

Sept. 15, 1970

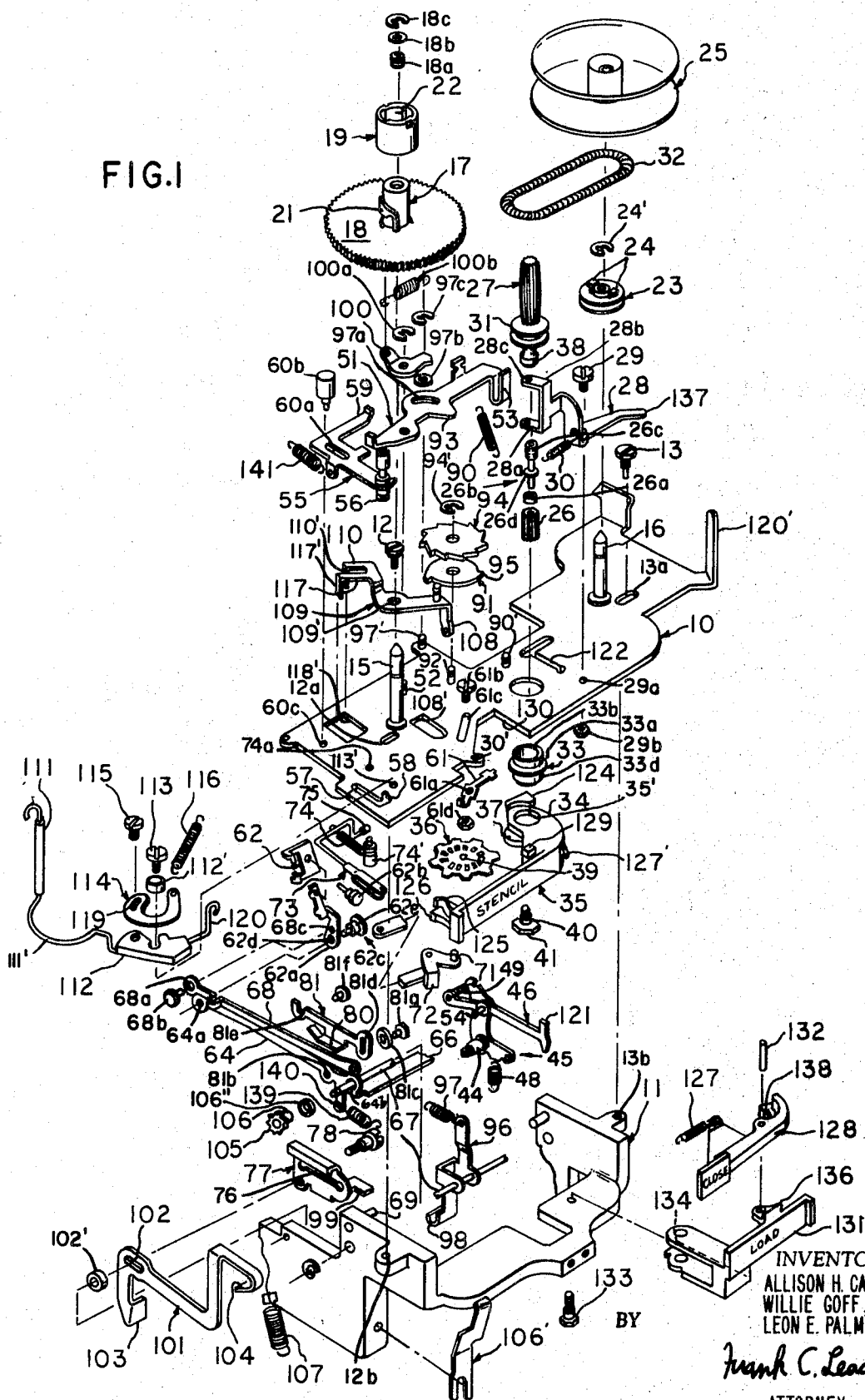
A. H. CAUDILL ET AL

3,528,536

RIBBON FEED MECHANISM FOR A SINGLE PASS RIBBON

Filed March 15, 1967

3 Sheets-Sheet 1



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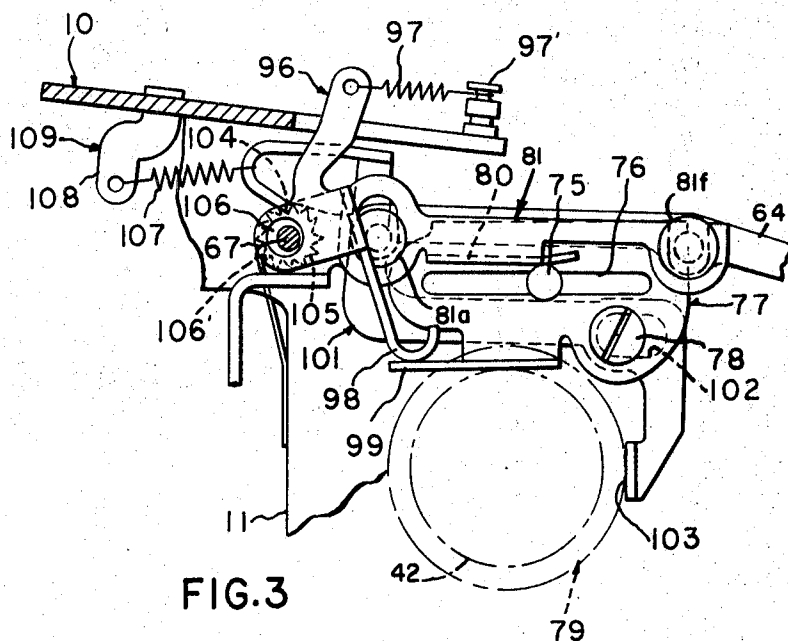
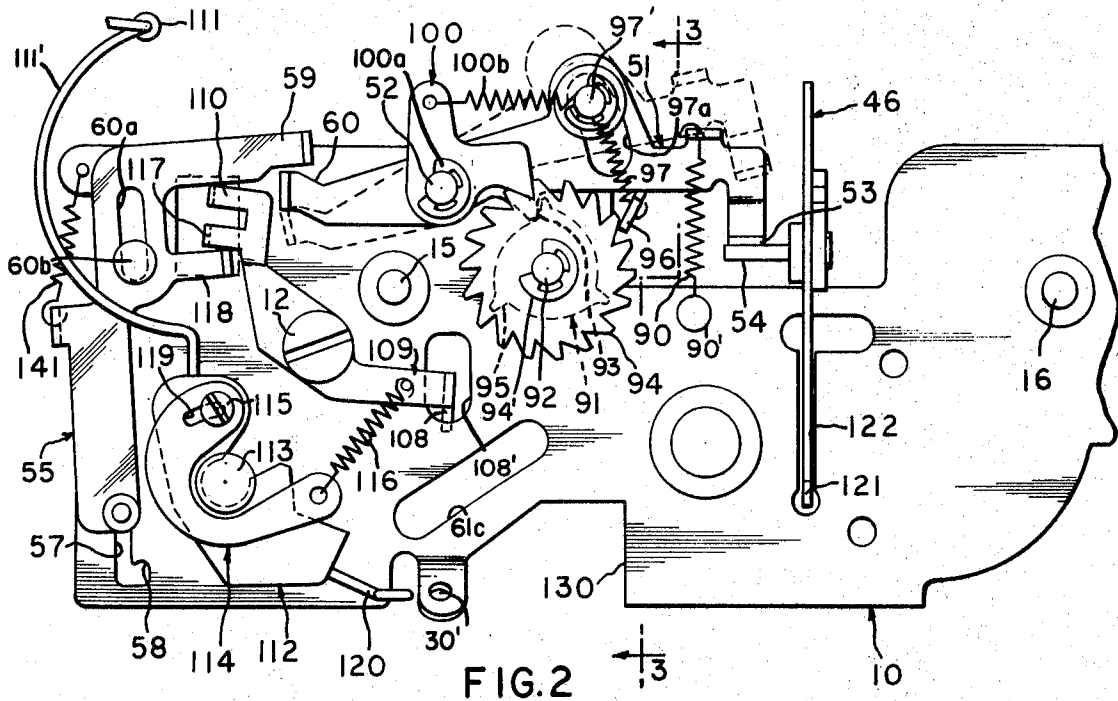
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RIBBON FEED MECHANISM FOR A SINGLE PASS RIBBON

