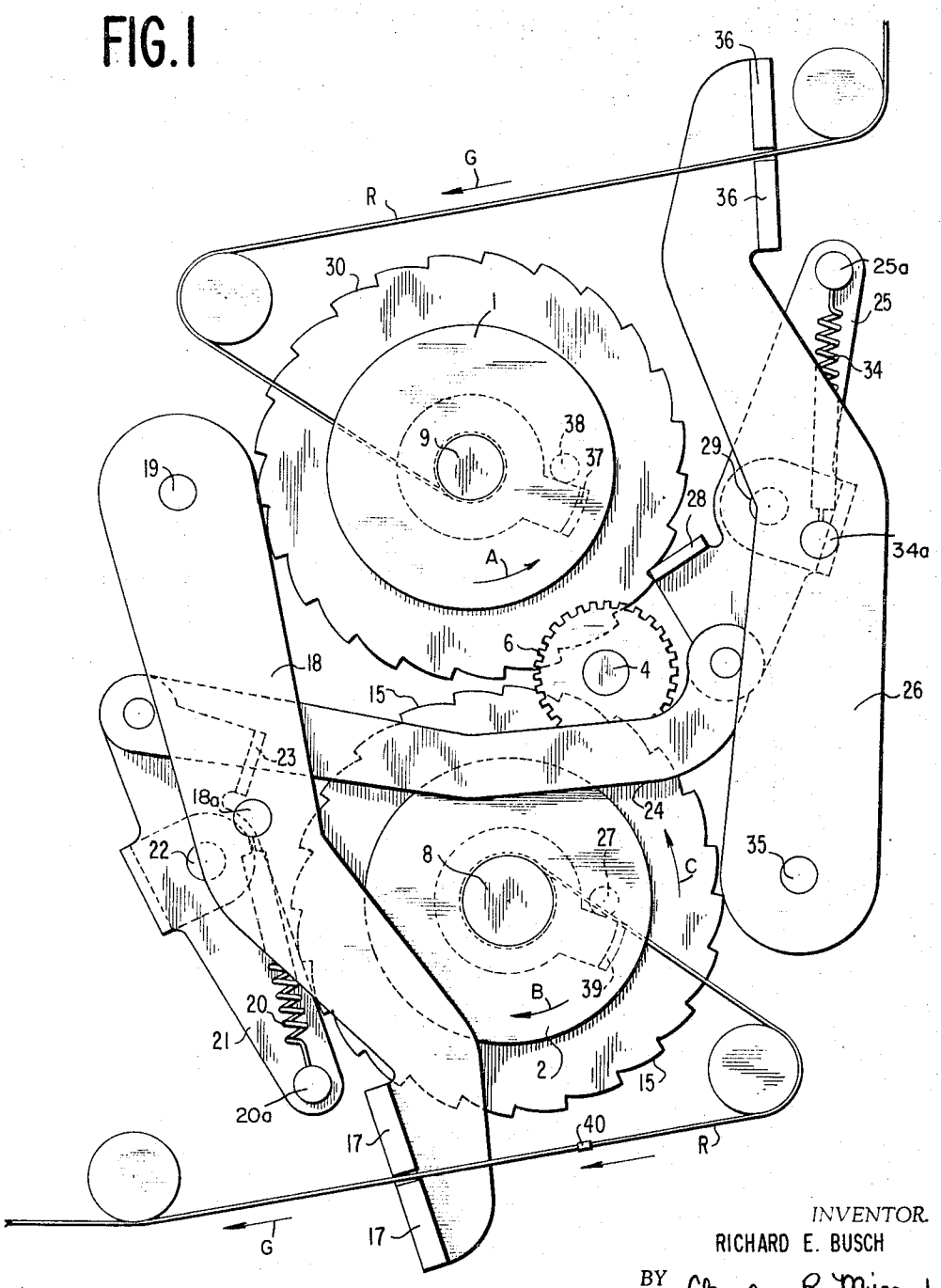
Sept. 12, 1967 R. E. BUSCH 3,340,989

RIBBON REVERSE MECHANISM

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FIG. 1



INVENTOR.
