take-up spool to insure the ribbon is tightly and properly wound on this spool. The diameter of the ribbon on the take-up spool increases to such an extent that the leaf spring flips to its other stable state where the bowed portion thereof is disposed toward the supply spool. The leaf spring is, therefore, positioned to cooperate with the ribbon or similar web material which will be wound on the supply spool when the direction of feed for the ribbon or similar web material is reversed.

The present invention is directed to the container and printing arts. More particularly, it is concerned with the provision of a highly simplified cartridge for receiving an inked printing ribbon or other similar thin web material.

The use of fabric or cloth webs impregnated with a printing ink to provide an inked ribbon for a printing device such as a typwriter is, of course, well known in the art. It is also known to enclose a pair of spools and a quantity of inked fabric ribbon in a disposable container or cartridge. The disposable fabric ribbon cartridge is mounted as a unit on the typewriter in cooperating relation with reversing ribbon feed mechanism. The ribbon is advanced after each printing operation and is fed back and forth between the pair of spools a number of times by the reversing ribbon feed mechanism. To change the ribbon, the typist merely removes and discards the entire fabric ribbon cartridge and inserts a new one in its place. This arrangement minimizes typist contact with the ribbon and eliminates most of the tedious threading of the ribbon which characterizes more conventional ribbon changing operations. Apparatus of this type is employed in the "Selectric" electric typewriter manufactured by International Business Machines Corporation, Armonk, N.Y. The ribbon cartridge is disclosed and claimed in U.S. Patent 2,986,260 while the reversing fabric ribbon feed mechanism is shown in U.S. Patent 2,902,136. Both of these patents are assigned to the assignee of the present invention. Other information concerning the "Selectric" single element typewriter is contained in a book entitled "IBM Customer Engineering Series 72 Instruction Manual," Form 241–5032–0, copyright 1961, and published by the IBM Corporation, Armonk, N.Y.

Printing of a higher quality compared to that provided when using an inked fabric ribbon can be obtained by employing a matrix type plastic ribbon. Such a plastic ribbon is disclosed in copending application Ser. No. 536,557 entitled "Transfer Medium and Method for Making Same," filed Mar. 9, 1966, in the names of H. T. Findlay and K. H. Froman and which is assigned to the assignee of the present invention. This ribbon comprises

a plastic substrate or matrix having many small voids which entrap and hold small pockets of ink. The ink is partially forced from these pockets on each typing operation. A number of high quality printed characters or images are obtained from typing repetitively on the same area of the plastic ribbon, and the ribbon is reusable. This permits the ribbon to be employed in much the same manner as a fabric ribbon in that it can be fed back and forth between a pair of spools past the printing point by the reversing ribbon feed mechanism.

It is highly desirable to employ a reusable plastic ribbon of the type described in the above co-pending application in fabric ribbon cartridges like those described in prior U.S. Patent 2,986,260. This is because there are a large number of typewriters presently in use which are adapted to employ such fabric ribbon cartridges. If the plastic ribbon can be satisfactorily packaged in cartridges similar to the fabric ribbon cartridges, then the owners of existing typewriters can employ and obtain the benefits of the plastic ribbon without any major modification of the reversing ribbon feed or other mechanisms of the typewriters.

Certain characteristics of the plastic ribbon have seriously limited the ability to package plastic ribbon in fabric ribbon cartridges prior to this invention. While the plastic ribbon is reusable, it is not reusable as many times as an inked fabric ribbon. Because there is an uneven dispersion of ink in the plastic ribbon with more ink disposed toward the document being printed, the ribbon is relatively thin and, in fact, is self-supporting in its preferred form. This thinness of the ribbon permits a greater quantity or length of ribbon to be wound on the spools in a fabric ribbon cartridge. However, the thinness of the ribbon which nominally permits an acceptable length of ribbon to be wound in a fabric ribbon cartridge presents other problems. The plastic ribbon is so thin that it is deformed under impact of the type and, because of this deformation, is wound in a loose manner on the take-up spool with each turn or convolution occupying a much greater radial distance than would normally be expected considering the initial thickness dimension of the ribbon. Increasing the tension on the ribbon being wound on the take-up spool reduces this problem, but is not completely acceptable since too much tension causes the ribbon to be stretched longitudinally and/or to fold over on itself about the deformed center portion thereof. Also, this requires an undesirable modification to the reversing ribbon feed mechanism of the typewriter. The result has been that prior to the present invention it has not been possible to obtain a fully suitable or satisfactory number of printing impressions from a plastic ribbon mounted in a fabric ribbon cartridge. Only a limited length of plastic ribbon can be employed and the typist is required to change the cartridge at too frequent intervals to provide a really practical or economically attractive ribbon cartridge assembly.

