United States Patent

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[54] **FEED AND REVERSE MECHANISM FOR AN INKING RIBBON**
4 Claims, 4 Drawing Figs.

[52] U.S. Cl. **197/162**
[51] Int. Cl. **B41j 33/46**
[50] Field of Search 197/160-165, 151; 101/336; 74/527

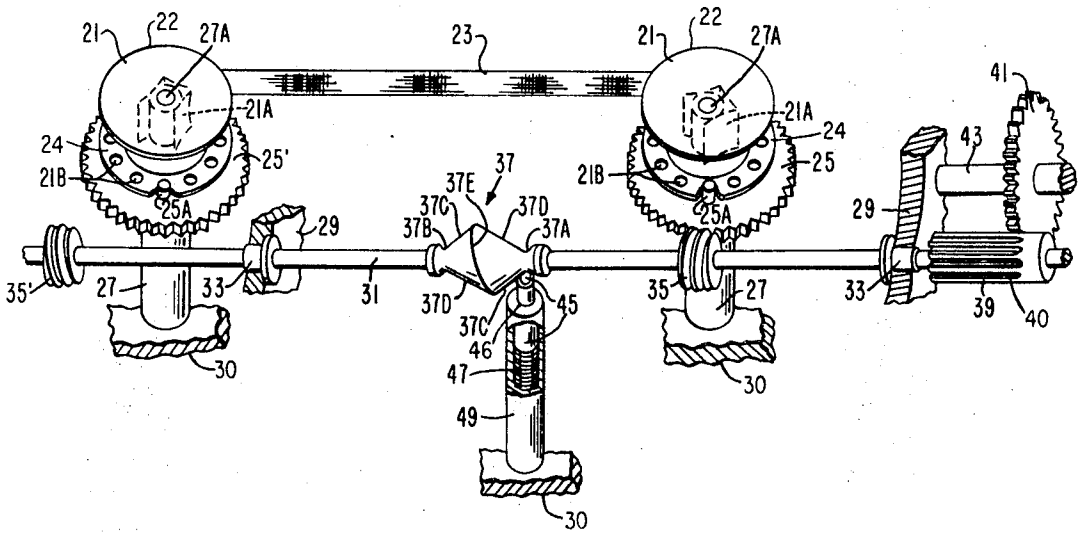
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ABSTRACT: An inking ribbon is feedingly wound onto each of two spools by the rotation of a shaft and the alternate cooperation of a pair of worms with a pair of spool supporting worm wheels. When ribbon feeding is interrupted by the unwound condition of one spool, the shaft is shifted laterally to disengage the worm and worm wheel associated with the fully wound spool and to engage the worm and worm wheel associated with the unwound spool, such shifting movement of the shaft being initiated by the expelling action of the active worm from its associated wheel and completed by the action of a biased detent pin against the rotating and declining slopes of a double-coned actuator.