RICHARD E. BUSCH
BY Charles R. Miranda

ATTORNEYS

Sept. 12, 1967 R. E. BUSCH 3,340,989

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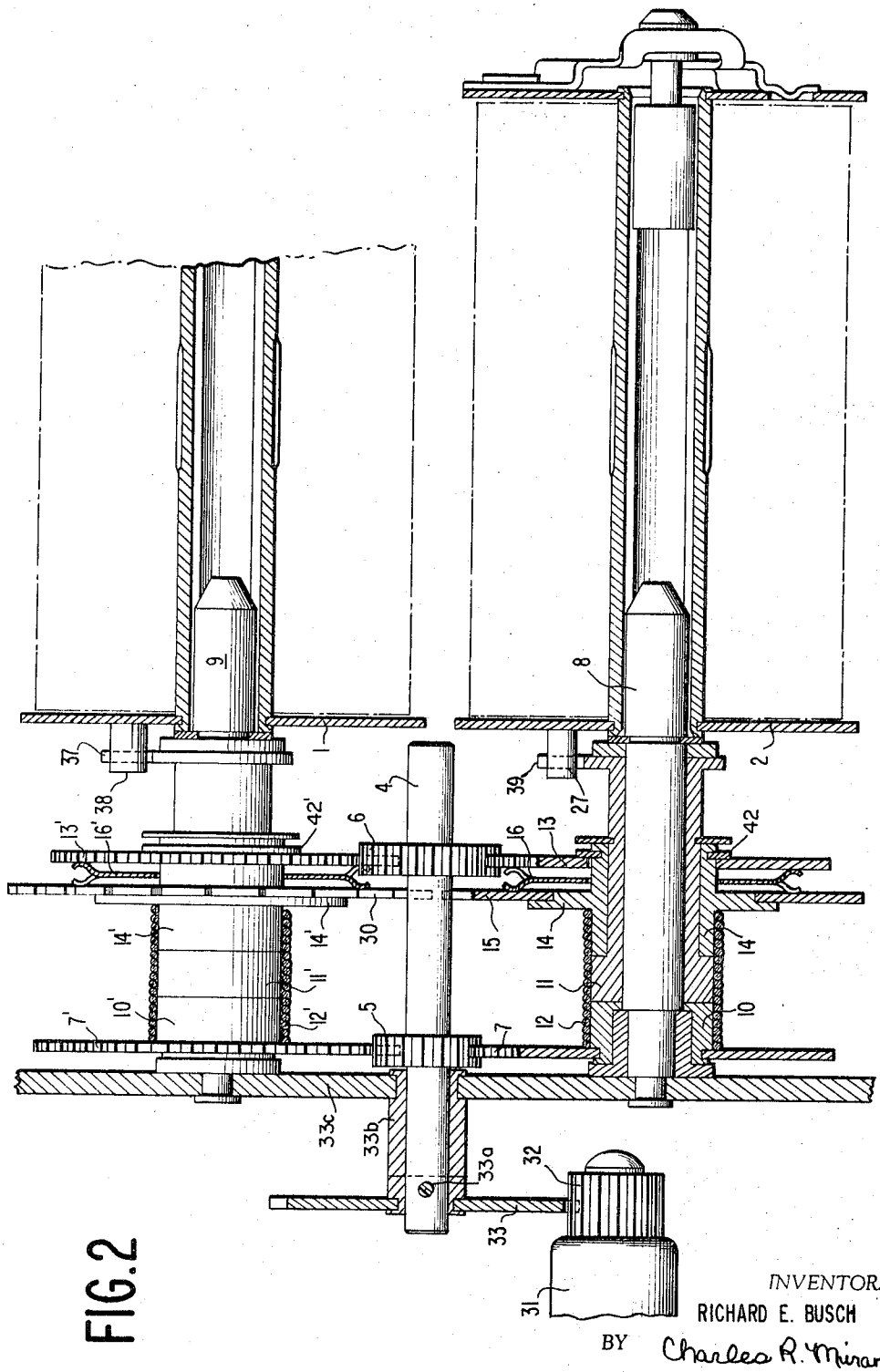


