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[54] **RIBBON TRANSPORTING AND REVERSING MECHANISM**

10 Claims, 2 Drawing Figs.

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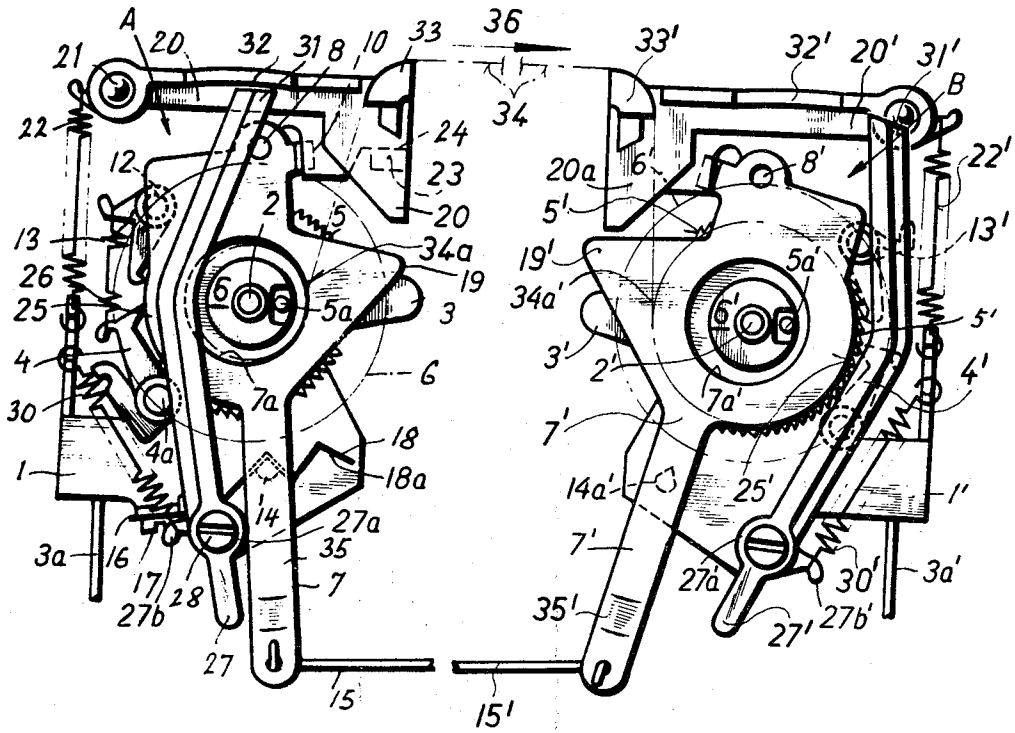
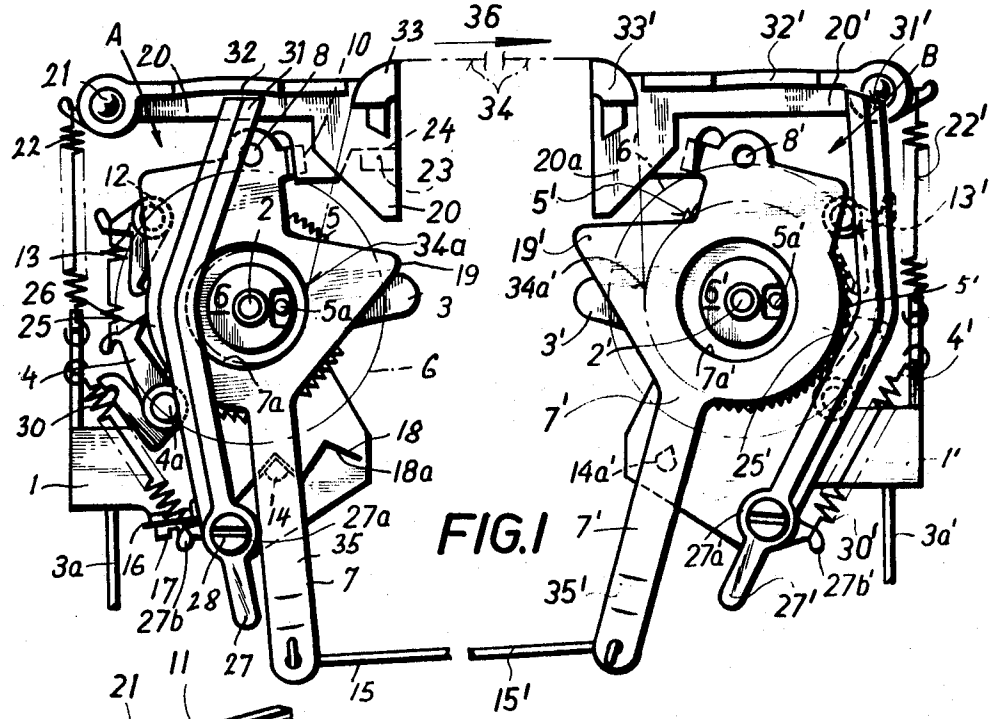
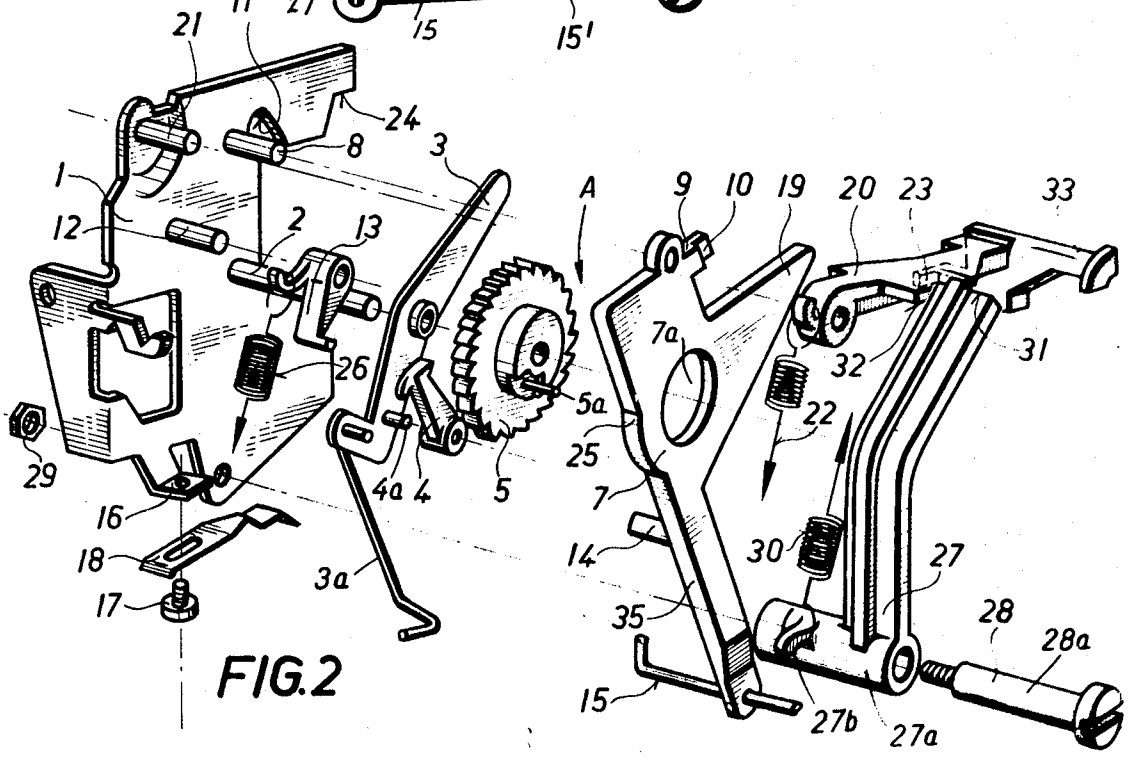
ABSTRACT: In a typewriter, each of the two units of a ribbon transporting and reversing mechanism, has a spring biassed control lever guiding the ribbon. When the ribbon is wound up in one unit and at its end in the other unit, it is tensioned and urges the control levers of both units to an actuated position. A sensing lever blocks the respective control lever when sensing the end of the ribbon in the other unit, so that only the control means of the unit where the ribbon is fully wound up, is displaced by the tensioned ribbon to the actuated position for reversing the direction in which the ribbon is transported.