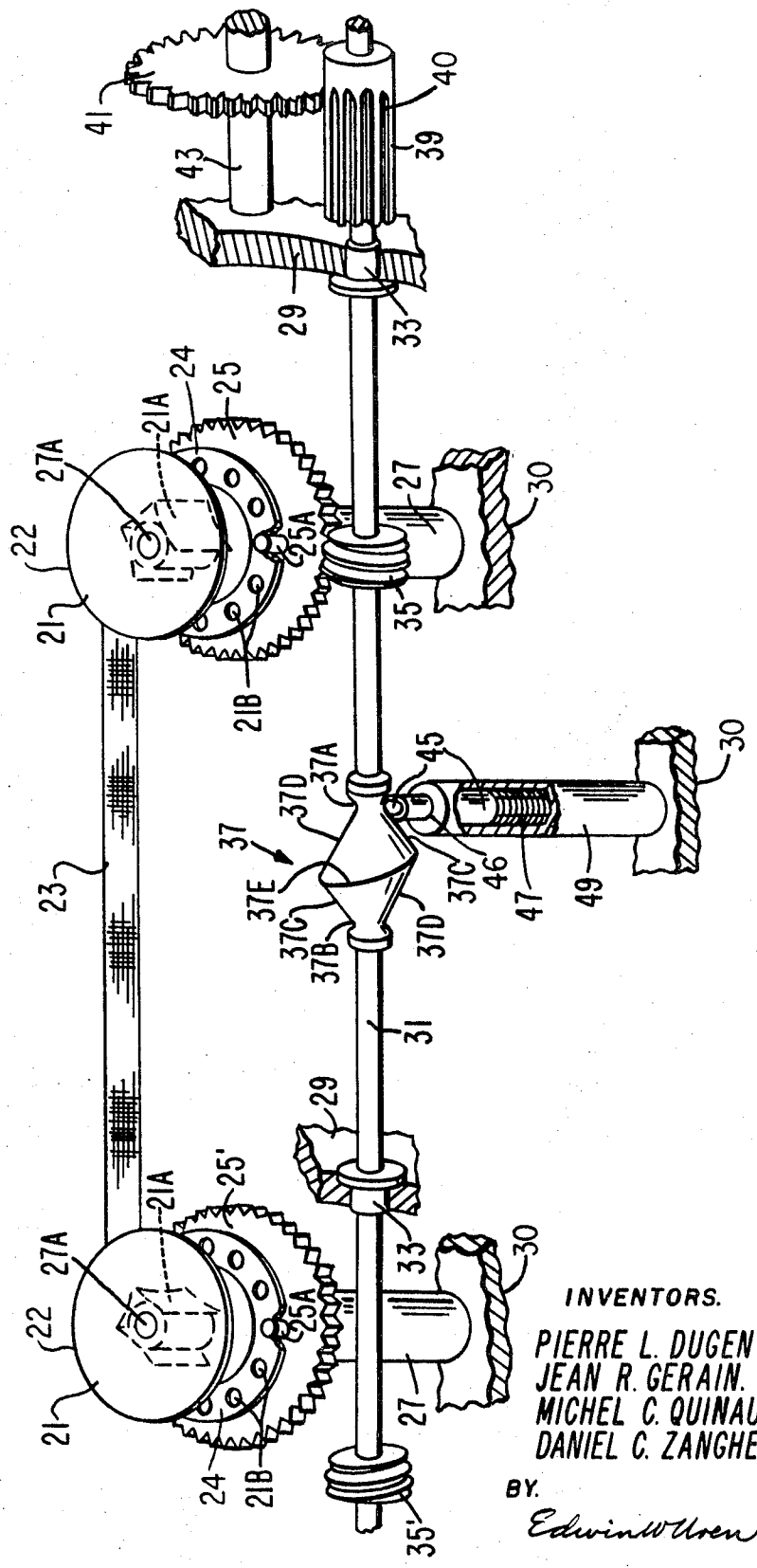

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27A
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37A
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37D
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37E
37C
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37B
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FIG. 1.

FIG.3.

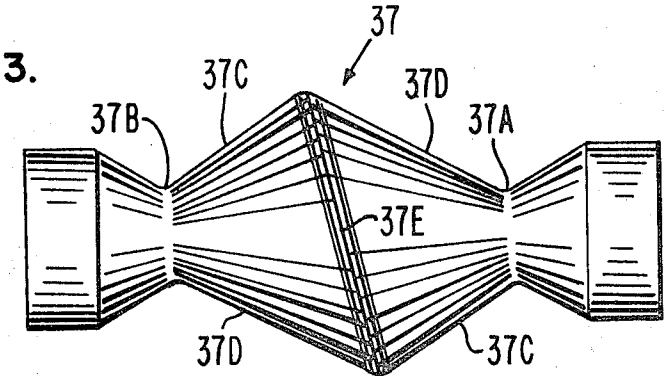


FIG.2.

