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A. REHUREK, JR
RIBBON FEED MECHANISM

2,889,909

Filed Dec. 30, 1957

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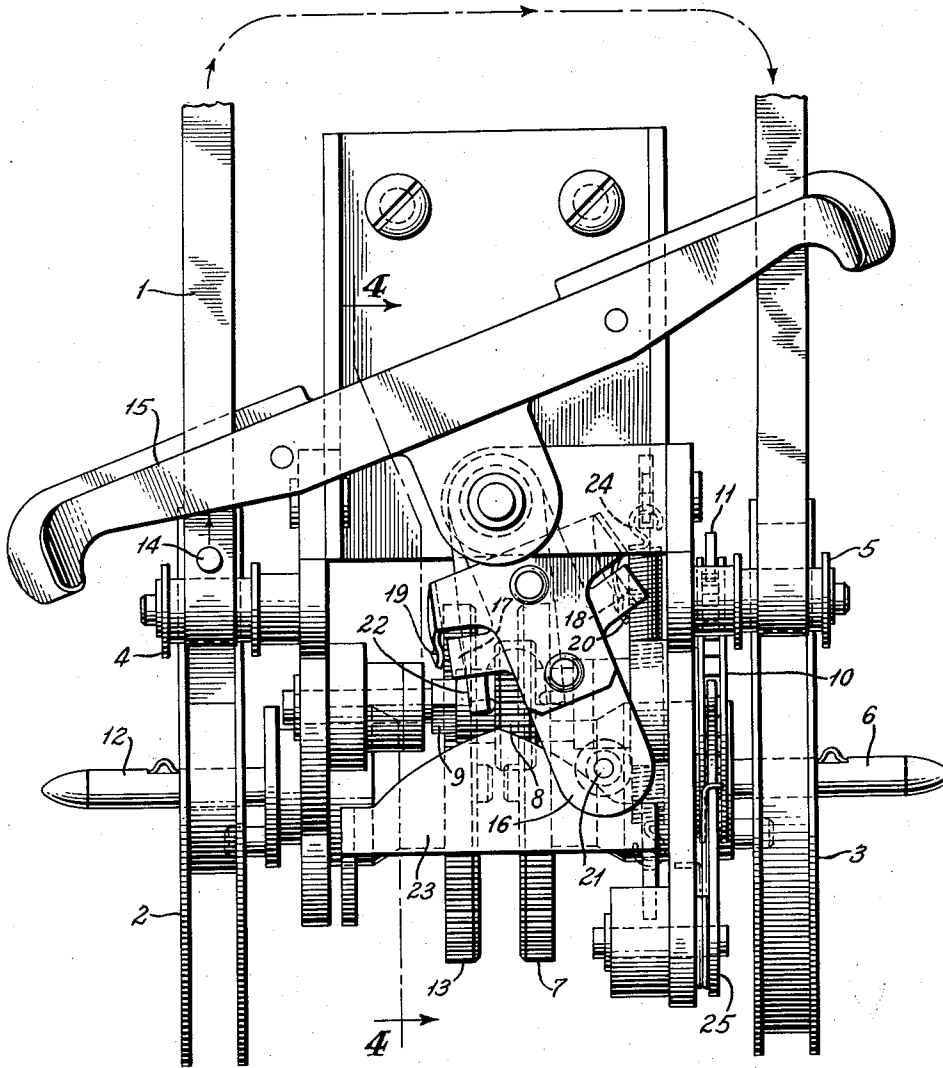


Fig. 1.