FIG. 2

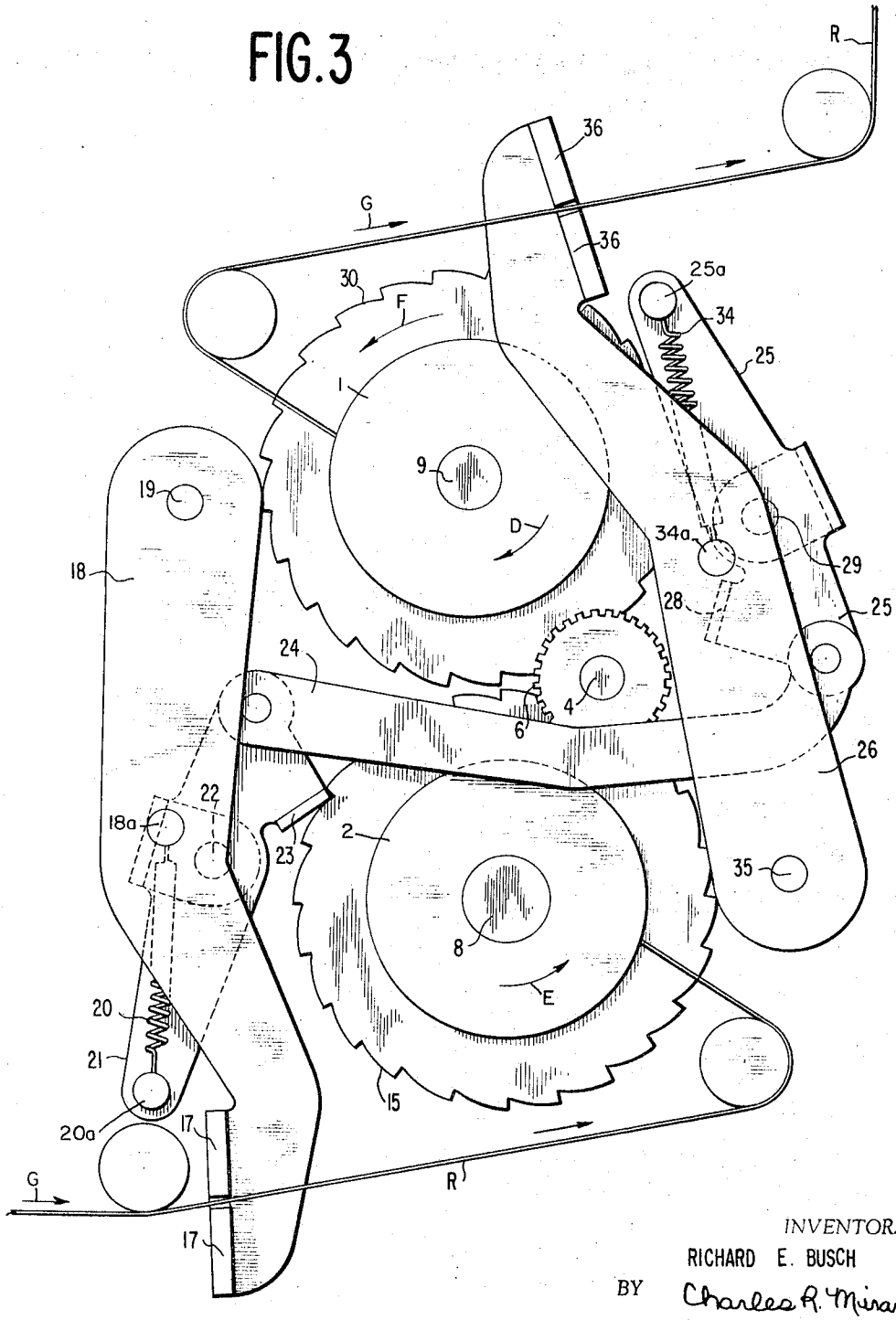
INVENTOR.
RICHARD E. BUSCH
BY Charles R. Miranda
ATTORNEYS

Sept. 12, 1967 R. E. BUSCH 3,340,989

RIBBON REVERSE MECHANISM

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FIG.3



INVENTOR.
RICHARD E. BUSCH
BY Charles R. Miranda
ATTORNEYS

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RIBBON REVERSE MECHANISM

Richard E. Busch, La Puente, Calif., assignor to Sperry Rand Corporation, New York, N.Y., a corporation of Delaware

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The present invention relates in general to calculating machines of the cash registering type and more particularly to a mechanism for control of the ink ribbon utilized for printing in such machines, which mechanism is capable of automatically reversing the direction of movement of the ink ribbon upon depletion of the ribbon supply spool.