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RIBBON TRANSPORTING AND REVERSING MECHANISM

BACKGROUND OF THE INVENTION

The present invention relates to a ribbon transporting and reversing mechanism for a typewriter which has two units, each of which is operable between a wind up position for winding up a ribbon and a let off position for unwinding the ribbon. The mechanism has a first operational condition in which the first unit is in the wind up position and the second unit is in the let off position, and a second operational condition in which the first unit is in the let off condition and the second unit is in the wind up condition.

In the mechanism disclosed in the German Pat. No. 705,097, the shifting of the mechanism between the first and the second operational conditions is influenced by two interconnected sensing levers which sense the diameter of the ribbon coils. The mechanism requires a complicated drive consisting of many expensive parts, and when the mechanism is shifted, a lever fixedly connected with the sensing lever falls into a worm spindle and effects a shifting of the spindle which requires parts consisting of wear-resistant material. The mechanism is bulky, and the unit cannot be constructed as flat compact units.

The German Pat. No. 1,217,115 discloses a mechanism in which the shifting is effected by the tension of the ribbon, and a pawl in frictional connection with a ratchet wheel locks the ribbon sensing lever of the unit which is in the wind up condition to prevent actuation of the shifting means. The cost of the mechanism is high, and additional elements are required for preventing inertia movements of the ribbon.

It is one object of the invention to overcome the disadvantages of known ribbon transporting and reversing mechanisms for typewriters, and to provide a simple, compact, inexpensive, reliably operating ribbon transporting and reversing mechanism which requires only very little force for shifting the mechanism between the two operational conditions in which the ribbon is transported in opposite directions.

Another object of the invention is to provide a ribbon transporting and reversing mechanism comprising two flat units which can be easily built into a flat typewriter.

SUMMARY OF THE INVENTION

With these objects in view, the present invention is concerned with an improvement of a ribbon transporting and reversing mechanism comprising first and second units, each of which is operable between a wind up position for winding up the ribbon and a let off position for unwinding the ribbon. The mechanism has a first operational condition in which the first unit is in the wind up position and the second unit is in the let off position, and a second operational condition in which the first unit is in the let off condition and the second unit is in the wind up condition.

In accordance with the invention, each unit comprises spring biassed control means having a normal position for guiding the ribbon to the control means of the respective other unit, and an actuated position for shifting the mechanism between the first and second operational conditions, and biassed sensing means for sensing the diameter of the ribbon coil.

The control means of both units guide the ribbon across the writing area, and are urged by the ribbon to the actuated position when the ribbon is fully wound up by one unit and completely unwound from the other unit and thereby tensioned.

Since the sensing means move to an inoperative position when sensing a coil, and to a blocking position blocking the respective control means when sensing the end of the ribbon, the control means of the unit whose ribbon is completely unwound is blocked in the normal position, and only the control means of the unit whose ribbon is fully wound up is moved by the tensioned ribbon to the actuated position and operates the respective unit to assume the let off position and the respective other unit to move to the wind up position whereby the direction of movement of the ribbon is reversed.

The sensing means and the control means of each unit are levers pivotally mounted for turning movement about axes which are located on opposite sides of the axis about which the ribbon spool turns. The sensing lever extends transversely to the control lever and has a free end engaging the control lever in the blocking position. A portion of the sensing lever between its free end and its pivotal support, engages the coil formed by the ribbon in the respective ribbon spool and senses the diameter of the same, moving to the blocking position when the coil is exhausted and the end of the ribbon, which is secured to the ribbon spool, is tensioned by the turning ribbon spool of the other unit. The sensing lever and the control lever are located substantially in the same place which is the plane in which the ribbon and ribbon coil is located.