In view of the above, it is the primary or ultimate object of the invention to provide a highly ingenious cartridge for inked printing ribbons or similar thin web materials wherein the cartridge is adapted to be removably mounted in a typewriter or similar business machine.

It is another object of the invention to provide a ribbon cartridge embodying pressure applying means which substantially increases the length of ribbon which may be stored in the cartridge as compared to cartridges of a similar type used in the prior art.

A further object of the invention is the provision of a ribbon cartridge having a bistable pressure applying resilient member which automatically switches its states into alternate operative relation with the spools of the cartridge. The resilient member comprises a bowed leaf

spring disposed between the spools in the cartridge. The ends of the leaf spring are held and the leaf spring switches its state in response to the growth of the diameter of the ribbon wound on the spool serving as the take-up spool at that time.

A still further object of this invention is to provide a cartridge for a ribbon having the characteristics set forth above which is readily manufactured at low cost. In this manner, the entire cartridge assembly can be discarded after the ribbon has been used.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a fragmentary top plan view showing a typewriter ribbon cartridge constructed in accordance with the teachings of the present invention;

FIGURE 2 is a front sectional view taken along the section line 2—2 of FIGURE 1;

FIGURE 3 is a side sectional view taken along the section line 3—3 of FIGURE 1 of one of the ribbon spools indicating the manner in which the spools cooperate with the spindle assemblies of the reversing ribbon feed mechanism;

FIGURE 4 is a side sectional view of one of the ribbon spools indicating the manner in which the spools cooperate with the spindle assemblies of the reversing ribbon feed mechanism;

FIGURE 5 is a side view of the bistable leaf spring employed in the ribbon cartridge of this invention; and

FIGURE 6 is a fragmentary top plan view similar to FIGURE 1 showing the leaf spring in its other stable state.

Referring now to the drawings, the ribbon cartridge comprises a housing **10** and a pair of spools **11** and **12** which may be made from any suitable material, such as heat formable plastic. The cartridge housing includes a top wall **13**, a depending side wall **14** formed integrally with the top wall and a cover plate **15** defining a bottom wall. Each of the spools **11** and **12** comprises an annular hub **18** and a pair of vertically spaced circular flanges **19** and **20**. The hub **18** has an axial opening **21** extending therethrough which has locating and driving elements **22** positioned on its surface.

As is fully explained in the above mentioned instructional manual, the axial opening **21** in each hub **18** is adapted to nestingly receive a spindle assembly **23** of the reversing ribbon feed mechanism mounted on the typewriter. The spindle assembly **23** comprises a pivoted reversing lever **24**, which, when the ribbon is almost exhausted from the spool serving as the supply spool, is allowed to pivot outwardly under the action of spring **25**. The movement of the pivoted reversing lever **24** actuates the reversing portion of the ribbon feed mechanism so that the direction of ribbon feed is reversed and the ribbon is now wound on the spool which previously served as the supply spool. The ribbon feed mechanism itself will not be described further in this specification, but those desiring additional information concerning the same should refer to the above mentioned patents and instructional manual.

The spools **11** and **12** are accurately located and mounted for rotation within the cartridge housing. The top wall **13** of the housing has a pair of apertures **26** therein which receive the projecting upper ends of the annular hubs **18**. Also, the inner or bottom surface of the top wall **13** has a pair of circular recesses **27** therein which are the same general size as and nestingly receive the top flanges **19** of the spools. In a somewhat similar manner the bottom cover plate **15** has a circular cutout portion **28** that permits the large projecting lower ends **29** of the hubs **18** to extend therethrough and circular recesses **30** that nestingly receive the bottom flanges **20** of the spools. The arrangement is such that the spools **11** and **12** are accurately located and held within the cartridge housing, but yet these spools are easily rotated so that a minimum of tension is applied to the thin and relatively fragile plastic ribbon **35**.

The plastic ribbon **35** has its opposite ends attached by adhesive or any other convenient attachment means to the outer surfaces of the hubs **18** of spools **11** and **12**. The ribbon is wound on the spools and extends from one spool to the other through a pair of slots **36** formed in the side wall **14** of the cartridge. The portion of the ribbon which extends outside the cartridge housing is adapted to be received in typewriter ribbon guides, not shown. In this manner, the ribbon is located adjacent the printing point and raised to a position to be struck by the print element during a printing operation. The side wall **14** of the cartridge is also formed with integral locating and mounting recesses **37** for receiving spring biased holding elements, also not shown, of the reversing ribbon feed mechanism so that the cartridge is accurately located and securely mounted on the typewriter.

As is most clearly shown in FIGURES 1 and 6 of the drawings, the side wall **14** of the cartridge has a pair of vertically extending mounting posts **38** and **39**. These mounting posts are formed integrally with the side wall **14** of the cartridge and are disposed on opposite sides thereof. A line interconnecting these mounting posts bisects and extends transversely to a line connecting the center axes of the spools **11** and **12**. Each of the mounting posts **38** and **39** has an end portion **40** which projects through and below an aperture in the bottom cover plate **15**.