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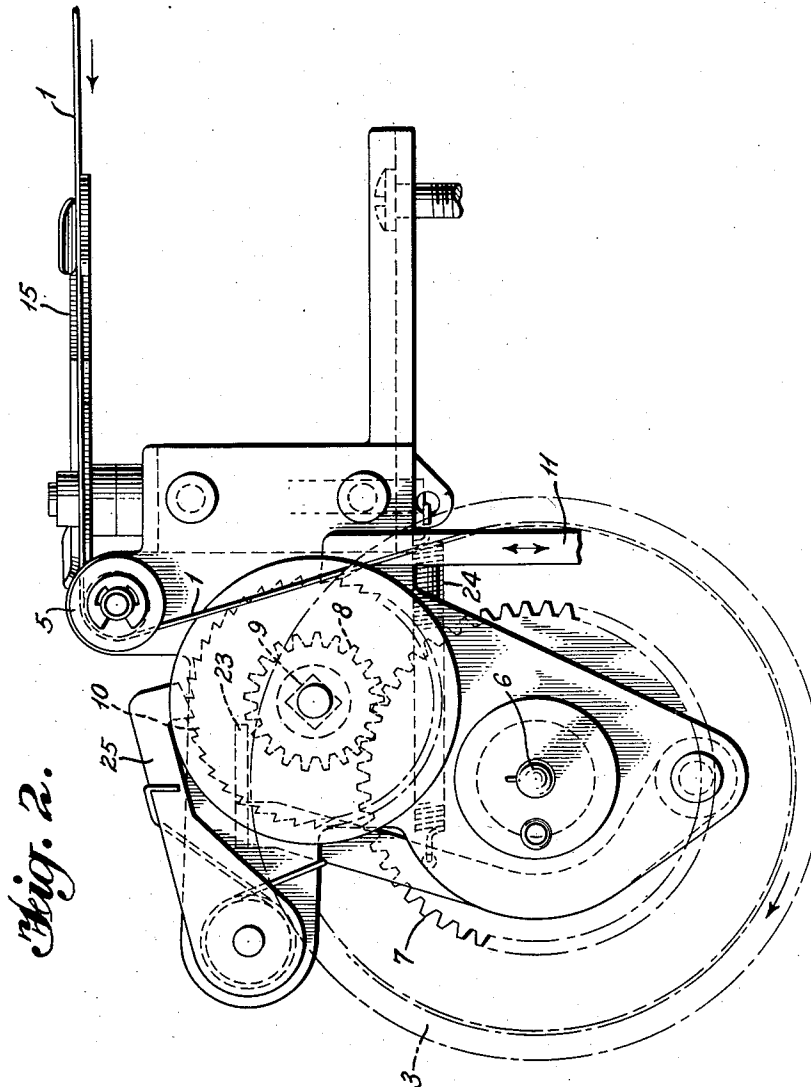
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