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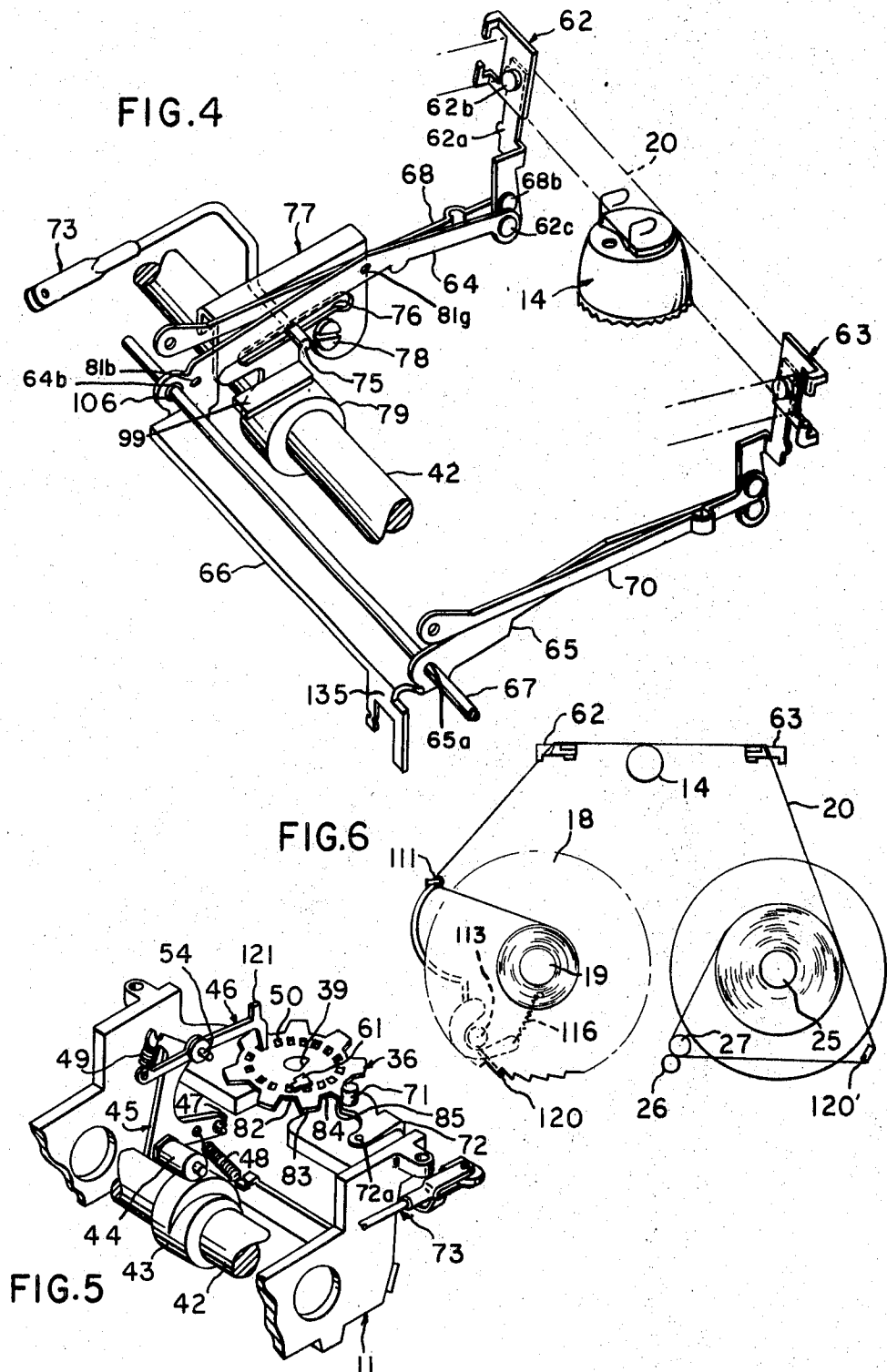
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RIBBON FEED MECHANISM FOR A SINGLE PASS RIBBON

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RIBBON FEED MECHANISM FOR A SINGLE PASS RIBBON

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10 Claims

ABSTRACT OF THE DISCLOSURE

A ribbon feed mechanism for feeding a single pass ribbon in two different manners and applying two different tensions on the ribbon depending on the feed mode. When a total release ribbon is employed whereby no overstriking is desired, means advance the ribbon both longitudinally and transversely relative to a printing position during each print cycle. When the ribbon is a solvent coated plastic transfer matrix whereby overstriking is desired, control means is moved to a position to prevent actuation of the advancing means. The control means is progressively moved from its preventing position to a non-preventing position by a cam during a selected number of print cycles. When the selected number of print cycles has occurred, the control means is moved to its nonpreventing position in which the advancing means may be actuated. During each of the print cycles in which the control means prevents actuation of the advancing means, means incrementally move the ribbon transversely non-constant amounts with the total sum of the nonconstant amounts during the selected number of print cycles being less than the transverse movement of the ribbon by the advancing means. The mechanism also includes means to vary the tension acting on the ribbon to maintain it taut at the printing position with a greater tension being maintained on the ribbon when a total release ribbon is used.

When a total release ribbon such as a carbon ribbon, for example, is employed with a typewriter for printing purposes, it is desirable that maximum utilization of the ribbon be obtained since the ribbon only makes a single pass through a printing position. However, there can be no overstriking of a previously printed area of a carbon ribbon for satisfactory printing. Accordingly, when a carbon ribbon is to be fed by a ribbon feed mechanism through a printing position, it is desired that each movement of the carbon ribbon relative to its previous position at the printing position be sufficient to insure that there is no overstriking.

When employing a single pass ribbon of the solvent coated plastic transfer matrix type such as that shown and described in the copending application of H. T. Findley et al., Ser. No. 536,557, filed Mar. 7, 1966, now Pat. No. 3,413,184 and owned by the same assignee as the assignee of the present application, print operations may take place on the ribbon in overlapping areas. A small amount of ink is forced from small pockets in which it is entrapped. Since no time is needed for recovery after each print operation, the ribbon can be utilized in the single pass through a printing position. To obtain maximum utilization of a plastic ribbon during its single pass through the printing position, the positioning of the ribbon at the printing position relative to its previous position at the printing position is such that overlapping of a portion of the previously printed area occurs.

In order to employ a single ribbon feed mechanism on a typewriter on which both carbon ribbons and plastic

ribbons may be employed efficiently, it is necessary to feed the ribbon through the printing position in different manners or modes depending upon the type of single pass ribbon being used. With the ribbon feed mechanism of the present invention, the efficient use of either type of single pass ribbon is readily obtained.

One means of obtaining maximum utilization of a total release ribbon such as a carbon ribbon, for example, has been to move the ribbon both transversely and longitudinally relative to the printing position during each of the ribbon feed cycles. In this arrangement, movable ribbon lift guides are employed so that the width of the ribbon is utilized to obtain greater use of the printing area of the ribbon. Accordingly, it is not necessary for the ribbon to be advanced longitudinally a distance greater than the width of the type character having the greatest width of the type characters. Instead, the ribbon need be advanced only a portion of the width of the type character with the greatest width. By also simultaneously moving the ribbon transversely of the printing position as the ribbon is advanced longitudinally, this arrangement insures that there is no overstriking of a previously printed area of the carbon ribbon.

In U.S. Pat. 3,171,530 to O'Daniel et al., two different modes of feeding a ribbon past its printing position are employed depending upon the material of the ribbon. When a fabric ribbon is used, the ribbon is linearly or longitudinally advanced during each actuation of a character key. When a plastic ribbon is employed, linear or longitudinal advancement of the ribbon occurs only after a predetermined number of actuations of typewriter character keys have occurred. During each of the predetermined number of actuations of the keys, the plastic ribbon is moved transversely with respect to the printing position through movable lift guides.

Since the ribbon feed mechanism of the present invention is utilized only for single pass ribbons, it is an improvement over the foregoing mechanism since it permits utilization of two types of single pass ribbons with a single ribbon feed mechanism. Accordingly, the present invention permits more efficient use of various types of single pass ribbon with a single ribbon feed mechanism employing movable lift guides than has previously been available.

In order that the single pass ribbon will remain taut at the printing position to produce satisfactory printing, it is necessary to exert a tension on the ribbon. A plastic ribbon is relatively weak in comparison with a carbon ribbon. Thus, if a tension force is selected so as to not break the plastic ribbon and still maintain the plastic ribbon taut at the printing position, this force may not be sufficient to maintain the carbon ribbon taut at the printing position. However, if sufficient tension force is selected to insure that the carbon ribbon remains taut at the printing position, this force may be large enough to break the plastic ribbon.

The present invention satisfactorily overcomes this problem by providing a ribbon feed mechanism in which the force of the tension on the ribbon is varied depending on the type of the ribbon. Thus, in the present invention, the force of the tension acting on the ribbon is reduced when a plastic ribbon is being employed in comparison with the tension force acting on the ribbon when a carbon ribbon is used while still maintaining the ribbon taut at the printing position.

An object of this invention is to provide a ribbon feed mechanism, adjustable by the operator, for feeding two different types of single pass ribbons in two different modes depending on the type of ribbon.

Another object of this invention is to provide a ribbon feed mechanism in which the force of the tension on the

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ribbon is varied in accordance with the material of the ribbon.

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

In the drawing:

FIG. 1 is an exploded perspective view of the ribbon mechanism of the present invention attached to a typewriter.

FIG. 2 is a top plan view of a portion of the ribbon feed mechanism of the present invention with some parts omitted for clarity purposes.

FIG. 3 is a side elevational view, partly in section, of a portion of the mechanism of FIG. 2 and taken substantially along line 3—3 of FIG. 2 with some parts omitted for clarity purposes.

FIG. 4 is a perspective view of the ribbon lift guides and related lift structure of the ribbon feed mechanism of the present invention with some parts omitted for clarity purposes.

FIG. 5 is a perspective view of an actuating structure used in conjunction with the mechanism of the present invention.

FIG. 6 is a schematic top plan view showing the path of the ribbon in the mechanism of the present invention.

Referring to the drawing and particularly FIG. 1, there is shown a base or ribbon feed plate 10, which is fixedly secured to a support member or carrier 11 by screws 12 and 13. The screws 12 and 13 extend through openings 12a and 13a, respectively, in the base plate 10 for disposition within tapped holes 12b and 13b, respectively, in the support member 11. The support member 11 is movable along a member (not shown) across the typewriter when the present invention is employed with a single element printing head 14 (see FIG. 4) of the type described in U.S. Pat. 2,919,002 to Palmer. The single element printing head 14 is carried by the support member 11 for movement therewith. If the present invention is used on a typewriter having a movable platen, then the base plate 10 will be attached to the typewriter.