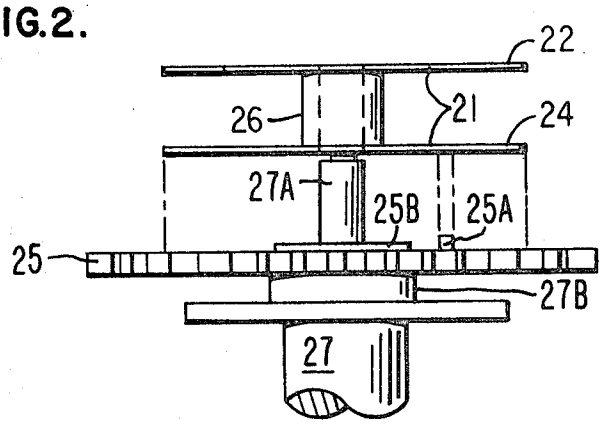
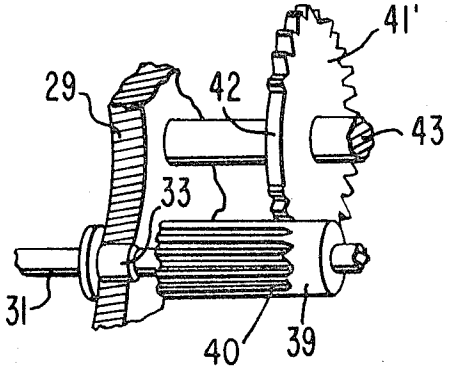


FIG.4.



FEED AND REVERSE MECHANISM FOR AN INKING RIBBON

BACKGROUND OF THE INVENTION

Devices of a ribbon feed and reverse nature are employed in typewriters, printing calculators and other business machines to render a fresh supply of ink constantly available to the printing elements. These known devices commonly provide for the gradual winding of the ribbon onto one of a pair of ribbon spools as it unwinds from the opposite spool and as the printing elements are impressibly or impactably brought into contact with a transversely moving area of the ribbon disposed between the spools. When the ribbon is fully wound onto one of the spools, the direction of ribbon travel is reversed and the ribbon is thereafter gradually wound onto the opposite spool commensurate with the frequency with which the printing elements are printably activated. This alternate winding of the ribbon onto the two spools serves not only to maintain a fresh supply of ink in the printing area, but also to preserve and to prolong the functional life of the ribbon.

Devices of this type generally employ one or more of a variety of complicated mechanical motions, oftentimes involving the reciprocating action of links and detenting slides which are uniquely formed and contoured to suit the space limitations of the printing mechanisms to which they are adapted. These links and slides generally cooperate with biased pawls which in turn cooperate with a pair of ratchet wheels to rotatably activate the ribbon spools. Such ribbon feed and reverse devices usually require considerable space and the exacting adjustment of parts in order to assure reliable performance and effective and timely ribbon feed and reversal.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a ribbon feed and reverse mechanism which is directly geared to and powered by the unidirectional rotation of a motor drive shaft, in contrast to the common practice of translating rotational power into a reciprocating motion of links or slides and then reconverting such motion to a pawl driven rotational winding of the ribbon spools. The invention, through these devices, achieves a higher level of reliability.

Another object of the invention is to provide a ribbon feed and reverse mechanism wherein positively driven worms are employed to rotate spool supporting worm wheels, in contrast to less positive biased pawls and ratchet wheels. The invention is accordingly designed for economy in maintenance, since its various parts require but a minimum of adjustment, at the time of initial assembly.

Still another object of the present invention is to provide a ribbon feed and reverse mechanism which comprises a minimum number of parts which may be fitted into very limited space in a printing mechanism. Economy of manufacture and space-saving compactness are thereby achieved.

An important aspect of the invention is the use of a rotatable and laterally movable shaft disposed in parallel relationship with the path of travel of an inking ribbon between a pair of spaced-apart spools and rotatable worm wheels, to alternatively wind the ribbon onto each spool as the shaft is rotated in a predetermined direction.

Another aspect of the invention is a pair of oppositely threaded worms fixed to the shaft at a greater spaced-apart distance than the distance between the spools and worm wheels, such that when one of the worms is cooperably engaged with its associated worm wheel the opposite worm is disengaged and disposed outwardly from its associated wheel, the maximum lateral movement permitted the laterally movable shaft being effective to fully disengage one worm from its associated worm wheel and to engage the opposite worm with its associated worm wheel.