Vertical slots **42** are provided in the mounting posts **38** and **39** for receiving the generally T-shaped ends **43** of a resilient biasing member or leaf spring **44**. The leaf spring **44** is best shown in FIGURE 5 of the drawings and has a length which is greater than the straight line distance between the mounting posts **38** and **39**. When the ends of the leaf spring are received in the slots **42** of the mounting posts, the leaf spring assumes one of the two bowed positions or states shown in FIGURES 1 and 6 of the drawings. The leaf spring **44** has a width dimension which is slightly less than the width of the plastic ribbon while the tabs on the T-shaped ends **43** locate the spring so that the same is freely movable between the flanges **19** and **20** of the spools **11** and **12**.

Considering the operation and use of the ribbon cartridge, it will be assumed that the plastic ribbon **35** is being wound from spool **12** onto spool **11** and the leaf spring **44** is deflected toward the take-up spool **11** as is shown in FIGURE 1 of the drawings. The bowed middle portion of the spring **44** engages the outer convolution of the plastic ribbon **35** being wound on the take-up spool **11**. The force exerted by the leaf spring **44** on the plastic ribbon **35** is sufficient to insure that the ribbon is fairly tightly wound on the take-up spool in an even and consistent manner. The overall effect is that a greater length of ribbon is wound on the take-up spool in a more compact mass than is possible using a ribbon cartridge not equipped with the leaf spring.

The plastic ribbon **35** continues to be wound on the take-up spool **11** and as the mass of ribbon on this spool grows in diameter, the center portion of the bowed leaf spring **44** is deflected. Eventually the ribbon on the take-up spool **11** reaches a size that the leaf spring is flipped or switched to its other stable position with the bowed portion extending toward the supply spool **12**. This occurs slightly before the ribbon is completely exhausted from the supply spool **12** and prior to or at the time of actuation of the reversing apparatus of the ribbon feed mechanism. The preferred design of the apparatus is such that the leaf spring does not engage the ribbon or the spools during and immediately after ribbon reversing operations. This is considered particularly significant since the effect or drag of the spring **44** is removed when sub-

stantial stretching forces incident to the ribbon feeding operations occurring immediately after reversal of the direction of ribbon feed are applied to the thin and relatively fragile plastic ribbon. Even if the cartridge is designed so that the bowed portion of the leaf spring does engage the ribbon on the spool serving as the supply spool immediately after switching its state, the drag on the large diameter mass of ribbon on the take-up spool is removed prior to or at the time of the reversing operation so that this drag does not interfere with the ribbon feeding operation.

The ribbon begins to wind on the spool **12** which now serves as the take-up spool. The mass of ribbon on this spool quickly grows in diameter until it is engaged by the bowed center portion of the leaf spring **44** and typing operations continue as outlined above. When the take-up spool **12** is nearly full, the leaf spring **44** is flipped or switched to its other stable state prior to the actuation of the reversing apparatus. This series of operations continues in an uninterrupted manner until the ribbon has been used to the desired extent. Then the typist removes and discards the cartridge containing the used plastic ribbon and replaces it with a new cartridge.

The end portions **40** of the mounting posts **38** and **39** which extend through the apertures in the cover plate **15** assist in maintaining the parts of the cartridge in assembled relation. The end portions **40** are preferably hot upset or otherwise deformed so that the cover plate **15** is maintained in assembled relation with the other parts of the cartridge. The hot upsetting of the ends of the mounting posts **38** and **39** also seals the ends of the slots **42** and prevents the removal of the bowed leaf spring **44**. While a preferred construction of the ribbon cartridge has been disclosed, it should be readily apparent that the same may be fabricated from a greater or smaller number of individual parts and any of a wide variety of attachment procedures and means can be employed to join or secure these parts together.

In a constructed embodiment of the invention, the leaf spring **44** was a strip of spring steel having a thickness dimension of .002 of an inch and a length dimension of approximately $1\frac{13}{16}$ inches. The linear or straight line distance between the mounting posts **38** and **39** of the cartridge was about $1\frac{11}{16}$ inches. The use of the leaf spring in this instance permitted approximately 20 yards of plastic ribbon having a thickness of about .0023 of an inch to be wound on the spools and fed back and forth past the printing point without any difficulty. When the leaf spring was removed, it was possible to wind only about 15 yards of plastic ribbon on the spools if the ribbon was to be fed back and forth without jamming. When appreciably more than 15 yards of plastic ribbon was wound on the spools, the spools became jammed and the cartridge was rendered inoperative for its intended purposes due to the loose and uneven manner in which the deformed ribbon is wound on the spool serving as the take-up spool. This increase of approximately five yards of plastic ribbon wound in the cartridge when the leaf spring is employed is quite significant in that the ribbon cartridges are changed at less frequent and more acceptable intervals by the typist. Also, the overall cost of the printing operation is reduced since the packaging cost is spread over considerably more print impressions than when the leaf spring is not employed.