In most cash registering machines, a printing unit records each transaction introduced into the machine on a paper tape which is then available at the end of the transaction for use as a receipt. The printing on the paper strip is accomplished through use of an ink ribbon which is passed from one ribbon spool through the printing apparatus of the machine to a second take-up spool. With machines of the cash registering type, it is important for the sake of customer convenience that the operator of the machine not be required to service the ribbon during the course of a transaction.

It is therefore quite desirable that some means be provided in or adjacent to the printing mechanism of the cash registering machine for automatically reversing the direction of movement of the printing ribbon when the ribbon supply spool becomes depleted.

Automatic ribbon reverse mechanism are known; however, the mechanism of the prior art have been generally overly complicated and therefore subject to repeated failure or inaccurate operation. It has also been found that these prior art mechanisms tend to place a large force on the ink ribbon during the reversing operation because their operation is based for the most part on a positive switching of gears and levers directly associated with the driving means.

The present invention provides a ribbon reverse mechanism in which the elements actuated by the ribbon to effect reversal thereof are not connected directly to the driving power but rather form a control for a pair of clutch elements which selectively apply the driving power to one or the other ribbon spool. In this way a ribbon actuated mechanism is provided which requires a minimum force to effect reversal of the ribbon.

It is therefore an object of the instant invention to provide a cash registering machine having a printing mechanism including an ink ribbon and a mechanism for automatically reversing the direction of movement of said ribbon when the ribbon supply spool becomes depleted.

It is a further object of the instant invention to provide a cash registering machine of the type described including a mechanism for automatically switching the driving power from one ribbon spool to the other ribbon spool in response to a depletion of ribbon on said one spool, wherein the switching is controlled by means isolated from said drive means.

It is still a further object of the present invention to provide a cash registering machine of the type described which is provided with an automatic ribbon reversing mechanism capable of selectively supplying driving power to one of the ribbon spools upon detection of ribbon depletion in the other spool, which mechanism is simple in construction, dependable in operation and requires a minimum force for actuation.

These and other objects, features and advantages of the present invention will become more obvious from the following description when taken in connection with

the accompanying drawings which shows, for purposes of illustration only, one embodiment in accordance with the present invention, and wherein:

FIGURE 1 is a detail view of the reciprocal ribbon control mechanism which forms part of the instant invention;

FIGURE 2 is a detail view of the clutch mechanism which cooperates with the mechanism of FIGURE 1 and forms the other part of the instant invention; and

FIGURE 3 is a detail view similar to FIGURE 1 with the elements shifted to their alternate positions.

Looking now to the figures of the drawing, wherein like reference numerals have been used to designate like parts, wherever possible, and more particularly to FIGURE 1, a printing ribbon R is passed from one ribbon spool **1**, through the printer (not shown) in an adjacent portion of the machine, and back to a second ribbon spool **2**. The spools are alternately driven from a main drive shaft in a manner to be described in detail in connection with FIGURE 2.

Looking first to FIGURE 1, an eyelet controlled lever **18** is pivoted at **19** and carries at its extreme end a pair of fingers **17**, which are spaced only slightly greater than the thickness of the printing ribbon and through which the printing ribbon is adapted to pass. The printing ribbon R is provided closely adjacent to each extreme end thereof with an eyelet or other projection **40** having a thickness somewhat larger than the spacing between the fingers **17** so that upon contact of the eyelet with the eyelet control lever **18**, which occurs when the spool **2** is almost depleted, the lever **18** will be rotated by the ribbon R in a clockwise direction. The lever **18** is connected at **18***a* by an over-center spring **20** connected at **20***a* to a blocking lever **21** pivoted at **22** and provided with a blocking ear or pawl **23** engageable with the teeth on a notched disk **15** associated with the spool **2**. The blocking lever **21** is also connected by way of link **24** to a similar blocking lever **25** pivoted at **29** and provided with a blocking ear or pawl **28** engageable with the teeth of a notched disk **30** associated with the spool **1**. The blocking lever **25** in connected at **25***a* to one end of an over-center spring **34**, the other end **34***a* of which is connected to a second eyelet control lever **26** pivoted at **35** and provided at its extreme end with a pair of fingers **36** similar to the fingers **17** on lever **18** and between which the printing ribbon R is adapted to pass to and from the spool **1**.