Another aspect of the invention is the use of a generally oval-shaped actuator comprising a pair of grooves and a raised central portion, such actuator being attached to the shaft at a predetermined point between the oppositely threaded worms.

The raised central portion of this actuator comprises a pair of end-butted truncated cones, the common base of which presents an ellipse representing the maximum radial distance from the axis of the shaft.

Still another aspect of the invention is a resiliently supported detent pin which is alternately engageable with each of the pair of grooves of the actuator to define the maximum lateral movement permitted the shaft. The resiliency of this detent pin is sufficient, when applied against the rotating and declining slopes of either truncated cone, to complete the lateral transverse movement of the shaft, such movement being initiated by the expelling action of the rotating active worm against its associated halted worm wheel, such expelling action having caused the rising slopes of the opposite truncated cone and the ellipse formed by the common base of the two cones to be presented to the biased detent pin.

BRIEF DESCRIPTION OF THE DRAWING

These and other objects, aspects and advantages of the invention will be more clearly understood from the following description when read in conjunction with the accompanying drawing, in which:

FIG. 1 is a perspective view showing the various component parts of the mechanism;

FIG. 2 is an elevation showing the details of one of the ribbon support posts;

FIG. 3 is a view of a double-coned actuator which is used in the preferred embodiment of the invention, such actuator having an inclined ellipse and vertices eccentric to the revolution axis; and

FIG. 4 is a fragmentary perspective view showing the elongated pinion of FIG. 1 in relationship with a drive gear having a toothless area of predetermined length disposed along its periphery.

DETAILED DESCRIPTION OF THE INVENTION

With reference to FIG. 1, the preferred embodiment of the invention provides a pair of upright ribbon support posts **27** disposed in spaced-apart relationship by means of suitable attachment to the framing **30** of the machine or mechanism in which is is incorporated. The upper end of each of these posts **27** comprises a shank member **27A** and a shoulder hub **27B** (see FIG. 2). A pair of worm wheels **25** and **25'** are positioned on the upper extremities of the posts **27** in contacting relationship with the shoulder hubs **27B**, and are freely rotatable on the shank members **27A**. Each of these worm wheels **25** and **25'** comprises a shoulder hub **25B** (FIG. 2) and a stud **25A** attached to the upper surface thereof at a predetermined point along its radius. A pair of ribbon spools **21** each comprising an upper flange **22**, a lower flange **24** and a central hub **26**, are frictionally attached by means of spring members **21A** disposed within the hubs **26** and forming the central openings thereof, to the shank members **27A** of the posts **27**, and are rotatably fixed to the worm wheels **25** and **25'** by the engagement of one of a plurality of apertures **21B** formed in the lower flanges **24** thereof with the studs **25A** disposed on the upper surfaces of the worm wheels **25** and **25'**. An inking ribbon **23** of predetermined length is anchored at each end, in any suitable and well-known manner, to one of the ribbon spools **21** such that when the ribbon **23** is completely unwound from either spool **21** it will not separate therefrom, even though the ribbon **23** is subjected to a moderate force applied in a separating direction. The ribbon **23** is so wound onto the two spools **21** that it exits from and is introduced to the spools **21** at their twelve o'clock positions, and the path of travel of the ribbon **23** between the two spools **21** is contiguous to and adjacent the printing elements (not shown).

The preferred embodiment of the invention also comprises a rotatable and laterally movable shaft **31** which is disposed in parallel relationship with the path of travel of the inking ribbon **23** between the two spools **21**. This shaft **31** is journaled within a pair of bearings **33** which are supportively fixed to a

pair of frame members 29, such bearings 33 being permissive of both the rotational and transverse movement of the shaft 31. The shaft 31 is continuously rotated in a clockwise direction during operation of the machine in which the embodiment of the invention is incorporated, such continuous rotation being accomplished through the cooperation of an elongated pinion 39 fixed to one extremity of the shaft 31 and a driving gear 41 fixed to one end of a motor drive shaft 43, the continuous rotation of the shaft 31 serving to wind the ribbon 23 onto one or the other of the spools 21 independently of the actuation of the printing elements of the machine.