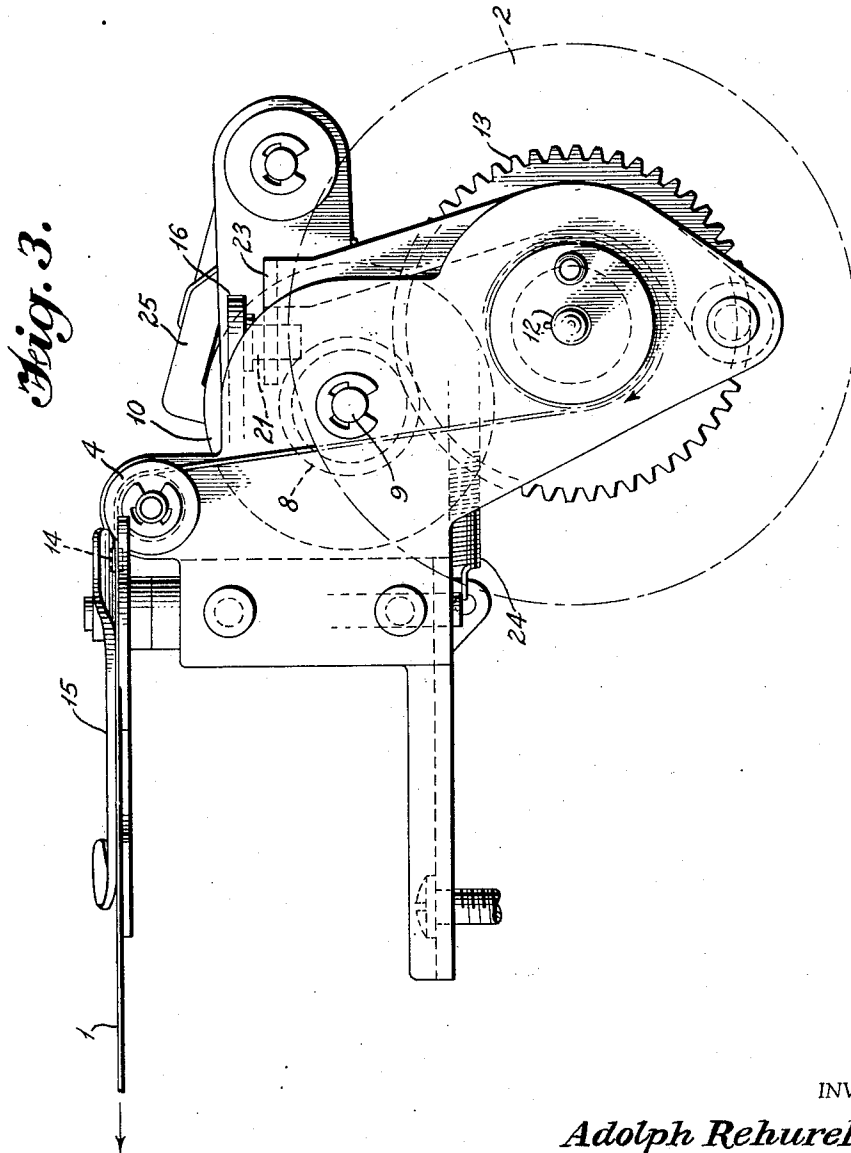
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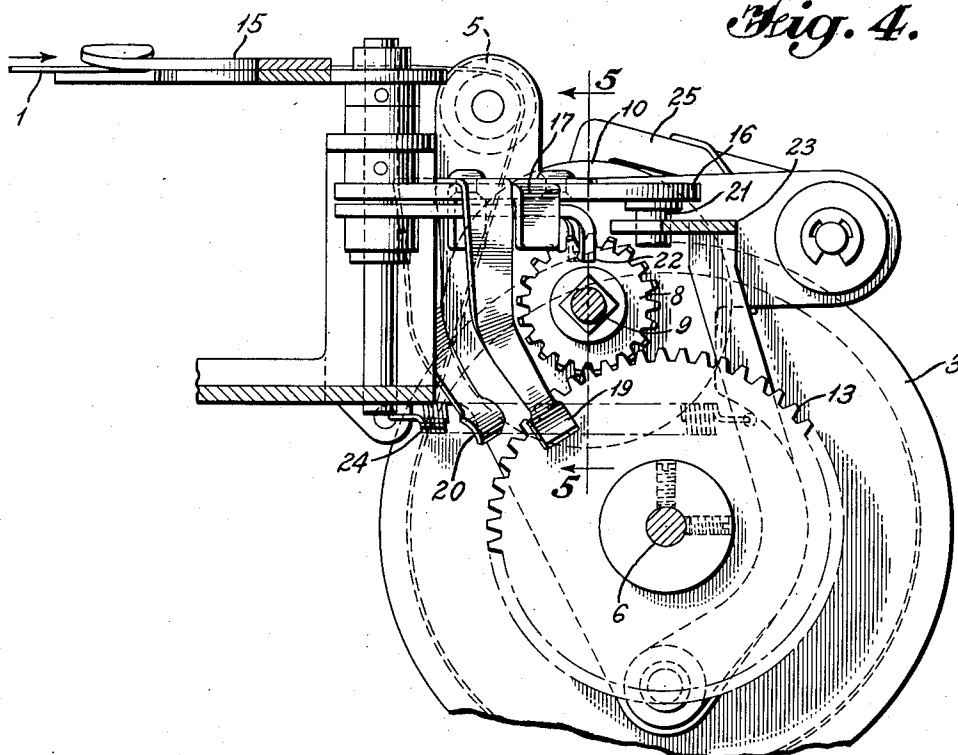
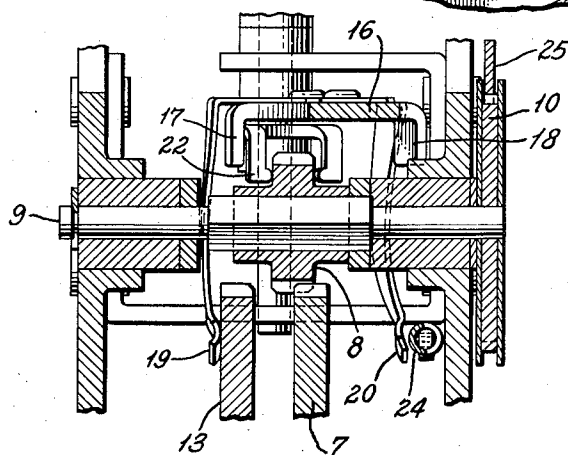