FIGURE 2 shows a side view of the mechanism and particularly illustrates the means by which the mechanism of FIGURE 1 controls notched disks **15** and **30** which, in turn, control the application of driving power alternately to the spools **1** and **2**, as more fully described below. A main drive shaft **31**, which is indexed or driven a prescribed amount during each cycle of the machine in the well-known manner, carries a drive gear **32** which meshes with a gear **33** mounted on the end of jack shaft **4** and fixed thereto by pin **33***a* which passes through the shaft and the hub of gear **33**. Shaft **4** is journalled in a bearing **33***b* fixed to the frame member **33***c* of the machine. The jack shaft **4** carries a small gear **5** and a larger gear **6** mounted in spaced relationship upon the shaft. The gear **5** meshes with gears **7** and **7'** on the two fixed spool supporting shafts **8** and **9**, respectively, each such gear **7** and **7'** being rotatably mounted on the shaft and provided with a hub **10** and **10'**, respectively, adapted to drive sleeves **11** and **11'** mounted on the respective shafts adjacent thereto. The gear **6** on jack shaft **4** meshes with gears **13** and **13'** rotatably mounted on hubs **14** and **14'**, which in turn are rotatably mounted on the sleeves **11** and **11'**, respectively, and in frictional driving engagement therewith through flange forming rings **42** and **42'**

fixed to the ends of hubs **14** and **14'**. Gears **13** and **13'** are of smaller diameter than gears **7** and **7'**. The notched disks **15** and **30** are also rortatably mounted on the hubs **14** and **14'** of the respective shafts **8** and **9** and friction spring disks **16** and **16'** are interposed between the gears **13** and **13'** and the disks **15** and **30** on the shafts **8** and **9**, respectively.

Springs **12** and **12'** are tightly wound about the outer periphery of the hubs **10** and **10'**, the sleeves **11** and **11'**, and the hubs **14** and **14'** on each of the shafts **8** and **9** in such a direction that rotation of the hubs **10** and **10'** in the normal driving direction when either disc **15** or **30** on hubs **14** and **14'** is blocked, as described above, will cause a tightening of the associated spring clutch and consequent rotation of the sleeve and hub as a unit. The sleeve **11** on shaft **8** is provided with a driving arm **39** which contacts a pin **27** mounted on the spool **2** such that rotation of the sleeve **11** will produce similar rotation of the spool **2**. In a like manner the sleeve **11'** on the shaft **9** is provided with a driving arm **37** which engages with a pin **38** so that rotation of the sleeve **11'** about the shaft **9** will produce a consequent rotation of the spool **1**.

It is apparent from the above description that the frictional engagement between discs **15** and **30** and their hubs **14** and **14'** is such as to overcome the frictional engagement between gears **13** and **13'** and the ring flanges **42** and **42'** as determined by the relative surface contact between these elements and the pressure of spring discs **16** and **16'**, when either of the discs **15** or **30** is blocked by its associated blocking ear.

It should be apparent that the hubs, sleeves and spring clutch members along with the associated gears on shaft **8** provide an identical arrangement to that of the shaft **9** and each of these mechanisms meshes with the gears **5** and **6** on the jack shaft **4**, which provides the driving power from the main drive shaft **31**. Such a use of similar parts in various portions of the mechanism and the provision of identical control units for each of the ribbon spools, provides for interchangeability of parts which considerably reduces the cost of manufacture of the device and provides for low-cost maintenance and overall simplicity of operation.