The shaft 31 also comprises a pair of fixed and oppositely threaded worms 35 and 35', each of which is separately and compatibly engageable with the worm wheels 25 and 25', respectively, by means of the lateral movement of the shaft 31 as between its two lateral positions, such worms 35 and 35' being attached to the shaft 31 at a greater spaced-apart distance than the distance between the two ribbon supporting posts 27. The worm 35 is so threaded as to rotate its associated worm wheel 25 in a clockwise direction when the shaft 31 is rotated, and the worm 35' is so threaded as to rotate its associated worm wheel 25' in a counterclockwise direction. The continued clockwise rotation of the shaft 31, after the actively driven worm wheel 25 or 25' is stopped and restrainably prevented from rotating by the unwound and connected state of the ribbon 23 relative to the spool 21 associated with the opposite worm wheel 25 or 25', causes the actively driven worm 35 or 35' to be rotationally expelled from its associated worm wheel 25 or 25', to thereby initiate the lateral translatory motion of the shaft 31 in the direction of its opposite lateral position. The unwound state of the ribbon 23 relative to either of the spools 21 is accordingly effective to restrain the worm wheels 25 and 25' against further rotational movement, such restraint being terminated by the translation of the shaft 31.

The shaft 31 also comprises a fixed actuator 37 disposed at a predetermined point between the worms 35 and 35'. This actuator 37 comprises a pair of circumferential grooves 37A and 37B, and a central raised portion consisting of a pair of base-butted truncated cones each having a short slope 37C and a long slope 37D, the difference between these slopes 37C and 37D producing an inclined ellipse 37E representing the greatest radial dimension of the actuator 37. The distance between the grooves 37A and 37B corresponds directly to the maximum lateral movement that is permitted the shaft 31, such lateral movement being defined by the alternate engagement of a resiliently supported detent pin 45 with the two grooves 37A and 37B. The detent pin 45 is supported by a spring 47 disposed within a cylindrical housing 49 which is attached to the machine framing 30 at a predetermined point and which is provided with a central aperture 46 through which the detent pin 45 extends. The relationship between the length of the short slopes 37C of the actuator 37 and the axial length of the worms 35 and 35' is such that the ellipse 37E, at its point of intersection with the slopes 37C, is encountered by and moved over the detent pin 45 at the same instant the active worm 35 or 35' is rotationally expelled from its associated and halted worm wheel 25 or 25' during the ribbon reversing process.

When, during the winding of the ribbon 23 onto the spool 21 supported by the actively driven worm wheel 25 or 25', the ribbon 23 becomes completely unwound from the opposite spool 21, both worm wheels 25 and 25' are stopped and restrainably prevented from rotating and the active worm 35 or 35' is translatably expelled from its associated worm wheel 25 or 25' as a result of its screwing action relative thereto, to thereby initiate the lateral translatory movement of the shaft 31 toward its opposite lateral position. During this initial lateral translatory movement of the shaft 31, the rising slopes 37C and 37D of the truncated cone of the actuator 37 adjacent the engaged groove 37A or 37B are presented to the detent pin 45 to thereby further compress the spring 47. When the declining slopes 37C and 37D of the opposite truncated cone of the actuator 37 are first presented to the detent pin 45, as the inclined ellipse 37E intersecting the short slope 37C rides over the pin 45, the bias of the spring 47 causes the detent pin 45 to act upon such declining slopes and to thereby complete the translation of the shaft 31, such translation culminating in the engagement of the detent pin 45 with the opposite groove 37A or 37B, and in the engagement of the opposite worm 35 or 35' with its associated worm wheel 25 or 25' supporting the unwound spool 21. Rotation of the shaft 31 thereafter results in feeding the ribbon 23 in the opposite direction and in winding the ribbon 23 onto the empty spool 21.