Fig. 5.



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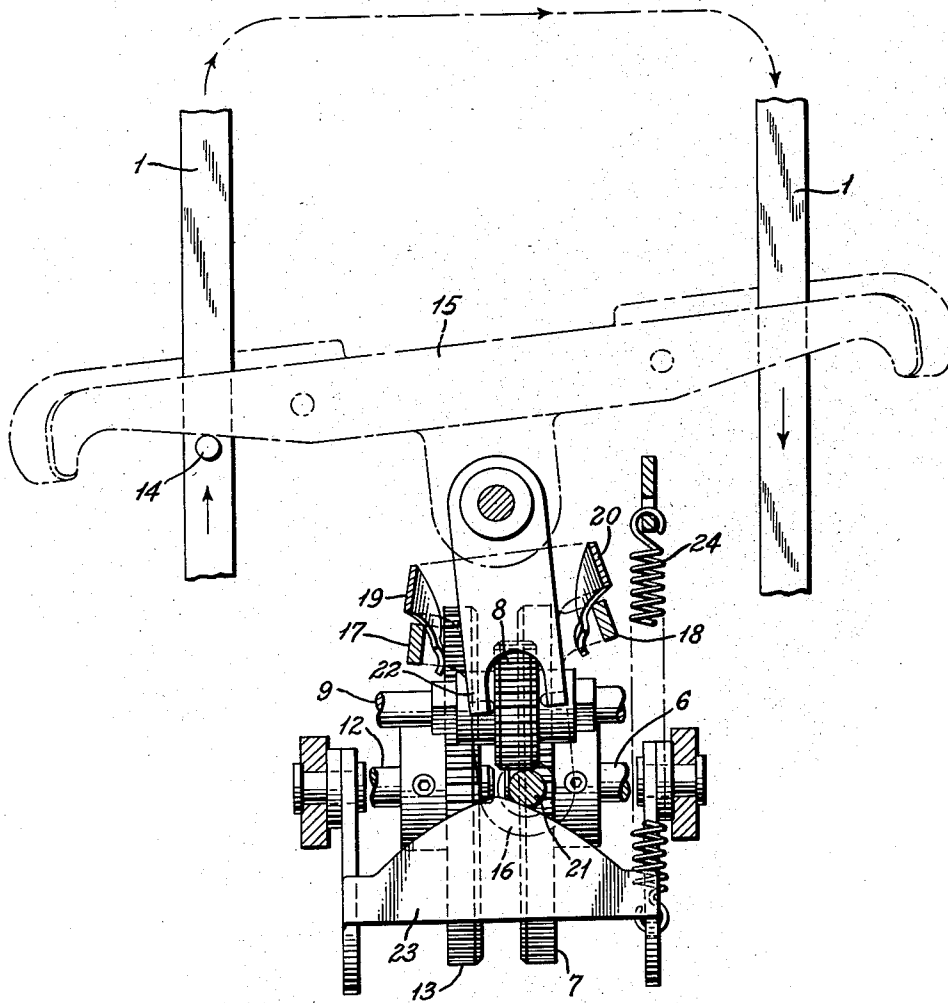


Fig. 6.