The base plate 10 has studs or spindles 15 and 16 extending upwardly from its upper surface. A supply spool 17, which has a ratchet wheel 18 integral therewith and adjacent one end thereof, is rotatably mounted on the stud or spindle 15. The supply spool 17 is retained on the stud 15 by a spring 18a, a washer 18b, and a retaining clip 18c.

A supply spool core 19, which has one end of a ribbon 20 (see FIG. 4) fixedly attached thereto, is mounted on the supply spool 17 for rotation therewith. The supply spool 17 has diametrically disposed portions 21 on its outer surface to engage with diametrically disposed portions 22 on the inner surface of the supply spool core 19 to insure that the supply spool core 19 and the supply spool 17 rotate together. It should be understood that initial counterclockwise rotation of the supply spool core 19 locks the core 19 to the spool 17 to prevent disengagement due to vibration and the like.

A pulley 23, which has a pair of diametrically disposed lugs 24 extending from its upper surface, is rotatably mounted on the stud 16. The pulley 23 is retained on the stud 16 by a retaining clip 24'. The lugs 24 are adapted to engage a takeup spool 25, which is rotatably mounted on the stud or spindle 16. The takeup spool 25 has the other end of the ribbon 20 fixedly attached thereto. It should be understood that initial clockwise rotation of the pulley 23 locks it to the takeup spool 25.

The ribbon 20 passes between a pressure roller 26 and a feed roller 27. The pressure roller 26 is rotatably mounted on a lever 28, which is pivotally mounted on the base plate 10 by a screw 29. The screw 29 extends through an opening 29a in the base plate 10 and has a nut 29b co-

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operating therewith to connect the screw 29 to the base plate 10. A spring 30, which has one end attached to the base plate 10 by disposition within an opening 30' in the base plate 10 and its other end attached to the lever 28, continuously urges the pressure roller 26 towards engagement with the feed roller 27 with the ribbon 20 therebetween.

The roller 26 is disposed between a lower arm 28a and an upper arm 28b of the lever 28. A spacer 26a is disposed between the upper surface of the roller 26 and the upper arm 28b.

An adjusting screw 26b is threadedly disposed within a tapped hole 28c in the upper arm 28b by having its threaded portion 26c threadedly connected with the tapped hole 28c. The adjusting screw 26b has a ring 26d mounted thereon with the outer surface of the ring 26d engaging the inner wall of the roller 26. As a result, movement of the adjusting screw 26b changes the position of the ring 26d within the roller 26 to change the fulcrum position of the roller 26 in accordance with the tracking of the ribbon 20.

Accordingly, rotation of the feed roller 27 pulls the ribbon 20 longitudinally from the supply spool core 19 past the printing position, which is where the printing head 14 engages the paper. The path of the ribbon 20 is from the feed roller 27 to the takeup spool 25.

The feed roller 27 has a pulley 31 integral therewith. A spring belt 32 connects the pulley 31 with the takeup pulley 23. Thus, whenever the feed roller 27 is rotated, the takeup spool 25 also is rotated to wind the ribbon 20 on the takeup spool 25. Accordingly, the ribbon 20 is advanced from the supply spool core 19 to the takeup spool 25 whenever the feed roller 27 rotates.

The pulley 31 is maintained vertically and in spaced relation to the feed plate 10 by a cylindrical bushing 33. The bushing 33 also rotatably supports an upper arm 34 of a stencil lever 35.

The bushing 33 has a flange 33a thereon and welded to the lower surface of the base plate 10 with upper portion 33b of the bushing 33 extending through an opening 33c in the base plate 10. The bushing 33 has its lower portion 33d extending through an opening 35' in the stencil lever 35.

A ratchet wheel 36 is disposed between the upper arm 34 and a lower arm 37 of the stencil lever 35. The feed roller 27 has its lower end 38 D-shaped and extending beneath the bottom of the cylindrical bushing 33 to fit within a D-shaped opening 39 in the ratchet wheel 36. Thus, a driving connection is provided between the ratchet wheel 36 and the feed roller 27 whereby rotation of the ratchet wheel 36 causes rotation of the feed roller 27 so as to advance the ribbon 20 longitudinally past the printing position.

The lower arm 37 of the stencil lever 35 is rotatably supported on a shoulder 40 of a threaded screw 41, which is disposed within a threaded passage in the lower end 38 of the feed roller 27. Thus, the stencil lever 35 does not rotate with the ratchet wheel 36 but is rotatable relatively thereto.

Whenever a character key of the typewriter is actuated, a motor (not shown) acting through a clutch (not shown) causes a revolution of a print shaft 42 (see FIG. 5), which has a feed cam 43 fixed thereto for rotation therewith. The feed cam 43 cooperates with a cam follower 44 on a link 45, which has a pin 54 to pivotally mount a feed pawl 46 thereon.

The link 45 has an opening in one end thereof to receive a stud 47 on the support member 11 to pivotally mount the link 45 thereon. A spring 48 is attached to the link 45 and to a portion of the support member 11 to cause the cam follower 44 to follow the feed cam 43.

A spring 49, which is connected to one end of the feed pawl 46 and to the link 45, causes the feed pawl 46 to cooperate with openings 50 in the ratchet wheel 36 provided that the feed pawl 46 may be move rearwardly

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during rotation of the feed cam 43. This is determined by the position of a feed control lever 51 (see FIGS. 1 and 2), which is pivotally mounted on a stud 52 on the base plate 10. When the feed control lever 51 is in the solid line position of FIG. 2, a U-shaped portion 53 on the lever 51 will engage the pivot pin 54 of the link 45 and the feed pawl 46. When this occurs, the feed pawl 46 cannot be moved rearwardly sufficiently during rotation of the print shaft 42; thus, the ratchet wheel 36 cannot be rotated.

However, when a mode change lever 55 is moved from the position of FIG. 2 in which a pin 56 (see FIG. 1) is disposed in a longitudinal slot 57 in the base plate 10 to the position in which the pin 56 is locked within a notch 58 in the base plate 10, an arm 59 of the mode change lever 55 will engage an arm 60 of the feed control lever 51 to cause counterclockwise rotation of the feed control lever 51 about the pivot stud 52. This moves the U-shaped portion 53 to a position beyond the dotted line position of FIG. 2 in which the U-shaped portion 53 of the feed control lever 51 will not engage the pivot pin 54 of the link 45 and the feed pawl 46. Thus, the ratchet wheel 36 can be advanced clockwise by the feed pawl 46 during each rotation of the print shaft 42.

The lever 55 has a slot 60a therein to receive a guide member 60b, which has its lower end extending through an opening 60c in the base plate 10. The lower end of the guide member 60b is upset on the lower surface of the base plate 10 to retain the guide member 60b on the base plate 10.

A detent pawl 61 is adjustably attached to the base plate 10. The detent pawl 61 is adapted to cooperate with the openings 50 in the ratchet wheel 36 to prevent reverse rotation of the ratchet wheel 36 when the feed pawl 46 is removed from engagement with one of the openings 50 in the ratchet wheel 36 during rotation of the print shaft 42.

The detent pawl 61 has an opening 61a therein to receive a screw 61b, which passes through a longitudinal slot 61c in the base plate 10. A nut 61d cooperates with the screw 61b to fix the position of the pawl 61. By releasing the nut 61d, the screw 61b can be moved through the slot 61c to adjust the position of the detent pawl 61.

The position of the feed control lever 51 determines whether the ratchet wheel 36 is actuated during each print cycle, which occurs due to actuation of a character key of the typewriter. If it is, then the ribbon 20 is advanced longitudinally from the supply spool core 19 to the take-up spool 25 past the printing position.

As shown in FIG. 4, the ribbon 20 extends through a pair of ribbon lift guides 62 and 63, which are disposed on opposite sides of the printing head 14. The ribbon lift guides 62 and 63 are adapted to be movable vertically to different positions so that the ribbon 20 may be moved transversely of the printing position whereby different portions of the width of the ribbon 20 are presented for engagement by the selected type character to print the selected type character.

The ribbon lift guides 62 and 63 are supported by being pivotally connected at their lower ends to the rear ends of lower lift arms 64 and 65, respectively. The lower lift arms 64 and 65 are fixedly connected to each other through a flange 66, which is formed integral with the lift arms 64 and 65 at their front or forward ends.

The ribbon lift guide 62 has a lift guide support 62a secured thereto by a screw 62b. The lower end of the lift guide support 62a has a shoulder screw 62c extending through an opening 62d in the support 62a for threaded connection with a threaded hole 64a in the lower lift arm 64. The shoulder screw 62c has a shoulder 62e on which the support screw 62a is pivotally mounted. A similar arrangement exists for pivotally connecting the ribbon lift guide 63 to the lower lift arm 65.

The arm 64 has an opening 64b therein at the forward end and the arm 65 has an opening 65a therein at the forward end to permit mounting of the structure on the

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support member 11. A rod 67 extends through the openings 64b and 65a and is supported in the support member 11.

An arm 68 is disposed above the lift arm 64 and has its rear end pivotally connected to the ribbon lift guide 62 above the connection of the lower lift arm 64 and its front or forward end pivotally connected to the support member 11 by a pin 69. The arm 68 has an opening 68a through which a rivet 68b passes. The rivet 68b also passes through an opening 68c in the lift guide support 62a to pivotally connect the arm 68 to the ribbon lift guide 62. An arm 70 is similarly connected to the ribbon lift guide 63 and the support member 11. If the present invention is used on a typewriter having a movable platen, then the rod 67 and the arms 68 and 70 will be supported by the typewriter.