The embodiment of the invention shown in FIG. 1 provides for the continuous feeding of the ribbon 23 whenever the motor drive shaft 43 is rotationally activated. Another embodiment of the invention comprises a spur gear 41' shown in FIG. 4, said gear 41 having a toothless area 42 disposed a predetermined distance along its periphery. This area 42 provides for an interruption in ribbon feeding at that instant in the cyclical operation of the machine when the printing elements are impressed or impacted against the ribbon 23. The toothless area 42 is so designed as to slidingly contact both sidewalls of one of the plurality of transverse grooves 40 formed in the elongated pinion 39, as the motor drive shaft 43 is rotated, to thereby retain the elongated pinion 39, the shaft 31, and the worm wheels 25 and 25' in a stationary position at the moment of element impact.

To further describe how the preferred embodiment of the invention operates to feed and reverse an inking ribbon 23 as between a pair of ribbon spools 21, an explanation is hereinafter set forth relative to winding the ribbon 23 onto the rightmost spool 21, reversal of the direction of ribbon feed when the ribbon 23 is completely wound thereon, and subsequent winding of the ribbon 23 onto the leftmost spool 21, such explanation beginning with the worm 35 cooperably engaged with the worm wheel 25 and with the detent pin 45 disposed in the rightmost groove 37A of the actuator 37. The counterclockwise rotation of the motor drive shaft 43 and the driving gear 41 provides a continuous clockwise rotation of the shaft 31, the worms 35 and 35', and the actuator 37, through the cooperation of the spur gear 41 and the elongated pinion 39. This clockwise rotation of the worm 35 causes the worm wheel 25 to be rotated in a clockwise direction to thereby wind the inking ribbon 23 onto the ribbon spool 21 associated therewith, and to unwind the ribbon 23 from the spool 21 associated with the worm wheel 25'. During such feeding of the ribbon 23 the detent pin 45 continues to ride in the groove 37A of the actuator 37. At such time as the ribbon 23 is fully wound onto the rightmost spool 21, and unwound from the leftmost spool 21, an anchoring device effectively attaching the leftmost extremity of the ribbon 23 to the leftmost spool 21 restrainably interrupts the clockwise rotation of both worm wheels 25 and 25' and effectively holds the worm wheel 25 in a stationary state. The continued rotation of the worm 35, being cooperably engaged with the teeth of the worm wheel 25, causes the worm 35 to be translatably expelled in a rightward direction from such stationary teeth, to thereby initiate a rightward translatory lateral movement of the shaft 31. During this rightward movement of the shaft 31, the rising slopes 37C and 37D of the adjacent truncated cone of the actuator 37 are presented to the detent pin 45 to further depress the pin 45 and to further compress the spring 47. When the inclined ellipse 37E of the actuator 37 is presented to the detent pin 45, at the point of intersection of said ellipse 37E with the short slope 37C, the pin 45 acts upon the declining slopes 37C and 37D of the opposite truncated cone under the power of the spring 47, to thereby complete the rightward translatory movement of the shaft 31 and to position the pin 45 in the leftmost groove 37B. With the pin 45 cooperably engaged with the groove 37B, the worm 35' is positioned in cooperating engagement with the worm wheel 25' whereupon it proceeds to rotate the worm wheel 25' in a counterclockwise direction, as the shaft 31 continues to be rotated in a clockwise direction. The ribbon 23 is thereafter wound onto the leftmost spool 21

until such time as it is completely unwound from the rightmost spool **21**, whereupon an additional ribbon reversal occurs and the shaft **31** is moved in a leftward translatory direction to reengage the pin **45** with the groove **37A** and the worm **35** with the worm wheel **25**.

While the invention has been shown and described in considerable detail, it will be understood that other variations thereof may be had without departing from the true spirit and scope of the invention.