Due to the fact that the length of the sensing lever from its pivot axis to its free end portion is substantially twice the distance of its pivot axis from the axis of the ribbon spool and the engaged portion of the ribbon coil, an exact and accurate blocking and releasing of the control lever is assured, since the increase of the diameter of the sensed ribbon coil is transmitted in the ratio 2:1 to the free end of the sensing lever which controls the operation of the control lever.

In the preferred embodiment of the invention, each ribbon spool is driven by a drive means which includes a ratchet wheel to which the ribbon spool is secured, and ratchet pawl means which include a shifting pawl and a holding pawl connected by a common spring which urges both pawls into engagement with the teeth of the ratchet wheel, the spring, pawls, and ratchet wheel being located in a common plane.

It is particularly advantageous to construct the sensing levers, control levers, ratchet wheel and pawls, and also the shifting means of a light synthetic plastic material which is suitable for injection molding. It is not necessary to use high quality bearings, since the synthetic material of the parts permits the provision of integral molded bearings.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a plan view illustrating the two units of a ribbon transporting and reversing mechanism according to an embodiment of the invention in an operational condition shortly before the shifting of the mechanism for the purpose of reversing the transporting direction of the ribbon; and

FIG. 2 is a side elevation of one of the units of the mechanism illustrated in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows the two identical and mirror symmetrical units A and B of the mechanism connected by a connecting rod **15**. The A unit on the left of FIG. 1 is in the let off condition in which a ribbon **34** is unwound, and the unit B on the right is in a wind up condition in which the ribbon **34** is wound up. Corresponding parts of the two identical units A,B are indicated by the same reference numerals, which are primed in the illustration of the windup unit B on the right. The following description will mainly refer to the left unit A, and reference will be made to the right unit B only when required for an understanding of the operation. A support **1** secured to the frame of the typewriter, not shown, carries a journal or axle **2** on which a ratchet wheel **5**, and an actuating member **3** with a wire link **3***a*, are mounted for turning movement.

Actuating member **3** has a pin **4***a* carrying a ratchet pawl **4** which during wind up cooperates with the teeth of ratchet

wheel 5, as shown at 4' and 5'. A ribbon spool 6 is coupled with the ratchet wheel 5, and can be turned stepwise with the same by a coupling pin 5a. Between ribbon spool 6 and ratchet wheel 5, a shifting lever 7 is mounted for angular movement about a pivot 8 secured to support 1. Shifting lever 7 is preferably made of a synthetic plastic material, and has a springy arm 9 with a nose 10 sliding on the bottom face of an edge 11 of support 1 during angular displacement of shifting lever 7. Shifting lever 7 also holds the actuating member 3 and the ratchet wheel 5, and also a holding pawl 13 which is turnable about a bolt 12, against axial movement.

The forwardly projecting arm 35 of shifting lever 7 carries a projecting stud 14 which slides on a face of support 1, and supports arm 35. A connecting rod 15 connects arm 35 of shifting lever 7 with arm 35' of shifting lever 7' of the other unit. Support 1 has a bent lug 16 to which an arresting leaf spring 18 is secured by a screw 17. Arresting leaf spring 18 has angular portions forming recesses 18a engaged by stud 14 which serves as an arresting member engaging one or the other recess 18a formed by arresting spring 18 to hold shifting lever 7 in one of two angular positions.

A corresponding arresting arrangement, not shown, may be provided in the other unit B, but can be omitted since the arresting means 14, 18 also hold the shifting lever 7' of the other unit B in two angularly displaced arrested positions due to the connection of the shifting levers 7, 7' by the connecting rod 15.