Each rotation of the ratchet wheel 36 to longitudinally advance the ribbon 20 past the printing position results in the position of the ribbon lift guides 62 and 63 being moved to change the portion of the width of the ribbon 20 disposed for engagement by the printing head 14 during the next print cycle. Thus, each linear or longitudinal advancement of the ribbon 20 during a print cycle also results in the ribbon 20 moving transversely. It should be understood that the timing during a print cycle is such that the ratchet wheel 36 is not rotated until after the ribbon 20 has been engaged by the printing head 14 to print the selected character.

The ratchet wheel 36 has its periphery formed in the shape of a cam for cooperation with a cam follower 71. The cam follower 71 is attached to an arm 72, which is pivotally mounted on the support member 11 by a stud or pin 72a and moves a ribbon lift guide link 73 connected thereto. The ribbon lift guide link 73 has a spring 74 attached thereto and to a stud 74' fixedly attached to the base plate 10 for urging the cam follower 71 into engagement with the periphery of the ratchet wheel 36. The stud 74' has its reduced portion extending through an opening 74a in the base plate 10 with the reduced portion being upset to fix the stud 74' to the base plate 10.

The position of the ribbon lift guide link 73 determines the vertical position to which the ribbon lift guides 62 and 63 are moved during each print cycle. The link 73 has a control element 75 disposed within a slot 76 in a cam follower 77. The cam follower 77 is pivotally connected to the support member 11 by a shoulder screw 78 and cooperates with a ribbon lift cam 79 (see FIGS. 3 and 4), which is attached to the print shaft 42 for rotation therewith in the same manner as the feed cam 43.

The control element 75 of the link 73 engages a shoe 80 of a lift guide plate 81, which is attached to the lower lift arm 64, to cause pivoting of the lower lift arms 64 and 65 as the cam follower 77 pivots about the screw 78 during its following of the ribbon lift cam 79. Thus, different positions of the control element 75 of the link 73 within the slot 76 in the cam follower 77 determine the vertical position to which the ribbon lift guides 62 and 63 will be moved during the next print cycle. Accordingly, the control element 75 is a lift selector that cooperates with the lift means for the guides 62 and 63 to select the vertical position to which the guides 62 and 63 are moved whenever the position of the control element 75 is changed.

The lift guide plate 81 is attached to the lower lift arm 64 by a screw 81a extending into a tapped hole 81b in the lower lift arm 64. The screw 81a extends through a washer 81c, which bears against the side of the lift guide plate 81, to retain the lift guide plate 81 on the lower lift arm 64. The screw 81a extends through an enlarged slot 81d in the lift guide plate 81.

The lift guide plate 81 has a U-shaped end 81e into which a screw 81f passes for disposition within a tapped hole 81g (see FIG. 4) in the lower lift arm 64. The screw 81f connects the other end of the lift guide plate 81 to the lower lift arm 64.

The cam surface on the periphery of the ratchet wheel 36 is formed with a lower low dwell 82, an upper high dwell 83, an upper low dwell 84, and a lower high dwell 85. With this arrangement, every other lobe extends the same radial distance from the center of the ratchet wheel 36 with one group comprising the upper high dwells 83 and the other set forming the lower high dwells 85. Every other valley is the same radial distance from the center of the ratchet wheel 36 whereby one group forms the lower low dwells 82 and the other set comprises the upper low dwells 84.

When the cam follower 71 is in engagement with the lower low dwell 82, the ribbon lift guides 62 and 63 are moved to their uppermost position during the print cycle so that the bottom portion of the ribbon 20 is engaged by the printing head 14. It should be understood that the lower low dwell 82 was so positioned during the prior print cycle after printing of the selected character. When the ratchet wheel 36 is rotated clockwise by the feed pawl 46 so that the cam follower 71 is engaging the upper high dwell 83 on the ratchet wheel 36, the ribbon lift guides 62 and 63 will be moved downwardly during the next print cycle to their lowermost print position whereby the upper portion of the ribbon 20 is disposed for engagement by the printing head 14 during the next print cycle.

When the ratchet wheel 36 is again rotated clockwise to position the cam follower 71 on the upper low dwell 84, the ribbon lift guides 62 and 63 will be moved during the next print cycle to a printing position below their uppermost printing position. In this position, the ribbon 20 is disposed so that a portion of the ribbon 20 above the lowermost portion of the ribbon 20 will be engaged by the printing head 14 during the next print cycle.

The next clockwise rotation of the ratchet wheel 36 by the feed pawl 46 results in the cam follower 71 engaging the lower high dwell 85. This positions the ribbon lift guides 62 and 63 above their lowermost printing position during the next print cycle but below the printing position produced by engagement of the cam follower 71 with the upper low dwell 84. In this position, the ribbon 20 is disposed so that a portion of the ribbon 20 beneath its uppermost portion will be engaged by the printing head 14 during the next print cycle.

During each of these operations, the control element 75 of the ribbon lift guide link 73 is positioned in various portions of the slot 76 in the cam follower 77. The position of the control element 75 in the slot 76 determines the amount of vertical movement of the ribbon lift guides 62 and 63.

For example, when the cam follower 71 is engaging the lower low dwell 82, the control element 75 is at the front of the slot 76 in the cam follower 77 so that it is furthestmost from the pivotal connection (the screw 78) of the cam follower 77 to the support member 11. When the cam follower 71 is engaging the upper high dwell 83, the control element 75 is disposed adjacent the rear of the slot 76 but slightly disposed therefrom. In this position, the control element 75 is positioned so that it is not disposed above the pivotal screw 78 but is adapted to engage a portion of the shoe 80 of the lift guide plate 81; there can be no lifting of the ribbon lift guides 62 and 63 when the control element 75 is disposed above the pivot screw 78 because the control element 75 cannot engage the shoe 80 when the cam follower 77 pivots about the screw 78.

Because of the contour of the ribbon lift cam 79, the ribbon lift guides 62 and 63 return to a rest position, which is below the printing position, after each print cycle. Thus, the rotation of the ratchet wheel 36 is such that the control element 75 is disposed in the desired position within the slot 76 before the cam follower 77 is moved by the ribbon lift cam 79 to position the ribbon lift guides 62 and 63 at the desired position with respect to the printing position during the print cycle.

Accordingly, if the feed pawl 46 may be moved rear-

wardly sufficiently to rotate the ratchet wheel 36 when the print shaft 42 is rotated, then the ribbon 20 is advanced not only longitudinally or linearly but also transversely relative to the printing position. Both of these movements are produced by rotation of the ratchet wheel 36.

As previously mentioned, the feed pawl 46 is capable of advancing the ratchet wheel 36 only when the feed control lever 51 is disposed so that the U-shaped portion 53 does not engage the pivot pin 54 of the feed pawl 46. The feed control lever 51 is so positioned that there is no engagement between the pin 54 of the feed pawl 46 and the U-shaped portion 53 of the feed control lever 51 when the ribbon 20 is a total release ribbon such as a carbon ribbon, for example. Thus, with the feed control lever 51 so disposed, maximum utilization of a carbon ribbon is obtained without any overstriking of a previously printed area.

The angular distance between the openings 50 in the ratchet wheel 36 determines the amount of longitudinal advancement of the ribbon 20 past the printing position. This is preferably selected so that the amount of advancement of the ribbon 20 past the printing position during each print cycle is about half of the width of the type character with the maximum width. Since the ribbon 20 also is moved transversely, this insures maximum utilization of the ribbon 20 without any overstriking of the previously printed area.

When the ribbon 20 is plastic, then overstriking of a portion of the printed area is desired to produce maximum utilization of the ribbon. Accordingly, when the ribbon 20 is plastic, the feed control lever 51 is positioned as shown in solid lines in FIG. 2. In this position, the U-shaped portion 53 of the feed control lever 51 engages the pivot pin 54 of the feed pawl 46 to prevent the feed pawl 46 from being actuated to advance the ratchet wheel 36 during each actuation of a character key of the typewriter.

With the ribbon 20 being plastic, it is desired that a selected or predetermined number of cycles of the print shaft 42 occur due to actuation of character keys to cause printing at the printing position before the ribbon 20 is advanced both longitudinally or linearly past its printing position and transversely to the next vertical position. Thus, it is necessary to position the feed control lever 51 after the predetermined or selected number of print cycles so that the pivot pin 54 of the feed pawl 46 clears the feed control lever 51 during a print cycle as shown in dotted lines in FIG. 2.

A spring 90, which has one end attached to the feed control lever 51 and its other end attached to the base plate 10 by connection to an upstanding stud 90' on the base plate 10, continuously urges the feed control lever 51 to the solid line position of FIG. 2. The feed control lever 51 is moved progressively against the force of the spring 90 from the solid line position of FIG. 2 toward the position in which the feed control lever 51 is locked or retained when the ribbon 20 is carbon. This progressive movement is accomplished by a cam 91, which is rotatably mounted on a stud 92 on the base plate 10, acting on a cam follower 93 (see FIG. 1) on the feed control lever 51.

The cam 91 is formed integral with a ratchet 94, which also is rotatably mounted on the stud 92. The ratchet 94 has a retaining clip 94' bearing against its upper surface to retain the integral cam 91 and ratchet 94 on the stud 92.