We claim:

1. In a frame-supported ribbon feed and reverse mechanism having a ribbon, a pair of spaced-apart rotatably mounted ribbon spools to which the ends of said ribbon are connected, a rotatable and translatable driven shaft, means for unidirectionally rotating said translatable driven shaft, means for alternately coupling said driven shaft with each of said ribbon spools to thereby effectuate the feedable winding of said ribbon thereon, and wherein ribbon feed reversal is accomplished when said ribbon is fully wound onto one of said spools by the translation of said rotatable and translatable driven shaft to thereby effect coupling of said driven shaft with the opposite of said spools, said translation of said shaft being partially effectuated by said coupling means in response to the continued rotation of said shaft at a time when the fully wound spool is prevented from further windable rotation, said ribbon feed and reverse mechanism being characterized by shaft translating means comprising:

a. a pair of base-butted truncated cones affixed to said shaft, the vertices of said cones being eccentric to axis of said shaft and the ellipse formed by said base butting being inclined relative to said axis, said inclined ellipse providing each of said cones with declining slopes of differential length, said slopes terminating in a pair of spaced-apart circumferential grooves, and

b. resilient detenting means mounted in juxtaposed and cooperating relationship with said slopes and said circumferential grooves of said pair of base-butted truncated cones on the supporting frame of said ribbon feed and reverse mechanism, said resilient detenting means activatably cooperating with said declining slopes of one of said pair of cones when presented to said inclined ellipse formed by said base butting of said pair of cones during said partial translation of said translatable shaft by said coupling means, said activatable cooperation serving to complete the translation of said translatable driven shaft such that said shaft is coupled through said coupling means with the spool from which said ribbon has been unwound, said resilient detenting means alternately cooperating also with said pair of spaced-apart circumferential grooves to thereby secure the coupling of said translatable driven shaft, through said coupling means, with the ribbon spool onto which said ribbon is to be or is being wound.

2. A motive power transfer device effective for alternately coupling a translatable driving means with a first and a second driven means, said driving means having at least two effective positions and said driven means each being activatable for a predetermined interval such as the interval required to wind a ribbon or the like onto a spool, said transfer device comprising:

a. coupling means associated with said driving means and effective for coupling said first driven means with said driving means when said driving means is disposed in one of its said two effective positions, and effective also for coupling said second driven means with said driving means when said driving means is disposed in the opposite one of its said two effective positions, said coupling means being effective also to initiate the translation of said driving means as between its said two effective positions in response to the termination of said predetermined interval, and

b. means jointly effective for defining said effective positions of said driving means and for completing said translation of said driving means as between its said two effective positions, said completed translation of said driving means serving to uncouple said driving means from one of said driven means and to effectuate the coupling therewith of the opposite one of said driven means, said jointly effective means including a rotary actuator formed by a pair of base-butted conical frustums, each of said frustums being formed by the section of a pair of inclined planes, said base butting of said frustums forming an inclined ellipse relative to the axis of said driving means, the truncated ends of said conical frustums terminating in a pair of grooves defining the length of said rotary actuator.

3. The motive power transfer device defined in claim **2** wherein said means jointly effective for defining said effective positions of said driving means and for completing said translation of said driving means additionally comprises:

resilient detent means disposed in cooperating relationship with said rotary actuator and with said pair of grooves, said detent means being displaced from one of said grooves and effectively brought into contact with the adjacent of said pair of conical frustums in response to said initation of said translation of said driving means by said coupling means, said detent means cooperating resiliently thereafter with the opposite of said conical frustums to effectively complete said translation of said driving means to the opposite of its said two effective positions, said translation of said driving means terminating when said detent means cooperably engages the opposite of said pair of grooves of said rotary actuator.

4. A device for shuttling a rotatably and translatably mounted two-position shaft as between its said two positions, said device comprising:

a. a pair of base-butted conical frustums affixed to said shaft, each of said frustums being formed by the section of a pair of inclined planes, said base butting of said frustums forming an inclined ellipse relative to the axis of said shaft, the truncated ends of said conical frustums terminating in a pair of spaced-apart grooves formed on said shaft,

b. resilient detenting means disposed in cooperating relationship with said pair of frustums and with said pair of grooves, said cooperation between said detenting means and said pair of grooves defining said two positions of said shaft,

c. means for unidirectionally rotating said shaft, and

d. means for partially translating said rotating shaft from a given one of its said two positions in the direction of the opposite one of said positions, said partial translation effectively presenting the conical frustum adjacent said detenting means and said inclined ellipse to said detenting means, said detenting means cooperating resiliently thereafter with the opposite of said conical frustums to thereby effectuate said shuttling of said shaft to said opposite one of its said two positions.