It should be understood that the increase in the amount of plastic ribbon which can be wound on the spools in a ribbon cartridge will depend on many factors and the above example should only be considered as representative. This example should not be considered as defining the increase in the amount of ribbon which can be loaded in a cartridge in each instance. Among the more significant and controlling factors are the drag and other forces exerted on the ribbon by the particular ribbon feeding mechanism being used, the size of the cartridge, the impact force of the print element which causes deformation of the ribbon, and the thickness of the ribbon itself. Also, any number of resilient materials can be used to provide the leaf spring. Cartridges for plastic typewriter ribbons employing leaf springs formed of brass and "Mylar" plastic have also been successfully constructed and tested.

The objects initially set forth have been accomplished. Of particular importance is the provision of a cartridge for an inked printing ribbon which permits a significant increase in the length or amount of plastic ribbon that may be mounted in the cartridge but yet this cartridge is adapted to be employed with existing typewriters. In this manner, owners of existing typewriters may receive the benefits of the improved printing quality obtainable with plastic ribbons without any major modification to the reversing fabric ribbon feed mechanism on their typewriters. This highly desirable result is accomplished by the use of a bistable leaf spring which exerts a drag on the ribbon which is being wound on the take-up spool.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the scope of the invention.

What is claimed is:

1. An inked ribbon cartridge comprising:
- a casing having upper and lower supporting walls extending parallel to each other;
- a side wall joined to said upper and lower walls to form a single enclosed chamber;
- a pair of spools arranged in said chamber and being supported for rotation on spaced parallel axes;
- ribbon slots formed in said side wall;
- an inked ribbon wound at its ends on said spools and extending between the latter through said slots;
- a resilient leaf spring positioned between said spools;
- said leaf spring extending between opposite portions of said side wall;
- said leaf spring having a length greater than the straight line distance between said opposite portions of said side wall to provide said leaf spring with a bowed center portion;
- said bowed center portion of said leaf spring having two operating positions;
- said bowed center portion of said leaf spring in one of said two operating positions extending toward and engaging the mass of ribbon being wound on the one of said spools serving as a take-up spool; and
- said mass of ribbon on said one of said spools switching said bowed center portion of said leaf spring to the other of said two operating positions adjacent the other of said spools when at least half of said ribbon is wound on said one of said spools.

2. Apparatus according to claim **1** further comprising:
- a pair of mounting posts on said opposite portions of said side wall; and
- a vertical slot in each of said mounting posts for receiving one end of said resilient leaf spring.

3. Apparatus according to claim **2** further characterized by:
- said leaf spring having T-shaped end portions to accurately position and locate said bowed center portion between said upper and lower supporting walls of said casing.

4. Apparatus according to claim **2** further characterized by:
- said lower wall comprises a separate bottom cover plate having a pair of apertures therein;
- said mounting posts having end portions extending through said apertures in said cover plate; and
- said end portions of said mounting posts being deformed to block said aperture and maintain said bottom cover plate in assembled relation with said side wall.

5. An inked ribbon cartridge comprising:
a casing having upper and lower walls extending parallel to each other;
a side wall joined to said upper and lower walls to form a single enclosed chamber;
a pair of spools arranged in said chamber and being supported for rotation on spaced parallel axes;
ribbon slots formed in said side wall;
an inked ribbon wound at its ends on said spools and extending between said spools;
a resilient leaf spring having a bowed center portion positioned between said spools;
said bowed center portion of said leaf spring having two operating positions;
said bowed center portion of said leaf spring in one of said two operating positions extending toward and engaging the mass of ribbon being wound on the one of said spools serving as a take-up spool; and
said mass of ribbon on said one of said spools switching said bowed center portion of said leaf spring to the other of said two operating positions adjacent the other of said spools when at least half of said ribbon is wound on said one of said spools.

6. A ribbon cartridge for thin web material comprising:
a casing having upper and lower walls extending parallel to each other;
a side wall joined to said upper and lower walls to form a single enclosed chamber;
a pair of spools arranged in said chamber and being supported for rotation on spaced parallel axes;
slots formed in said side wall;

thin web material wound at its ends on said spools and extending between said spools;
a resilient member having a pair of stable positions;
said resilient member engaging the mass of thin web material wound on one of said spools when in one of said stable positions and engaging the mass of thin web material wound on the other of said spools when in the other of said stable positions; and
said resilient member switching to another stable position when more than half of the web material is wound on the spool whose mass of web material is engaged by said resilient member.

7. Apparatus according to claim 6 further characterized by:
said resilient member comprises a leaf spring having a bowed center portion.

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