The ratchet 94 is advanced one tooth during each rotation of the print shaft 42 due to actuation of a character key on the typewriter. Accordingly, after a predetermined number of actuations of character keys of the typewriter has occurred with the feed control lever 51 originally in the solid line position of FIG. 2, the cam 91 advances to a position in which one of its lobes 95 engages the cam follower 93. When this occurs, the

feed control lever 51 is momentarily disposed in the dotted line position of FIG. 2 so that the pin 54 will clear the U-shaped portion 53 of the feed control lever 51. Accordingly, the ratchet wheel 36 is rotated clockwise so that the ribbon 20 is advanced both longitudinally by the feed roller 27 and moved transversely to one of its vertical positions by the ribbon lift guide structure.

The angular relation of the lobes 95 to the teeth of the ratchet 94 is such that one of the lobes 95 engages the cam follower 93 just after a print cycle starts. Thus, the feed pawl 46 moves rearwardly during this same print cycle whereby the ratchet wheel 36 is rotated. The lobe 95 ceases to engage the cam follower 93 by the time that the print cycle is completed so that the feed control lever 51 returns to the solid line position of FIG. 2 during the same print cycle. In the solid line position of FIG. 2, the cam 91 acts on the cam follower 93 to maintain the arm 60 of the feed control lever 51 slightly spaced from the arm 59 of the mode change lever 55.

It should be understood that the contour of the cam 91 between the lobes 95 is such that the feed control lever 51 moves progressively from the solid line position of FIG. 2 during each print cycle until the feed control lever 51 is disposed in the dotted line position of FIG. 2 to permit the pivot pin 54 of the feed pawl 46 to clear the U-shaped portion 53. The ratio of the number of the teeth on the ratchet 94 to the number of the lobes 95 on the cam 91 determines how many print cycles occur before the ribbon 20 is both advanced longitudinally and moved transversely to one of its vertical positions relative to the printing position. For example, if the ratchet 94 has twenty-one teeth and the cam 91 has three lobes 95, then the feed pawl 46 actuates the ratchet wheel 36 every seventh print cycle.

The ratchet 94 is rotated during each print cycle by a secondary feed pawl 96, which is pivotally mounted on the rod 67. A spring 97, which has one end attached to the pawl 96 and its other end attached to a stud 97' on the base plate 10, continuously urges the pawl 96 away from engagement with the driving portions of the teeth of the ratchet 94 and into engagement with the rest portions of the teeth of the ratchet 94. The stud 97' extends from the base plate 10 through a slot 97a in the lever 51.

A washer 97b engages the upper surface of the lever 51 adjacent the slot 97a by passing over the stud 97'. A retaining clip 97c holds the washer 97b in the position over the arcuate slot 97a. The stud 97', the washer 97b, and the retaining clip 97c cooperate to provide stability to the lever 51.

The pawl 96 has a U-shaped lower end 98, which rides on a finger 99 of the ribbon lift cam follower 77. As the cam follower 77 rides along the surface of the ribbon lift cam 79 and pivots about the screw 78, the pawl 96 is pivoted about the rod 67 against the force of the spring 97 to advance the ratchet 94 clockwise one tooth. A spring biased detent 100, which is pivotally mounted on the stud 52, engages the teeth of the ratchet 94 to prevent counterclockwise rotation when the pawl 96 ceases to engage the teeth of the ratchet 94.

The detent 100 is retained on the stud 52 by a retaining clip 100a. A spring 100b, which has one end attached to the arm of the detent 100 away from the ratchet 94 and its other end attached to the stud 97', spring biases the detent 100 into engagement with the teeth of the ratchet 94.

Since the ribbon lift cam 79 rotates during each revolution of the print shaft 42, the pawl 96 causes rotation of the ratchet 94 irrespective of the position of the feed control lever 51. Of course, if the feed control lever 51 is positioned for the ribbon 20 being carbon whereby the U-shaped portion 53 will not engage the pin 54, then there is no engagement between the cam follower 93 on the feed control lever 51 and the cam 91. However, both the cam 91 and the ratchet 94 rotate irrespective of whether the ribbon 20 is plastic or carbon.

While a plastic ribbon permits overlapping printing operations on the same area of the ribbon, it is desirable to not have a complete overlapping of the same printing area during each of the plurality of print cycles before the ribbon 20 is advanced longitudinally past the printing position. The present invention utilizes a mechanism in which the ribbon lift guides 62 and 63 are moved an incremental amount transversely relative to the printing position when the ribbon 20 is plastic. This incremental movement of the ribbon 20 is a nonconstant amount during each of the print cycles and the total amount of movement during the predetermined or selected number of print cycles before the ribbon 20 is both advanced longitudinally and moved transversely relative to the printing position is less than the distance between any of the vertical positions to which the ribbon 20 is moved when the ribbon 20 is advanced both longitudinally and transversely past the printing position. For example, each incremental movement might be about .003" while the vertical positions would be at least .050" apart.

This variable lift mechanism includes a variable lift pawl 101, which is mounted on the screw 78 for both pivoting and sliding through a slot 102 in the pawl 101. The pawl 101 is mounted on the shoulder screw 78 by having a washer 102' surrounding the screw 78 and disposed within the slot 102. The washer 102' is wider than the pawl 101 so that it protrudes beyond the pawl 101 to prevent binding of the cam follower 77. As shown in FIG. 3, the pawl 101 has a flat surface 103, which engages the ribbon lift cam 79 to function as a cam follower.

The pawl 101 has its other end 104 engaging the teeth of a ratchet 105, which is formed integral with an eccentric 106. The eccentric 106 surrounds the rod 67 and is disposed within the opening 64b in the lower lift arm 64. Thus, as the eccentric 106 is rotated by the ratchet 105 being rotated through the variable lift pawl 101, there is a slight amount of pivotal movement of the lift arms 64 and 65 with the control element 75 as the pivot.

It should be understood that the ratchet 105 is spaced from the lift arms 64 and 68 by a spacer 106'. The spacer 106' is mounted adjacent the ratchet 105 on a preferably circular portion integral with the ratchet 105 but prior to the eccentric 106.

This slight pivotal movement of the lower lift arms 64 and 65 results in the ribbon lift guides 62 and 63 being moved an incremental non-constant amount transversely relative to the printing position to modify the position to which the guides 62 and 63 are moved. Thus, each rotation of the ribbon lift cam 79 causes a slight transverse movement of the ribbon 20 with respect to its printing position as long as the surface 103 of the variable lift pawl 101 engages the ribbon lift cam 79. It should be understood that a detent pawl 106', which is attached to the support member 11, engages the teeth of the ratchet 105 to prevent reverse rotation.

The surface 103 of the variable lift pawl 101 is maintained in engagement with the ribbon lift cam 79 by a spring 107. One end of the spring 107 is attached to the variable lift pawl 101 adjacent the end 104 while its other end is secured to a downwardly projecting ear 108 which extends through an opening 108' in the base plate 10, on a lever 109. The lever 109 is pivotally connected to the base plate 10 through the shoulder screw 12, which extends through an opening 109' in the lever 109.

When the ribbon 20 is plastic so that the mode change lever 55 is in the position of FIG. 2, the lever 109 also is positioned as shown in FIG. 2 whereby the spring 107 holds the surface 103 of the variable lift pawl 101 in engagement with the ribbon lift cam 79 so as to follow the cam 79 and be moved thereby to rotate the ratchet 105. However, when the ribbon 20 is carbon so that the mode change lever 55 is positioned with the pin 56 in the notch 58, the lever 109 will be rotated counterclockwise by the arm 59 of the mode change lever 55 engaging a downwardly depending ear 110' on an arm 110 of the

lever 109. As a result, the lever 109 is pivoted to decrease the force on the spring 107 sufficiently so that the surface 103 of the variable lift pawl 101 is not maintained in engagement with the ribbon lift cam 79. With the surface 103 of the pawl 101 not following the cam 79, the ratchet 105 is not rotated.

Accordingly, the variable lift of the ribbon lift guides 62 and 63 through rotation of the eccentric 106 occurs only when the ribbon 20 is plastic. Thus, when the ribbon 20 is carbon and each print cycle results in the ribbon 20 being advanced longitudinally relative to the printing position and transversely to another of the vertical positions by the ratchet wheel 36, there is no incremental movement of the ribbon lift guides 62 and 63 since it is not required at this time.

As previously mentioned, a plastic ribbon is weaker than a carbon ribbon. However, it is still necessary to maintain a tension on the ribbon 20 irrespective of the material in order to insure that the ribbon 20 is taut at the printing position.

Accordingly, a ribbon spring guide 111, which comprises a roller engaging the ribbon 20 and supported by a wire 111' secured to a support block 112, is pivotally mounted on the base plate 10 through the support block 112, a spacer 112', and a screw 113. The screw 113 is threaded into a tapped hole 113' in the base plate 10. The support block 112 has a spring retaining plate 114 adjustably attached thereto through a screw 115. The spring retaining plate 114 has one end of a spring 116 attached thereto. The other end of the spring 116 is attached to the lever 109.

When the lever 109 is in the position of FIG. 2 wherein the ribbon 20 is plastic, the tension of the spring 116 is selected so that it provides the desired tension to maintain the plastic ribbon 20 taut at the printing position without breaking it. When the ribbon 20 is carbon so that the pin 56 of the mode change lever 55 is locked within the notch 58 in the base plate 10, the force of the spring 116 is increased in comparison with its force when the ribbon 20 is plastic because of the rotated position of the lever 109. Accordingly, a greater force on the ribbon 20 is provided by the ribbon spring guide 111 when the ribbon 20 is carbon than when it is plastic.