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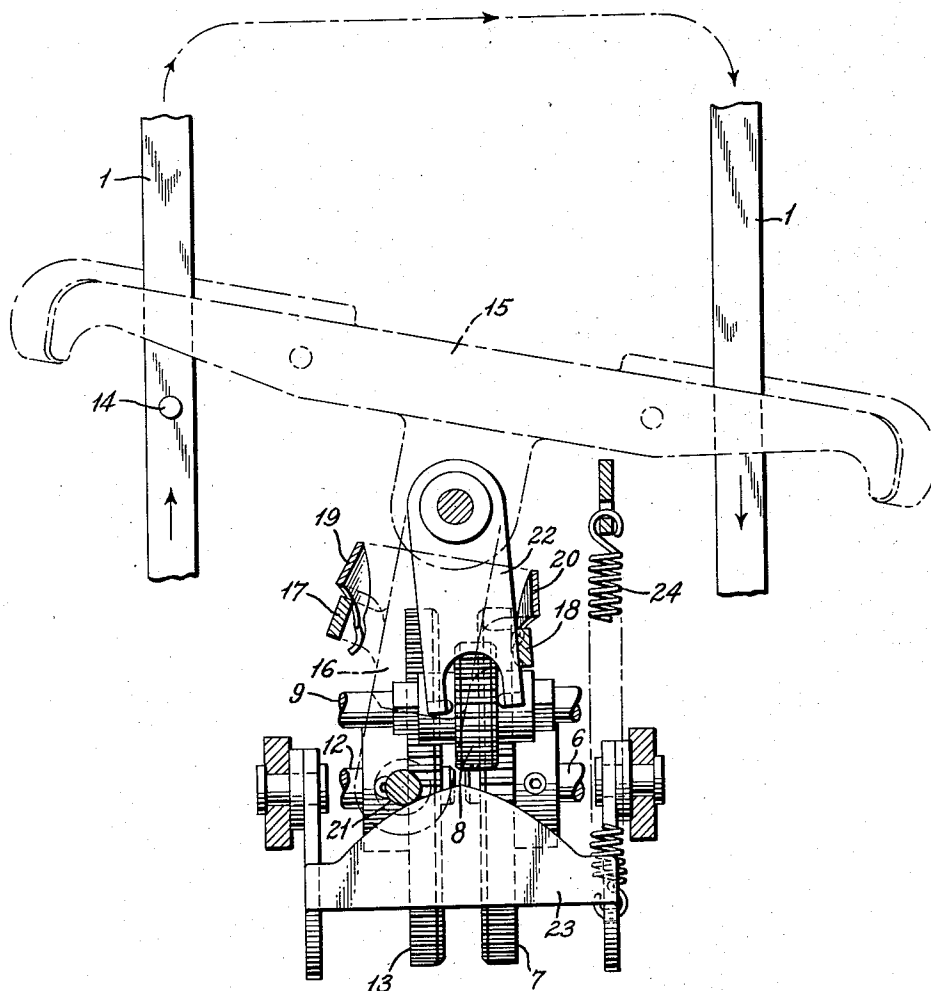


Fig. 7.

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RIBBON FEED MECHANISM

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10 Claims. (Cl. 197—165)

This invention relates to automatically reversing inked ribbon feeding devices and more particularly to improvements in the reversing mechanisms thereof.

The main object of the invention is to provide a dependable automatically reversing inked ribbon feeding mechanism.

Ribbon mechanisms in which the force to effect reversal is transmitted through the ribbon are often afflicted with failures due to ribbon entanglement or breakage. An explanation for the causes of such failures is found in the analysis of the forces in the reversing mechanism and the ribbon, particularly the forces acting during the reversal.

The cocking of a toggle or the like for the actual shifting of the driving means, and additional friction, increase the load on the ribbon during reversal. The ribbon must pass through and around guides in its path between the driven, or winding spool and the idling, or unwinding spool. The ratio of the force applied to the ribbon at the driven spool to the force transmitted through the ribbon near the unwinding spool is increased by linear and power functions of the frictional characteristics of such guides; in modern printing machines the path of the ribbon is often long or irregular increasing further this effect. Therefore, any reduction in the force requirement on the ribbon near the unwinding spool more than proportionally reduces the tension in the ribbon near the driven spool. When operating at higher speeds, the greater acceleration requirements of the feeding and reversing functions impose still higher tensile forces on the ribbon. Under these conditions, the ribbon tends to stretch and relax each time it is advanced, giving rise to an impulsive whipping action. As a result of this whipping, the ribbon occasionally becomes entangled with the mechanism and may cause the mechanism to jam or cause itself to be damaged.

It was previously known that the relaxation effects of the ribbon that result in whipping could be reduced by applying drag to the spools. However, this drag also increases the tension in the ribbon during reversal, and intensifies the undesirable characteristics mentioned above. One feature of the invention is the application of a retarding force which is substantial during the feeding of the ribbon, and gradually reduced to zero during reversal; this is allowable since the idling end of the ribbon is stabilized by contact with the reversing mechanism during reversal. Furthermore, since drag applied to the driven spool is unnecessary, the preferred embodiment of the invention is further refined to apply drag on either spool only while idling. The application of drag during the feeding only also maintains the tension in the ribbon during ordinary feeding more nearly equal to the tension in the ribbon during reversal.