Shifting lever 7 has a cam portion 25 engaging shifting pawl 4 and holding pawl 13 in the unwinding condition of the left unit, and preventing engagement of ratchet wheel 5 by pawls 4 and 13 which are urged by a common connecting spring 26 toward cam portion 25 and ratchet wheel 5. When shifting lever 7 is shifted to its other position in which stud 14 engages the other recess 18a arresting spring 18, shifting lever 7 assumes a position in which its cam portion 25 does not hold the shifting pawl 4 and the holding pawl 13 in inoperative position, but permits cooperation of the pawls 4, 13, with the ratchet wheel 5, as shown for pawls 4', 13', and ratchet wheel 5' of the right unit A which is in the wind up condition.

A bolt 28 is secured by a nut 29 to support 1 and has a journal portion 28a on which the hub 27a of a sensing lever 27 is mounted for angular movement. A spring 30 connects a hook portion 27b of the sensing lever 27 with support 1 and biases sensing lever 27 to turn in clockwise direction, while the corresponding sensing lever 27' is urged by spring 30' to turn in counterclockwise direction.

Spring 30 and the portion of sensing lever 27 to which it is secured, are designed and positioned so that sensing lever 27 engages the coil 34a formed by the ribbon 34 on the ribbon spool 6 with substantially the same force irrespective of the diameter of the wound up ribbon coil 34a.

Sensing lever 27 is angular, and the length between the axis of bolt 28 and the free end portion 31 is about twice the distance from bolt 28 to the journal 2 of ribbon spool 6, and since the central sensing portion of sensing lever 27 engages the wound up ribbon coil 34a in the same region, a variation of the diameter of the sensed ribbon coil 34a will result in a twice as great displacement of the free end portion 31 of sensing lever 27.

A pivot 21 secured to support 1 mounts a control lever 20 for angular movement. Control lever 20 has a transverse projection 32 cooperating with the free end 31 of shifting lever 27. A spring 22 connects support 1 with a portion of control lever 20, and urges the same to turn in counterclockwise direction until a stop 23 abuts a stop portion 24 of support 1. Spring 22' urges the corresponding control lever 20' to turn in clockwise direction. The ribbon 34 passes about guide portions 33 and 33' of control levers 20 and 20', and forms a coil 34a in the ribbon spool 6 of the left unit, and a coil 34a' in the ribbon spool 6' of the right unit. Each shifting lever 7 and 7' has a central opening 7a, 7a' permitting its angular displacement about pivot 8, 8' and an arm 19, 19' cooperating with the tranversely projecting end portion 33, 33' of the respective control lever 20 and 20'.

OPERATION

In the position of FIG. 1, the ribbon 34 moves in the direction of the arrow 36 and is wound up on the spool 6', forming a large coil 34a', while being unwound from the smaller coil 34a on spool 6. Shifting pawl 4' and holding pawl 13' cooperate with ratchet wheel 5' and shift the same stepwise in counterclockwise direction so that the ribbon 34 is wound up on spool 6'. Since cam portion 25 holds pawls 4 and 13 in an inoperative position spaced from ratchet wheel 5, the same can freely turn together with spool 6 so that ribbon 34 is unwound from spool 6.

Actuating members 3 and 3' and wire links 3a, 3a; of actuating means, not shown, which are reciprocated by the universal bar, not shown, of the typewriter during each return movement of a type action. While the reciprocation of actuating member 3' about journal 2' effects stepwise transport of ribbon 34 by the drive means 4', 5', 13', the drive means 4, 13, 5 of the left unit A are inoperative, since shifting pawl 4 slides on the curved cam portion 25 of shifting lever 7. During the winding up in the right unit B and the unwinding in the left unit A, the small diameter of the coil 34a permits spring 30 to turn sensing lever 27 to the illustrated blocking position in which its end 31 is located opposite the transverse stop projection 32 so that clockwise turning of control lever 20 is blocked.