The force of the spring 116 in both of the positions of the lever 109 must be carefully selected as must the force of the spring 107. In adjusting the forces of the springs 107 and 116, the mode change lever 55 is disposed in the position of FIG. 2.

Then, the force of the spring 107 is first selected by bending a downwardly depending ear 117' on an arm 117 of the lever 109 to determine its engagement with an arm 118 on the mode change lever 55. This positions the lever 109 relative to the mode change lever 55 in the position shown in FIG. 2. It should be understood that the ears 110' and 117' of the lever 109 extend through an opening 118' in the base plate 10.

With the mode change lever 55 still in the position of FIG. 2, the force of the spring 116 is adjustable through a slot 119 in the spring retaining plate 114. The slot 119 permits movement of the spring retaining plate 114 with respect to the support block 112 whereby the force of the spring 116 is adjustable.

Then, the mode change lever 55 is moved to the position in which the pin 56 is retained in the notch 58. In this position, the desired tension of the spring 116 when the ribbon 20 is carbon is determined by bending the downwardly projecting ear 110' on the arm 110 to determine the position of the lever 109 relative to the mode change lever 55 when the mode change lever 55 has the pin 56 retained in the notch 58.

The support block 112 has a wire 120 attached thereto and extending upwardly therefrom. The wire 120 cooperates with the teeth of the ratchet wheel 18 on the supply spool 17 to function as a detent to permit only counterclockwise rotation of the supply spool 17.

As shown in FIG. 6, the path of the ribbon 20 is from

the supply spool core 19 around the ribbon spring guide 111 and then through the ribbon lift guide 62 past the printing head 14. The ribbon 20 then passes through the ribbon lift guide 63, around an upstanding guide 120' on the base plate 10, and then between the pressure roller 26 and the feed roller 27 to the takeup spool 25.

The spring 116 continuously urges the support block 112 to pivot the ribbon spring guide 111 counterclockwise (as viewed in FIG. 6). This results in the wire 120 being maintained in engagement with one of the teeth of the ratchet wheel 18 of the supply spool 17 to prevent counterclockwise rotation of the supply spool 17.

When the takeup spool 25 and the feed roller 27 are rotated due to rotation of the ratchet wheel 36, the ribbon 20 creates a sufficient force on the ribbon spring guide 111 to overcome the force of the spring 116. As a result, the support block 112 is rotated to remove the wire 120 from the teeth of the ratchet wheel 18 whereby the supply spool 17 may freely rotate counterclockwise and permit the ribbon 20 to be pulled off of the supply spool core 19.

When a sufficient length of the ribbon 20 has been paid out, the tension on the ribbon 20 decreases below that created on the ribbon 20 by the spring 116 acting through the ribbon spring guide 111. As a result, the spring 116 returns the wire 120 into engagement with one of the teeth of the ratchet wheel 18 to again lock the supply spool 17 and the supply spool core 19 against counterclockwise rotation. In this position, the spring 116 exerts the predetermined force of tension on the ribbon 20 through the ribbon spring guide 111.

Considering the operation of the present invention with the ribbon 20 being plastic, the mode change lever 55 is disposed in the position of FIG. 2. It will be assumed that the cam follower 93 of the feed control lever 51 has just moved off one of the high dwell lobes 95 of the cam 91 as shown in the solid line position of FIG. 2. In this position of the feed control lever 51, the U-shaped portion 53 of the feed control lever 51 is disposed closest to the front of the base plate 10 so as to block rearward movement of the feed pawl 46 due to the engagement of the U-shaped portion 53 of the feed control lever 51 with the pivot pin 54 of the feed pawl 46. This prevents the ratchet wheel 36 from being advanced during a print cycle.

As shown in FIG. 2, the feed pawl 46 has a portion 121 extending into a slot 122 in the base plate 10. This insures that the feed pawl 46 must move along a path in which the pin 54 can engage the U-shaped portion 53 of the feed control lever 51.

With the first actuation of a character key of the typewriter, the print shaft 42 makes a revolution. As a result, the ribbon lift cam 79 rotates to cause the secondary feed pawl 96 to engage one of the teeth of the ratchet 94 and advance the ratchet 94 clockwise one tooth. Since the cam 91 is integral with the ratchet 94, it also rotates the same angular amount.

During each print cycle whereby the print shaft 42 makes a revolution, the variable lift pawl 101 both slides and pivots about the screw 78 because of the cooperation of the cam follower surface 103 on the pawl 101 with the ribbon lift cam 79. However, this movement of the variable lift pawl 101 to rotate the ratchet 105 whereby there is a small incremental movement of the ribbon 20 transversely with respect to the printing position occurs after printing of the character. This is assured by the fact that the cam follower surface 103 of the pawl 101 engages the ribbon lift cam 79 90° from engagement of the cam 79 by the cam follower 77 (see FIG. 3). The spring 107 holds the surface 103 of the variable lift pawl 101 in engagement with the ribbon lift cam 79 because of the position of the lever 109.

During the selected or predetermined number of print cycles, the feed control lever 51 is progressively rotated counterclockwise by the cam 91 about the stud 52 to pro-

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gressively move the U-shaped portion 53 toward the position in which it occupies when the ribbon 20 is carbon. After the selected or predetermined number of print cycles has occurred, one of the lobes 95 engages the cam follower 93 of the feed control lever 51 during the next print cycle to move the feed control lever 51 to the dotted line position of FIG. 2 in which the U-shaped portion 53 will not engage the pin 54 so as to permit the feed pawl 46 to be moved rearwardly sufficiently to advance the ratchet wheel 36 clockwise.

When the ratchet wheel 36 is rotated clockwise, the ribbon 20 is advanced longitudinally past the printing position due to rotation of the feed roller 27. At the same time, the control element 75 is moved to another of its positions within the slot 76 in the cam follower 77 so that the ribbon lift guides 62 and 63 may be moved to another of their vertical positions during the next print cycle. Thus, another portion of the width of the ribbon 20 will be disposed at the printing position for engagement by the printing head 14 during the next print cycle.

As the feed pawl 46 rotates the ratchet wheel 36 by forward movement of the feed pawl 46, the secondary feed pawl 96 has completed rotation of the ratchet 94 and the integral cam 91. As a result, the feed control lever 51 is returned by the spring 90 to the solid line position of FIG. 2 since the lobe 95, which was engaging the cam follower 93 on the feed control lever 51, is rotated beyond engagement therewith to the solid line position of FIG. 2.

The predetermined or selected number of print cycles again occurs during each of which there is no advancement longitudinally of the ribbon 20 past the printing position. However, there is non-constant incremental lifting in a transverse direction of the ribbon 20 to prevent complete overlapping of the printing areas.

When the ribbon 20 is carbon, the mode change lever 55 is disposed with the pin 56 locked in the notch 58 in the base plate 10. As a result, the lever 109 is pivoted counterclockwise about the screw 12 to increase the force of the spring 116 whereby a greater tension is exerted by the ribbon spring guide 111 on the ribbon 20. Additionally, the feed control lever 51 is moved to a position, which is further to the rear than the dotted line position of FIG. 2, in which the U-shaped portion 53 will not engage the pivot pin 54 of the feed pawl 46 and the cam follower 93 will not engage the cam 91.

Accordingly, each actuation of a character key on the typewriter results in the ratchet wheel 36 being rotated. This causes the ribbon 20 to be advanced longitudinally past the printing position and moved transversely to one of the four vertical positions whereby there is no overstriking of the printed areas.

When the mode change lever 55 is in the position wherein the pin 56 is locked within the notch 58 in the base plate 10, the lever 109 is positioned so that the spring 107 no longer exerts a biasing force on the variable lift pawl 101. Thus, the surface 103 of the variable lift pawl 101 does not engage the ribbon lift cam 79 when the ribbon 20 is carbon whereby incremental lifting of the ribbon 20 is eliminated.

When it is desired to use the typewriter for cutting a stencil wherein the ribbon 20 is not to be used, the stencil lever 35 is rotated clockwise about the axis of the cylindrical bushing 33. The upper arm 34 of the stencil lever 35 has an ear 124 (see FIG. 1), which is moved over the top of the feed pawl 46 when the stencil lever 35 is rotated clockwise. This prevents the feed pawl 46 from being moved out of the opening 50 in the ratchet wheel 36 within which the feed pawl 46 is disposed whereby the ratchet wheel 36 cannot be actuated.

The stencil lever 35 has a curved finger 125, which is adapted to be disposed over the stud 74' to lock the stencil lever 35 in the stencil position. As the stencil lever 35 is rotated clockwise, a portion 126, which is disposed beneath the finger 125 on the stencil lever 35, engages the

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link 73 to move the control element 75 within the slot 76 in the cam follower 77 to the position in which the control element 75 is disposed above the pivot screw 78.

With the control element 75 so positioned, the ribbon lift guides 62 and 63 are not raised by the lift structure during rotation of the print shaft 42. Of course, the cam follower 77 follows the ribbon lift cam 79 during each revolution of the print shaft 42 but no movement of the ribbon lift structure occurs. Additionally, the movement of the ribbon lift guide link 73 by the portion 126 of the stencil lever 35 moves the cam follower 71 away from engagement with the periphery of the ratchet wheel 36.