In order to further reduce the undesirable effects mentioned, a uniform loading of the ribbon during reversal is advantageous. The spring on the before-mentioned toggle or the like requires more force as its displacement

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increases, and the displacement increases to a maximum midway through reversal. The drag mentioned above is gradually reduced and becomes zero just prior to maximum spring displacement. This invention teaches the use of a spring mechanism utilizing a cam profile defined to cause spring expansion at a rate so related to the degree of ribbon reversal as to maintain an approximately uniform total reaction force during the first half of the reversing cycle.

Accordingly, another object of this invention is to provide for consistently smooth operation of an automatic ribbon reversing mechanism.

Still another object of the invention is to reduce the whipping of ribbon in such a mechanism.

A further object of the invention is to provide for the lowest possible ribbon tension in such a mechanism.

A still further object of the invention is to maintain constant the ribbon tension in such a mechanism during ribbon feeding and reversing.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode which has been contemplated of applying that principle.

In the drawings:

Fig. 1 is a top plan view of the device shown in the condition of feeding ribbon from the left to the right.

Fig. 2 is an elevation view of the device showing the right side as seen in Fig. 1.

Fig. 3 is an elevation view of the device showing the left side as seen in Fig. 1.

Fig. 4 is a vertical section taken along lines 4—4 in Fig. 1.

Fig. 5 is a vertical transverse section taken along line 5—5 in Fig. 4.

Fig. 6 is a semi-schematic top view of the reversing apparatus at the point of reversal where the retarding force on the emptying spool has been reduced to zero.

Fig. 7 is a semi-schematic top view of the reversing apparatus just prior to shifting the driving means.

Referring first to Figs. 1 through 5, in the preferred example of the invention shown, a ribbon 1, unwinding from a spool 2, is fed past a guide 4, through the left end of a slotted arm 15, through the utilization mechanism, through the right end of the arm 15, around another guide 5, and wound onto another spool 3. The spool 3 is mounted on a shaft 6 to which is fixed a spur gear 7. The spur gear is driven by a pinion gear 8, which is driven by a square shaft 9 on which the pinion gear may slide longitudinally. The square shaft 9 is rotated by a ratchet 10 which is driven by pawl 11 and locked by dog 25. The unwinding spool 2 is mounted on a shaft 12 to which is fixed a second spur gear 13. With the pinion 8 in the position shown in Figs. 1 and 5, the spur 13 is disconnected, and the spool 2 is able to rotate as necessary to unwind the ribbon as it is being taken up by the other spool 3.

An eyelet 14 is embedded near the end of the ribbon so as to engage the arm 15 through which the ribbon passes. The arm has an extension 16 to which are attached the lost motion ears 17 and 18, the drag springs 19 and 20, and the reversing lug 21. In the position shown in Figs. 1, 4 and 5, the drag spring 19 is pressed tightly against the spur 13 retarding the spool 2; the lost motion ear 17 is holding the pinion yoke 22 so as to maintain engagement of the pinion 8 with the spur gear 7; the drag spring 20 is out of contact with the spur gear 7; and the lost motion ear 18 is out of contact with the pinion yoke 22. The reversing lug 21 is held to the right by the cam 23 under the restraint of the reversing spring 24. This is the position of the reversing mechanism while ribbon is being stepped from spool 2 to spool 3,

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When the ribbon on the unwinding spool 2 is nearly exhausted, the eyelet 14 engages the arm 15 causing it to rotate clockwise; each time the ribbon is stepped, the arm rotates a few more degrees. The direction of ribbon feed is about twenty degrees from normal to the arm, but as the arm rotates this angle decreases, improving the force advantage. The drag spring 19 is distorted when in the operating position, and as the arm rotates the distortion decreases, lowering the drag on the spur gear 13. Another function of arm rotation is the displacing of the cam 23 by the reversing lug 21.

As shown in Fig. 6, at the point of reversal where the drag spring 19 is completely relaxed and no longer applies drag to the spur 13, the lug is near the center of the cam, and the reversing spring 24 is stretched almost to its maximum elongation. It will be noted that the lost motion ears 17 and 18 have been inoperative through this portion of reversal, and therefore the pinion 8 is still in full engagement with spur 7. The force imposed by the ribbon on the arm has remained nearly constant since the increasing tension in the reversing spring 24 has been complemented by a better force advantage at the point of contact of the eyelet on the arm and a decrease in the drag applied by the drag spring on the unwinding spool. Up to this point in the reversal, the arm has been rotated in steps as the ribbon has been advanced for each character space. The ribbon has been stretched as a result of the tension transmitted by it to overcome the drag on spur 13, and to effect the first part of the reversing cycle.