With the mechanism oriented as illustrated in FIGURE 1, power is applied to the shaft **9** assembly by way of main drive shaft **31**, gears **32** and **33**, and gears **5** and **6** on jack shaft **4** to drive spool **1** counterclockwise, as shown by arrow A so as to effect, as seen by arrows G, a winding of the ribbon upon spool **1** and an unwinding of the ribbon from spool **2** which is in an "idle" condition permitting it to rotate in a clockwise direction, as shown by the arrow B, as the ribbon unwinds therefrom. Notched wheel **15** and the other elements on shaft **8**—except actuator **11**—are being driven in the opposite direction, as shown by arrow C.

These driving conditions are attained in the following manner. Disk **30** is blocked by blocking ear **28** thereby preventing rotation of hub **14'** by gear **13'** which merely rotates around the hub **14'**. The hub **10'** is rotated by gear **7'** and, since no relative rotation is applied to the clutch spring **12'** by hub **14'**, the clutch spring **12'** will tighten to drive sleeve **11'** and hub **14'** all at the same speed. Sleeve **11'** drives spool **1** through the driving arm **37** and pin **38**. Hub **14'** will rotate relative to disk **30** and gear **13'** but has no effect on either.

At the same time, disk **15** is free to rotate permitting hub **14** to be rotated by gear **13** at a higher speed than gear **7** is rotated by gear **5**.

One end of the spring **12**, that is, the end in contact with the hub **14**, will therefore rotate at a greater speed than the end of the spring which contacts the hub **10** thereby producing a twisting of the spring which loosens the coils thereof and unlocks the sleeve **11** from the hub **10** breaking the driving power between these two members. With no driving power applied to the sleeve **11**, the spool **2** will be in an idle condition.

However, when the spool **2** becomes substantially depleted, the eyelet or other projection **40** placed near each extreme and of the ribbon R will catch in the aperture between the fingers **17** on eyelet control lever **18** forcing the lever in a clockwise direction. The lever **18** will then shift a position such as indicated in FIGURE 3. Since the spring **20** will be pulled to the other side of pivot **22**, the blocking lever **21** will rotate in a clockwise direction until the blocking ear **23** engages with a tooth in the notched disk **15**, thereby preventing further rotation of this disk.

At the same time, as blocking lever **21** is rotated clockwise, it rocks linkage **24** thereby rotating the blocking lever **25** in a counterclockwise direction away from the notched disk **30** bringing the over-center spring **34** to the left of the pivot **29** thereby rotating the eyelet control lever **26** in a counterclockwise direction also. With notched disk **30** free to rotate and notched disk **15** blocked, the driving power will be shifted from the shaft **9** to the shaft **8** assembly thereby reversing the direction of the spools **1** and **2**, as indicated by arrows D and E and the ribbon R, as shown by arrows G. Disk **15** is now still while disk **30** is rotating counterclockwise, as shown by arrow F so that it is wound upon the spool **2** from the spool **1**.

In a like manner when spool **1** becomes depleted, an eyelet placed at the end of the ribbon will contact the projections **36** on the eyelet control lever **25** thereby rotating the lever **26** in a clockwise direction effecting a clockwise rotation of the blocking lever **25** until the blocking ear **28** contacts the teeth on the notched disk **30** thereby preventing its further rotation. At the same time, through link **24**, the blocking lever **21** is rocked in a counterclockwise direction swinging the teeth on notched disk **15** from blocking ear **23** and effecting a counterclockwise rotation of the eyelet control lever **18** to the position indicated in FIGURE 1. With the notched disk **30** blocked by the blocking ear **28** and the notched disk **15** free to rotate, power will be reapplied to the shaft **9** assembly and withdrawn from the shaft **8** assembly thereby effecting a winding of the ribbon R on the spool **1**, which ribbon is then supplied from the spool **2**.

In summary, it will be understood that when disc **15** is blocked, as shown in FIG. 3, reel **2** will be conditioned to be driven by way of the spring clutch **12** driving sleeve **11** and the driving engagement of drive arm **39** with pin **27**. At the same time, hub **14'** is free to be driven faster than hub **10'** and the driving engagement of spring clutch **12'** with sleeve **11'** is broken. Therefore, there will be no driving of reel **1** which will be in idle condition permitting the ribbon to feed freely from it to reel **2**. The exact opposite condition will prevail when disc **30** is blocked and hub **14** is free to be rotated at a higher speed **10**, as explained above.