With the stencil lever 35 disposed in the position in which a stencil may be cut, there can be no actuation of the ratchet wheel 36 during each revolution of the print shaft 42. As a result, there is no longitudinal or transverse movement of the ribbon 20 relative to its printing position. Furthermore, because of the position of the control element 75 within the slot 76 in the cam follower 77, the ribbon lift guides 62 and 63 are maintained in their lowermost or rest position wherein the uppermost portion of the ribbon 20 is disposed beneath the printing position.

When the stencil lever 35 has the finger 125 removed from engagement with the stud 74' by urging the lever 35 counterclockwise, a spring 127, which has one end attached to a projection 127' on the stencil lever 35 and its other end attached to a close lever 128, urges the stencil lever 35 counterclockwise until a stop 129 on the stencil lever 35 engages a surface 130 on the base plate 10. In this position, the ear 124 is not in engagement with the feed pawl 46. Furthermore, the portion 126 of the stencil lever 35 is out of engagement with the link 73 to permit the follower 71 to again engage the ratchet wheel 36.

The close lever 128 is pivotally mounted on a load lever 131 by a pin 132. The load lever 131 is pivotally mounted on the support member 11 by a screw 133.

When it is desired to load or unload a ribbon, the load lever 131 is pivoted counterclockwise about the screw 133. This results in a corner 134 on the load lever 131 engaging an ear 135 (see FIG. 4) on the flange 66 of the ribbon lift structure. As a result, the ribbon lift structure pivots clockwise (as viewed in FIG. 1) about the rod 67. The load lever 131 is capable of being moved sufficiently to dispose the ribbon lift guides 62 and 63 in a position above their uppermost printing position, in which printing occurs on the lowermost portion of the ribbon 22, to permit easy loading and unloading of the ribbon 20.

As the load lever 131 pivots counterclockwise, an upstanding portion 136 on the load lever 131 engages a projection 137 on the pressure roller lever 28. As a result the force of the spring 30 is overcome, and the pressure roller 26 is removed from engagement with the feed roller 27.

As the load lever 131 pivots counterclockwise, the close lever 128 moves with the load lever 131 due to its connection through the pivot pin 132. The close lever 128 has a portion 138, which engages a tenon on the screw 13 to latch the close lever 128 and the load lever 131 in the loading and unloading position. In the loading and unloading position, the pressure roller 26 is not engaged with the feed roller 27 and the ribbon lift guides 62 and 63 are disposed in a position in which the ribbon 20 may be easily inserted or removed therefrom.

When loading and/or unloading of the ribbon 20 has been completed, the close lever 128 is pivoted clockwise about the axis of the pin 132. As a result, the portion 138 of the close lever 128 ceases to engage the tenon of the threaded screw 13 whereby the load lever 131 and the close lever 128 are unlatched.

A spring 139, which has one end attached to a hook 140 on the lower lift arm 64 and its other end connected to the support member 11, continuously biases the lift structure counterclockwise (as viewed in FIG. 1) about the rod 67. Accordingly, the spring 139 exerts a force through the ear 135 on the flange 66 of the lift structure

and the corner 134 on the load lever 131 to return the load lever 131 and the close lever 128 to their inactive positions. The spring 127 retains both the close lever 128 and the load lever 131 along with the stencil lever 35 in their inactive positions. The spring 127 also aids the spring 139 in moving the load lever 131 and the close lever 128 to their inactive positions.

It should be understood that a spring 141 retains the pin 56 of the mode change lever 55 in either the slot 57 or the notch 58 in which it is disposed. Thus, the mode change lever 55 cannot be accidentally displaced.

It should be understood that there is one of the openings 50 for each of the dwells 82-85. Thus, with the ratchet wheel 36 having four of each of the dwells 82-85, the ratchet wheel 36 would have sixteen openings.

While this invention has been shown and described with respect to a typewriter using a single element printing head 14, it should be understood that it can be used with a typewriter having a movable platen. While the variable lift pawl 101 has been described as being rendered inactive when the ribbon 20 is carbon, it should be understood that the pawl 101 could be active irrespective of the material of the ribbon 20. In such an arrangement, the spring 107 would be secured to a fixed stud on the base plate 10 rather than to the movable lever 109.

An advantage of this invention is that it insures maximum utilization of a single pass ribbon. Another advantage of this invention is that a single ribbon feed mechanism is employed to feed the ribbon in two different modes depending on the material of the ribbon. Still another advantage of this invention is that sufficient tension is applied to the ribbon to maintain the ribbon taut at the printing position without breaking it irrespective of the strength of the ribbon.

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

What is claimed is:

1. An inked ribbon feed mechanism for feeding a single pass ribbon relative to a printing position including:

guide means for a ribbon;

means to advance a ribbon longitudinally past the printing position during a print cycle;

means to move said guide means in a direction transverse of the ribbon to position the ribbon in different vertical positions relative to the printing position only during each actuation of said advancing means;

control means preventing actuation of said advancing means and said transverse moving means when disposed in a first position;

means to move said control means a sufficient distance from its first position after a selected number of print cycles to a position wherein said control means is disposed so that actuation of said advancing means and said transverse moving means can occur to both advance the ribbon longitudinally and move the ribbon to the next of the different vertical positions;

means to incrementally move said guide means in a direction transverse of the ribbon during each print cycle;

said transverse moving means moving the ribbon between any two vertical positions a distance greater than the sum of the incremental movements of the ribbon by said incremental moving means between actuations of said transverse moving means;

means continuously urging said control means to its first position;

means to lock said control means in a second position wherein said control means is disposed to that said advancing means and said transverse moving means are actuated during each print cycle, said locking

means being movable between its locking position and an inactivated position;

said moving means for said control means progressively moving said control means from its first position toward its second position during each print cycle when said locking means is inactivated;

said progressive moving means being disposed so that said control means can be returned to its first position by said urging means after said advancing means and said transverse moving means have been actuated;

said incremental moving means being actuated at least during each print cycle when said locking means is in its inactivated position;

a base plate;

said control means including a feed control lever pivotally mounted on said base plate;

said progressive moving means including a cam rotatably mounted on said base plate;

said feed control lever having a cam follower thereon for following said cam;

said cam having a ratchet fixedly attached thereto for movement therewith;

means to rotate said ratchet during each print cycle;

said feed control lever having means fixedly attached thereto to engage said advancing means to prevent actuation of said advancing means and said transverse moving means during a print cycle;

and said continuously urging means comprising a spring attached to said feed control lever and said base plate to maintain said cam follower in engagement with said cam when said locking means is inactivated.

2. An inked ribbon feed mechanism for feeding a single pass ribbon relative to a printing position including:

guide means for a ribbon;

means to advance a ribbon longitudinally past the printing position during a print cycle;

means to move said guide means in a direction transverse of the ribbon to position the ribbon in different vertical positions relative to the printing position only during each actuation of said advancing means;

control means preventing actuation of said advancing means and said transverse moving means when disposed in a first position;

means to move said control means a sufficient distance from its first position after a selected number of print cycles to a position wherein said control means is disposed so that actuation of said advancing means and said transverse moving means can occur to both advance the ribbon longitudinally and move the ribbon to the next of the different vertical positions;

means to incrementally move said guide means in a direction transverse of the ribbon during each print cycle;

said transverse moving means moving the ribbon between any two vertical positions a distance greater than the sum of the incremental movements of the ribbon by said incremental moving means between actuations of said transverse moving means;

support means;

said guide means including:

a pair of guide members;

a first pair of arms with each of said first pair of arms being pivotally connected respectively to a corresponding one of said guide members;

means fixedly connecting said first pair of arms to each other to form an integral structure;

means to pivotally mount said first pair of arms on said support means;

and a second pair of arms with one end of each of said second pair of arms being pivotally connected respectively to a corresponding one of

said guide members and its other end pivotally connected to said support means;

said transverse moving means including means cooperating with one of said first pair of arms to cause pivotal movement of said first pair of arms about said pivotal mounting means of said first pair of arms;

and said incremental moving means including:

an eccentric supported on said pivotal mounting means and cooperating with one of said first pair of arms;

and means to rotate said eccentric during each print cycle to cause pivotal movement of said first pair of arms about said cooperating means of said transverse moving means.

3. An inked ribbon feed mechanism for feeding a single pass ribbon relative to a printing position including:

guide means for a ribbon;

means to advance a ribbon longitudinally past the printing position during a print cycle;

means to move said guide means in a direction transverse of the ribbon to position the ribbon in different vertical positions relative to the printing position only during each actuation of said advancing means;

control means preventing actuation of said advancing means and said transverse moving means when disposed in a first position;

means to move said control means a sufficient distance from its first position after a selected number of print cycles to a position wherein said control means is disposed so that actuation of said advancing means and said transverse moving means can occur to both advance the ribbon longitudinally and move the ribbon to the next of the different vertical positions;

means to incrementally move said guide means in a direction transverse of the ribbon during each print cycle;

said transverse moving means moving the ribbon between any two vertical positions a distance greater than the sum of the incremental movements of the ribbon by said incremental moving means between actuations of said transverse moving means;

means continuously urging said control means to its first position;

means to lock said control means in a second position wherein said control means is disposed so that said advancing means and said transverse moving means are actuated during each print cycle, said locking means being movable between its locking position and an inactivated position;

said moving means for said control means progressively moving said control means from its first position toward its second position during each print cycle when said locking means is inactivated;

said progressive moving means being disposed so that said control means can be returned to its first position by said urging means after said advancing means and said transverse moving means have been actuated;

said incremental moving means being actuated at least during each print cycle when said locking means is in its inactivated position;

support means;

said guide means including:

a pair of guide members;

a first pair of arms with each of said first pair of arms being pivotally connected respectively to a corresponding one of said guide members;

means fixedly connecting said first pair of arms to each other to form an integral structure;

means to pivotally mount said first pair of arms on said support means;

and a second pair of arms with one end of each of said second pair of arms being pivotally connected respectively to a corresponding one of

said guide members and its other end pivotally connected to said support means;

said transverse moving means including means cooperating with one of said first pair of arms to cause pivotal movement of said first pair of arms about said pivotal mounting means of said first pair of arms;

and said incremental moving means including:

an eccentric supported on said pivotal mounting means and cooperating with one of said first pair of arms;

and means to rotate said eccentric during each print cycle when said locking means is inactivated to cause pivotal movement of said first pair of arms about said cooperating means of said transverse moving means.