When the arm has rotated so as to place the lug over the high point of the cam, the tension stored in the reversing spring pulls the cam back toward its rest position; the cam, in turn, forces the lug to the left. In fact, the restoring spring stores energy supplied by the ribbon during the first half of the reversing cycle, and returns that energy, as it becomes the driving force, during the second half of the reversing cycle. After the spring takes over, the rotation of the arm is smooth and continuous, since it is no longer controlled by the stepping of the ribbon; the arm 15 rotates away from the eyelet 14, and the ribbon relaxes, restoring to its unstretched shape. As the ribbon relaxes, the eyelet follows the arm, and, since the portion of ribbon between the eyelet and the unwinding spool is not stretched, that portion of the ribbon follows the eyelet as a unit, and causes the unwinding spool to rotate proportionally. This coasting of the unwinding spool due to ribbon relaxation is material in permitting a smooth and positive engagement of the pinion 8 with the spur 13, later in the cycle.

When the arm has further rotated to the point where the drag spring 20 has just barely engaged the spur 7, the lost motion ear 18 has not yet engaged the pinion yoke 22, so the pinion 8 is still engaged to the spur 7. This means that the ribbon is being positively driven until the lug is well over the high point on the cam, nullifying any chance for the lug to hang up on the dead center of the cam in the event that the stepping of the ribbon results in that being one of the step positions.

The arm continues to rotate smoothly, and at the point shown in Fig. 7, the lost motion ear 18 engages the pinion yoke 22 and begins to slide the pinion along the shaft 9 to the left. It should be noted that the force required to slide the pinion with respect to the spur is a frictional function of the normal force between the contacting teeth of these two gears. At this time, the reversing spring is doing all the work of reversing, the ribbon has relaxed, and there is no drag on the spur 13. The force being applied to the ribbon by the spur 7 through the spool 3 is at a minimum, and the drag spring 20 is applying only an insignificant amount of drag on the spur 7; hence, the frictional force between the pinion and the spur 7 is at a minimum, and the pinion may slide smoothly from engagement with the spur.

At the point where the pinion is disengaged from the spur 7, the drag spring 20 is applying a nominal drag

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to spur 7 and overcomes any slight tendency of the spur to whip forward due to relaxation of the small amount of tension in the ribbon at the time of disengagement.

The arm then causes the pinon to become engaged with the spur 13. At this point, the ribbon has restored from having tension toward the right to a condition of complete relaxation, and is ready to undergo tension toward the left. Also, the spool 2 and the spur 13 are coasting slightly, which facilitates a smooth meshing of that spur and the pinion.

After spur 13 is engaged, the ribbon begins to be stepped in a counterclockwise direction, and the arm continues to rotate, under the influence of the reversing spring 24, to the rest position.

The mechanism is symmetrical and consequently reversal in the opposite direction is identical to that which was described.

Several variations from the embodiment described may be made without altering the novel operating principles taught herein. For example, the well-known direct pull method of operating the reversing device by the ribbon when the spool is empty may be used. Similarly, the drag springs may be substituted for by a single alternating member, or by a single member capable of applying drag to both spool assemblies simultaneously.

While there have been shown and described and pointed out the fundamental novel features of the invention is applied to the preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In an inked ribbon feeding device of the type comprising a pair of rotary spool devices which are alternately driven to wind the ribbon from one onto the other, and vice versa, the combination with said spool devices, of a driving means, driving connections for alternatively connecting said driving means to either of said spool devices, respectively, means operated by said ribbon for shifting said driving connections from one of said conditions to the other, drag means for said spool devices adapted to apply a variable drag on the one of said spool devices from which the ribbon is being unwound, and means to vary the drag applied to said spool devices.

2. In an inked ribbon feeding device of the type comprising a pair of rotary spool devices which are alternately driven to wind the ribbon from one onto the other, and vice versa, the combination with said spool devices, of a driving means, driving connections for alternatively connecting said driving means to either of said spool devices, respectively, means for shifting said driving connections to disengage the same from one of said spool devices and to connect the same to the other of said spool devices, drag means for said spool devices, and means responsive to said shifting means to vary the drag selectively so as to retard the unwinding one of said spool devices.