In other words, when sleeve **11** is rotated, sleeve **11'** is idle, and vice versa. Each sleeve is conditioned to be driven when its associated notched disc is prevented from being rotated by the ears **23** and **28**, respectively.

It should therefore be apparent that the instant invention provides a ribbon reversing mechanism wherein a clutch mechanism is positioned between the main drive shaft **31** and each of the means controlled by levers **18** and **26** for alternately engaging one of said clutch mechanisms while inactivating the other.

As a result, the ribbon R does not directly actuate the clutch mechanisms but cooperates directly with an easily actuated over-center, spring-lever combination, which takes a minimum force to actuate and which performs the required reversing operation.

It should therefore be equally apparent that using these basic principles of the invention one may alter the structural form of the invention as specifically described and illustrated herein without departing from the spirit and scope of the instant invention.

I claim:

1. A ribbon reversing mechanism comprising:

(a) first and second shafts fixed in spaced apart relationship with each other;

(b) first and second ribbon spools mounted for rotation on said first and second shafts and to which the opposite ends of said ribbon are attached respectively;

(c) first and second spool actuating means rotatably mounted on said first and second shafts, respectively, for rotating said spools, each of said actuating means comprising:

(1) a sleeve around the shaft and extending longitudinally along its length;

(2) a hub on one end of said sleeve; and

(3) a spool drive means at the other end of said sleeve;

(d) rotatable drive means comprising:

(1) a first hub rotatably carried on each of said shafts on one side of the hub end of said actuating means and being of the same outer diameter as said hub end;

(2) a second hub rotatably carried on each sleeve on the other side of said hub end of said actuator and being of the same outer diameter as the hub end;

(3) first hub driving means for rotating each of said first hubs at one speed; and

(4) second hub driving means for rotating each of said second hubs at a faster speed;

(e) first and second clutch means mounted on said first and second shafts, respectively, and each comprising:

(1) a coil spring tightly wound around all three of said hubs;

(f) projection means on each end of said ribbon; and

(g) blocking means responsive to said projection means for alternately counteracting each of said second hubs driving means;

(h) each of said clutch means in response to said blocking means being alternately ineffective to drive its associated actuating means when said second hub is rotating at the higher speed whereby its associated spool is in an idle condition, and effective to drive said associated actuating means when said blocking means is effective thereby to rotate the associated spool to wind ribbon thereupon from the idle spool.

2. A construction according to claim 1 wherein said blocking means comprises:

(a) a notched wheel rotatably mounted on each of said second hubs;

(b) means for effecting rotation of said notched disk at the same speed as said second hub when said notched disk is free to rotate;

(c) pawl means associated with each of said notched disks; and

(d) an over-center lever means responsive to movement of one of said projection means as it moves away from its spool to activiate one of said pawls into blocking engagement with one of said notched wheels and to move the other of said pawls away from blocking engagement with the other of said notched wheels.

3. A reversing mechanism according to claim 2 wherein each of said pawl means comprises:

(a) a third lever pivotally mounted intermediate its ends; and

(b) a pawl carried on one free end; and wherein said over-center lever means comprises:

(c) a first pivoted lever having its free end in the path of the projection means on one end of the ribbon;

(d) a second pivoted lever having its free end in the path of projection means on the other end of the ribbon;

(e) an over-center spring connecting the other free end of each of said pawl carrying third levers to one of said pivoted levers intermediate their free and pivoted ends; and

(f) link means interconnecting said pawl carrying ends of said third levers; whereby

(g) movement of the free end of one of said first or second levers by said projection means moves the pivotal connection of said over-center spring with said first or second lever over-center relative to the pivot point of a said third lever thereby to move its pawl into blocking engagement with the associated notched wheel and the other pawl out of blocking engagement with its notched wheel.

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ROBERT E. PULFREY, *Primary Examiner.*

E. T. WRIGHT, *Assistant Examiner.*