When ribbon 34 is further wound up on spool 6', and unwound from spool 6, it is finally completely unwound so that its end portion, which is secured to the hub of spool 6, cannot move further so that the continued pull of the still driven ratchet wheel 5' with ribbon spool 6', tensions the ribbon 34 so that pressure is exerted by the same of the guide portions 33 and 33' to turn both control levers 20 and 20' against the action of springs 22 and 22'. Since sensing lever 27 and its free end portion 31 are in the blocking position in which the free end portion 31 is located opposite the stop portion 32 of control lever 20, the tension of ribbon 34 has no effect on control lever 20, except of pressing the stop projection 32 against the end 31 of sensing lever 27. Since control lever 20' is not blocked due to the fact that the larger diameter of the wound up coil 34a' has placed sensing lever 27' in an inoperative position in which its free end portion 31' is spaced from the stop portion 32' of control lever 20, the tensioned ribbon 34, acting on the guide portion 33', turns control lever 20' in counterclockwise direction until the end portion 20a' of control lever 20' engages the arm 19° of shifting lever 7' and turns the same to its other position, which motion is transmitted by connecting rod 15 to shifting lever 7 which is also angularly displaced and arrested in the new position by arresting means 14, 18. Due to the angular displacement of shifting lever 7, cam portion 25 of the same is now in a position corresponding to the position of cam portion 25' in FIG. 1, so that spring 26 urges pawls 4 and 13 into engagement with ratchet wheel 5. Following reciprocation of actuating member 3 with shifting pawl 4 will effect stepwise displacement of ratchet wheel 5 with ribbon spool 6 so that the ribbon 34 is now wound up on ribbon spool 6, and unwound from ribbon spool 6'. Since feeler lever 27' follows coil 34a' due to the action of spring 30', it reaches soon the blocking position in which its free end 31' is located opposite the stop portion 32' of control lever 20', ready to block the same when ribbon 34 is completely unwound from spool 6'.

After the shifting of the units, when winding up of ribbon 34 on spool 6 starts, the tension of ribbon 34 is immediately reduced, so that spring 22' turns control lever 20' back to the illustrated normal position after the same has engaged arm 19' and turned shifting lever 7'.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of ribbon transporting and reversing apparatus differing from the types described above.

While the invention has been illustrated and described as embodied in a ribbon reversing mechanism in which a sensing lever blocks a control lever on which a tensioned ribbon acts,

it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

We claim:

1. Ribbon transporting and reversing mechanism comprising first and second units, each unit being operable between a wind up position for winding up a ribbon and a let off position for unwinding the ribbon, said mechanism having a first operational condition in which said first unit is in said wind up position and said second unit in said let off position, and a second operational condition in which said first unit is in said let off condition and said second unit is in said wind up condition; each unit comprising biassed control means having a normal position for guiding the ribbon to the control means of the respective other unit, and an actuated position for shifting said mechanism between said first and second operational conditions, said control means of both units being urged by the ribbon to said actuated position when the ribbon is fully wound up by one unit and completely unwound from the other unit and thereby tensioned; and biassed sensing means for sensing the diameter of the ribbon coil and moving to an inoperative position when sensing a coil, and to a blocking position blocking the respective control means when sensing the end of the ribbon so that said control means of said other unit whose ribbon is completely unwound is blocked in said normal position, and only the control means of said one unit whose ribbon is fully wound up is moved by said tensioned ribbon to said actuated position and operates said one unit to assume said let off position and said other unit to move to said wind up position whereby the direction of the movement of the ribbon is reversed.

2. A mechanism as claimed in claim 1 wherein said sensing means and said control means of each unit include a sensing lever and a control lever; and wherein said sensing lever extends transversely to said control lever and has a pivot axis and a free end engaging said control lever in said blocking position and releasing said control lever in said inoperative position, and a sensing portion between said pivot axis and said free end for sensing the ribbon coil; and means mounting said sensing lever for angular movement about said pivot axis between said inoperative and blocking positions and positioning said sensing lever so that said free end moves along a flat arc substantially parallel with said control lever in said normal position.