3. In an inked ribbon feeding device of the type comprising a pair of rotary spool devices which are alternately driven to wind the ribbon from one onto the other, and vice versa, the combination with said spool devices, of a driving means, driving connections for alternatively connecting said driving means to either of said spool devices, respectively, means for shifting said driving connections so that one spool device is alternatively engaged while the other spool device is disengaged, and vice versa, means to sense the impending exhaustion of ribbon on said disengaged spool device, drag means adapted to retard the disengaged one of said spool devices, and means responsive to said sensing means to gradually reduce the drag on said disengaged spool device.

4. In an inked ribbon feeding device of the type com-

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prising a pair of rotary spool devices which are alternately driven to wind the ribbon from one onto the other, and vice versa, the combination with said spool devices, of a driving means, driving connections for alternatively connecting said driving means to either of said spool devices, respectively, means for shifting said driving connections so that one spool device is alternately engaged while the other spool device is disengaged, and vice versa, drag means adapted to apply a variable drag on the disengaged one of said spool devices, means responsive to said shifting means for reducing the drag on said disengaged spool device.

5. In an inked ribbon feeding device of the type comprising a pair of rotary spool devices which are alternately driven to wind the ribbon from one onto the other, and vice versa, the combination with said spool devices, of a driving means, driving connections for alternatively connecting said driving means to either of said spool devices, respectively, means for shifting said driving connections from one of said conditions to the other, drag means for said spool devices switchable to retard one or the other of them alternatively and means operable by said shifting means for switching said drag means so as to retard the unwinding one of said spool devices.

6. In an inked ribbon feeding device of the type comprising a pair of rotary spool devices which are alternately driven to wind the ribbon from one onto the other, and vice versa, the combination with said spool devices, of a driving means, driving connections for alternatively connecting said driving means to either of said spool devices, respectively, means for shifting said driving connections to disengage the same from one of said spool devices and to connect the same to the other of said spool devices, drag means for said spool devices switchable to retard one or the other of them alternatively, and means operable by said shifting means to switch said drag means to the spool device from which said driving connections are being disengaged.

7. In an inked ribbon feeding device of the type comprising a pair of rotary spool devices which are alternately driven to wind a ribbon from one onto the other, and vice versa, the combination with said ribbon and said spool devices, of a driving means, driving connections for alternatively connecting said driving means to either of said spool devices, respectively, means operable by said ribbon for shifting said driving connections from one of said conditions to the other, energy storing means including a spring, and means responsive to said ribbon to displace said energy storing means in a manner related to the operation of said ribbon on said shifting means so as to maintain essentially constant the tension in said ribbon.

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8. In an inked ribbon feeding device of the type comprising a pair of rotary spool devices which are alternately driven to wind a ribbon from one onto the other, and vice versa, the combination with said ribbon and said spool devices, of a driving means, driving connections for alternatively connecting said driving means to either of said spool devices, respectively, means operable by said ribbon for shifting said driving connections from one of said conditions to the other, drag means adapted to apply a variable drag on said spool devices, means to vary said drag on said spool devices, energy storing means including a spring, and means responsive to said ribbon to displace said energy storing means in relation to the operation of said ribbon on said shifting means and to said drag varying means so as to maintain constant the tension in the ribbon.

9. In an inked ribbon feeding device of the type comprising a pair of rotary spool devices which are alternately driven to wind a ribbon from one onto the other, and vice versa, the combination with said ribbon and said spool devices, of a driving means, driving connections for alternatively connecting said driving means to either of said spool devices, respectively, drag means adapted to apply a variable drag on said spool devices, means responsive to said ribbon to vary said drag on said spool devices, and means operable by said ribbon for shifting said driving connections from one of said conditions to the other including an energy storing means having a spring and means to displace said energy storing means in a manner to relate said shifting means and said drag varying means so as to maintain constant the tension in the ribbon.

10. In an inked ribbon feeding device of the type comprising a pair of rotary spool devices which are alternately driven to wind a ribbon from one onto the other, and vice versa, the combination with said ribbon and said spool devices, of a driving means, driving connections for alternatively connecting said driving means to either of said spool devices, respectively, and controlling means operable by said ribbon including means for shifting said driving connections from one of said conditions to the other, drag means operable to apply a variable drag to said spool devices, energy storing means including a spring, and means to displace said energy storing means in a manner relating said drag means and said shifting means so as to maintain constant the tension in said ribbon.

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