4. An inked ribbon feed mechanism including:

rotatably mounted supply spool means;

rotatably mounted takeup spool means;

means to longitudinally advance an inked ribbon, having one end attached to said supply spool means and its other end attached to said takeup spool means, from said supply spool means to said takeup spool means past a printing position;

means to maintain a tension on the ribbon to maintain the ribbon taut at the printing position;

said maintaining means including:

a roller engaging the ribbon;

a pivotally mounted support block having said roller attached thereto;

and a spring having one end attached to said support block;

means to change the tension on said maintaining means depending upon the material of the ribbon used;

and said changing means including a pivotally mounted lever having the other end of said spring attached thereto whereby the force of said spring is changed by changing the position of said lever.

5. An inked ribbon feed mechanism for feeding a single pass ribbon relative to a printing position including:

guide means for a ribbon;

means to advance a ribbon longitudinally past the printing position during a print cycle;

means to move said guide means in a direction transverse of the ribbon to position the ribbon in different vertical positions relative to the printing position only during each actuation of said advancing means;

a source of motion operable during each print cycle;

a reciprocating member for transmitting motion from said source to said advancing means and said transverse moving means for causing actuation thereof;

control means for selectively determining whether said reciprocating member can transmit motion from said source to said advancing means and said transverse moving means;

said control means including movable means that may be actuated during each print cycle;

said movable means cooperating with said reciprocating member so that said reciprocating member can transmit motion from said source to said advancing means and said transverse moving means only once during every group of a predetermined number of print cycles;

means to incrementally move said guide means in a direction transverse of the ribbon during each print cycle;

said transverse moving means moving the ribbon between any two vertical positions a distance greater than the sum of the incremental movements of the ribbon by said incremental moving means between actuations of said transverse moving means;

support means;

said guide means including:

a pair of guide members;

a first pair of arms with each of said first pair

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of arms being pivotally connected respectively to a corresponding one of said guide members; means fixedly connecting said first pair of arms to each other to form an integral structure; means to pivotally mount said first pair of arms on said support means; 5
and a second pair of arms with one end of each of said second pair of arms being pivotally connected respectively to a corresponding one of said guide members and its other end pivotally connected to said support means; 10
said transverse moving means including means cooperating with one of said first pair of arms to cause pivotal movement of said first pair of arms about said pivotal mounting means of said first pair of arms; 15
and said incremental moving means including:
an eccentric supported on said pivotal mounting means and cooperating with one of said first pair of arms; 20
and means to rotate said eccentric during each print cycle to cause pivotal movement of said first pair of arms about said cooperating means of said transverse moving means.

6. An inked ribbon feed mechanism for feeding a single pass ribbon relative to a printing position including: 25
guide means for a ribbon;
means to advance a ribbon longitudinally past the printing position during a print cycle;
means to move said guide means in a direction transverse of the ribbon to position the ribbon in different vertical positions relative to the printing position only during each actuation of said advancing means; 30
a source of motion operable during each print cycle;
a reciprocating member for transmitting motion from said source to said advancing means and said transverse moving means for causing actuation thereof; 35
control means for selectively determining whether said reciprocating member can transmit motion from said source to said advancing means and said transverse moving means; 40
said control means including movable means that may be actuated during each print cycle;
said movable means cooperating with said reciprocating member so that said reciprocating member can transmit motion from said source to said advancing means and said transverse moving means only once during every group of a predetermined number of print cycle; 45
means to incrementally move said guide means in a direction transverse of the ribbon during each print cycle; 50
said transverse moving means moving the ribbon between any two vertical positions a distance greater than the sum of the incremental movements of the ribbon by said incremental moving means between actuations of said transverse moving means; 55
means to lock said control means in a position wherein said control means is disposed so that said reciprocating member can transmit motion to said advancing means and said transverse moving means during each print cycle, said locking means being movable between its locking position and an inactivated position; 60
said incremental moving means being actuated at least during each print cycle when said locking means is in its inactivated position; 65
support means;
said guide means including:
a pair of guide members; 70
a first pair of arms with each of said first pair of said arms being pivotally connected respectively to a corresponding one of said guide members; means fixedly connecting said first pair of arms to each other to form an integral structure; 75

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means to pivotally mount said first pair of arms on said support means;
and a second pair of arms with one end of each of said second pair of arms being pivotally connected respectively to a corresponding one of said guide members and its other end pivotally connected to said support means;
said transverse moving means including means cooperating with one of said first pair of arms to cause pivotal movement of said first pair of arms about said pivotal mounting means of said first pair of arms;
and said incremental moving means including:
an eccentric supported on said pivotal mounting means and cooperating with one of said first pair of arms;
means to rotate said eccentric during each print cycle when said locking means is inactivated to cause pivotal movement of said first pair of arms about said cooperating means of said transverse moving means;
and said locking means having means to inactivate said rotating means when said locking means is in its locking position.

7. An inked ribbon feed mechanism for feeding a single pass ribbon relative to a printing position including: 25
guide means for the ribbon;
means to advance the ribbon longitudinally past the printing position during a print cycle;
lift means operative during a print cycle to move said guide means from a normal rest position to vertically spaced active positions adjacent the printing position;
lift selecting means controllingly cooperative with said lift means for periodically selecting one of a plurality of nominal vertically spaced active positions for said guide means;
and lift modifying means in cooperation with said lift means separately from said lift selecting means for modifying the nominal active positions of said guide means by vertical increments within a range that is less than the vertical spacing between the nominal positions.

8. The mechanism according to claim 7 including: 30
means to move said lift selecting means to a plurality of different positions with each of the positions corresponding to one of the plurality of nominal vertically spaced active positions selected for said guide means by said lift selecting means cooperating with said lift means;
control means preventing actuation of said advancing means and said moving means when disposed in a first position;
and means to move said control means a sufficient distance from its first position after a selected number of print cycles to a position wherein said control means is disposed so that actuation of said advancing means and said moving means can occur to both advance the ribbon longitudinally and move said lift selecting means to another of its plurality of positions so that said guide means is moved to another of the plurality of nominal vertically spaced active positions.

9. The mechanism according to claim 7 including means to selectively render said lift modifying means inactive.

10. An inked ribbon feed mechanism for feeding a single pass ribbon relative to a printing position including: 35
support means;
guide means for a ribbon;
lift means connected to said guide means;
means to pivotally mount said lift means on said support means;
means to advance the ribbon longitudinally past the printing position during a print cycle;
means to move said guide means in a direction trans-

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verse of the ribbon to position the ribbon in different vertical positions relative to the printing position only during each actuation of said advancing means; said transverse moving means including means cooperating with said lift means to cause pivotal movement of said lift means about said pivotal mounting means; 5

control means preventing actuation of said advancing means and said transverse moving means when disposed in a first position; 10

means to move said control means a sufficient distance from its first position after a selected number of print cycles to a position wherein said control means is disposed so that actuation of said advancing means and said transverse moving means can occur to both 15

advance the ribbon longitudinally and move the ribbon to the next of the different vertical positions; means to incrementally move said guide means in a direction transverse of the ribbon during each print cycle; 20

said incremental moving means including:

- an eccentric supported on said pivotal mounting means and cooperating with said lift means;
- and means to rotate said eccentric during each print cycle to cause pivotal movement of said lift 25

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means about said cooperating means of said transverse moving means;

and said transverse moving means moving the ribbon between any two vertical positions a distance greater than the sum of the incremental movements of the ribbon by said incremental moving means between actuations of said transverse moving means.

References Cited

UNITED STATES PATENTS

415,529	11/1889	Lasar	197—151
654,028	7/1900	Shimer	197—151
1,015,594	1/1912	Spurgin	197—151
1,064,703	6/1913	Brown	197—157
1,069,985	8/1913	Steele	197—151
1,198,505	9/1916	Adamson	197—151
3,171,530	3/1965	O'Daniel et al.	197—158 X
3,346,090	10/1967	Goff et al.	197—158
3,349,887	10/1967	Goff	197—151
3,349,888	10/1967	Page	197—151 X
3,442,366	5/1969	Spears	197—151

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,528,536

Dated September 15, 1970

Inventor(s) Allison H. Caudill et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 42, "ribbon", first occurrence, should read -- ribbons --. Column 3, line 70, "pully" should read -- pulley --. Column 5, line 32, after "61" insert -- is --. Column 10, line 60, after "108" insert a comma. Column 15, line 73, "to" should read -- so --. Column 16, line 68, the paragraph beginning with "means" should be indented. Column 18, line 13, "tivatedto" should read -- tivated to --. Column 19, line 49, "cycle" should read -- cycles --.

Signed and sealed this 20th day of April 1971.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
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