3. A mechanism as claimed in claim 1 wherein each unit comprises a support, and a spool for winding up the ribbon and mounted on said support for turning movement about a first axis; wherein said control means is mounted on said support for turning movement about a second axis; wherein said sensing means is mounted on said support for turning movement about a third axis, and wherein said second and third axes are located on opposite sides of said first axis

4. A mechanism as claimed in claim 3 wherein said control means, ribbon spool, and sensing means are substantially located in the same plane in which said ribbon is located; and wherein the distance from said third axis to said control means and to the portion of said sensing means engaging said control means for blocking said control means is substantially twice the distance from said third axis to said first axis and thereby to the portion of the ribbon coil sensed by said sensing means.

5. Ribbon transporting and reversing mechanism including first and second units alternately serving as wind up and let off units for a ribbon extending between said units, connecting means connecting said units, and actuating means; each unit comprising; a support; a ribbon spool mounted on said support for rotation, said ribbon extending between said ribbon spools of said units and having ends secured to said ribbon spools; drive means actuated by said actuating means and having an inoperative position, and an operative position for rotating the ribbon spool of the respective unit; shifting means for shifting said drive means between said inoperative and operative positions, said shifting means of said units being connected by said connecting means for movement between first and second positions for shifting said drive means of each unit to said operative position while shifting the drive means of the respective other unit to said inoperative position; biassed control means having a normal position for guiding the ribbon between said spools to the control means of the respective other unit, and an actuated position for shifting said shifting means and thereby said connecting means and said shifting means of the respective other unit between said first and second positions, said control means of both units being urged by the ribbon to said actuated position when the ribbon is fully wound up on the driven spool of one unit and completely unwound from said spool of the other unit and thereby tensioned by said drive means of said driven spool of said one unit; and biassed sensing means for sensing the diameter of the ribbon coil wound up on said spool and moving to an inoperative position when sensing a coil, and to a blocking position blocking movement of said control means to said actuated position when sensing the end of the ribbon so that said control means of the unit whose ribbon is unwound is blocked in said normal position, and only the control means of said one unit whose ribbon is fully wound up is moved by said tensioned ribbon to said actuated position and operates said shifting means and connecting means to move said drive means of said one unit to said inoperative position and said drive means of said other unit to said operative position whereby the direction of movement of the ribbon is reversed.

6. A mechanism as claimed in claim 5 wherein said ribbon spool of each unit is mounted for rotation about a first axis; wherein said control means of each unit is mounted on said support for turning movement about a second axis; wherein said sensing means of each unit is mounted on said support for turning movement about a third axis; and wherein said second and third axes are located on opposite sides of said first axis in each unit.

7. A mechanism as claimed in claim 6 wherein said control means, ribbon spool, and sensing means are substantially located in the same plane in which said ribbon is located; and wherein the distance from said third axis to said control means and to the portion of said sensing means engaging said control means for blocking said control means is substantially twice the distance from said third axis to said first axis and thereby to the portion of the ribbon coil sensed by said sensing means.

8. A mechanism as claimed in claim 5 wherein said drive means of each unit include a ratchet wheel connected with said ribbon spool for turning movement, and biassed pawl means including a shifting pawl cooperating with said ratchet wheel; wherein said actuating means include a reciprocating actuating member in each unit carrying and reciprocating said shifting pawl so that said ratchet wheel and said ribbon spool of said one unit are stepwise turned for winding up the ribbon in one direction only; and wherein said shifting means of each unit has a cam portion cooperating with said pawl means for holding the pawl means of said other unit spaced from said ratchet wheel so that the ribbon can be freely unwound from said ribbon spool of said other unit.

9. A mechanism as claimed in claim 11 wherein said pawl means of said drive means of each unit comprise a holding pawl mounted on said support, and a spring connecting said shifting pawl with said holding pawl and biassing said pawls to engage said ratchet wheel.

10. A mechanism as claimed in claim 9 wherein said control means, said sensing means, said ratchet wheel, said shifting and holding pawls, and said shifting means are made of a light synthetic plastic material.