Oct. 26, 1954 W. A. ANDERSON 2,692,556

RIBBON FEEDING AND VIBRATING IN PRINTING MACHINES

Filed June 29, 1953 2 Sheets-Sheet 1

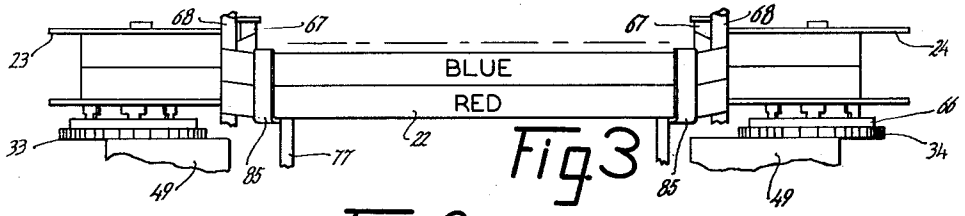
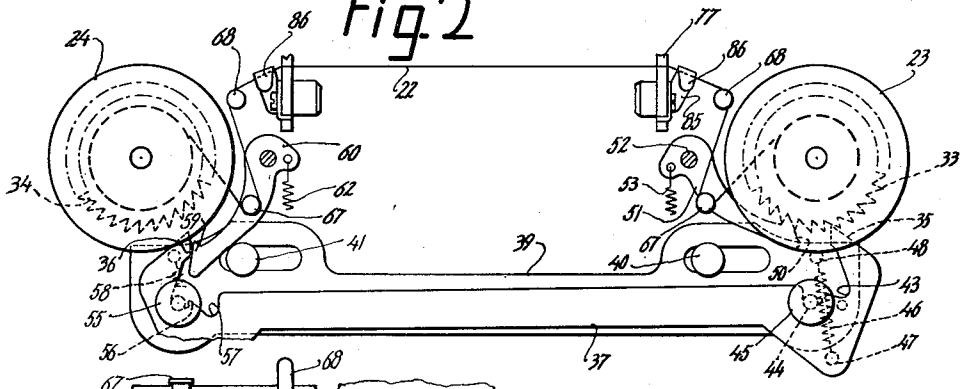


Fig. 3

Fig. 2



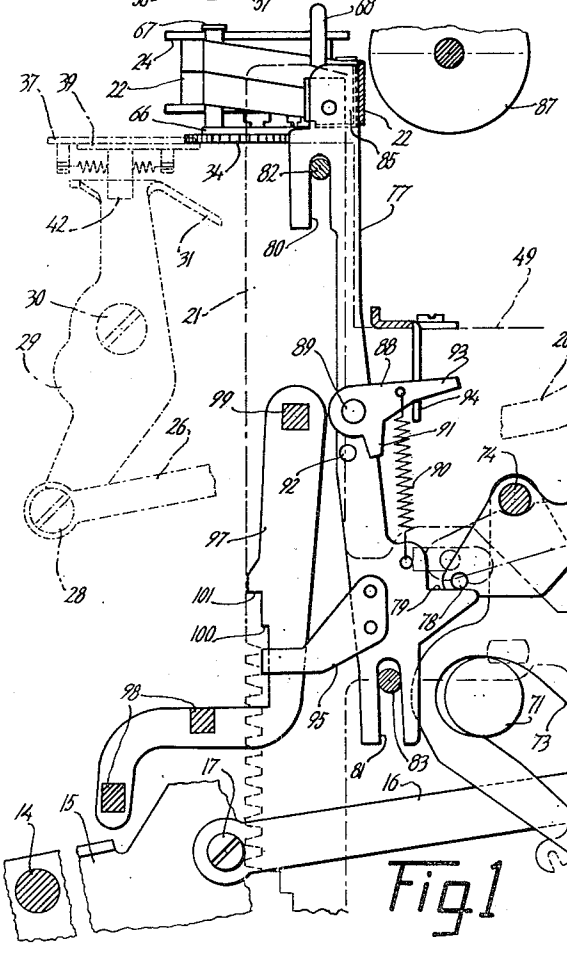


Fig. 1

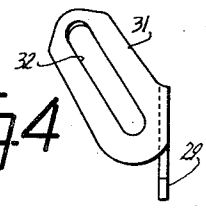


Fig. 4

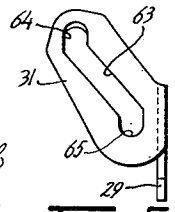


Fig. 5

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RIBBON FEEDING AND VIBRATING IN PRINTING MACHINES

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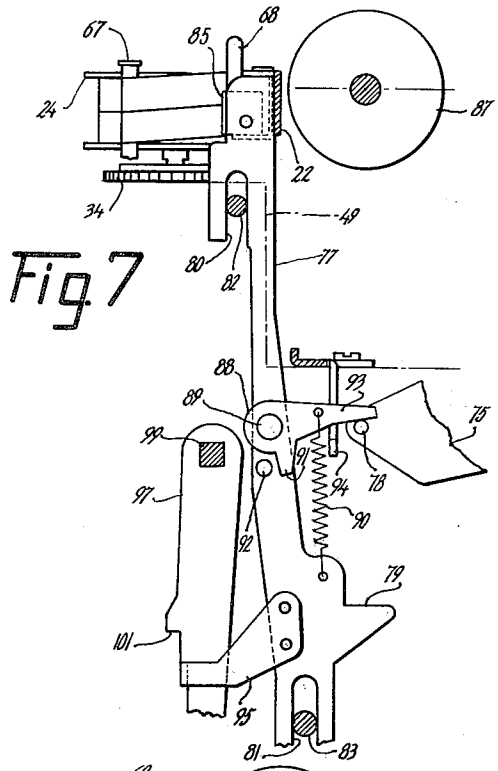

Fig. 7

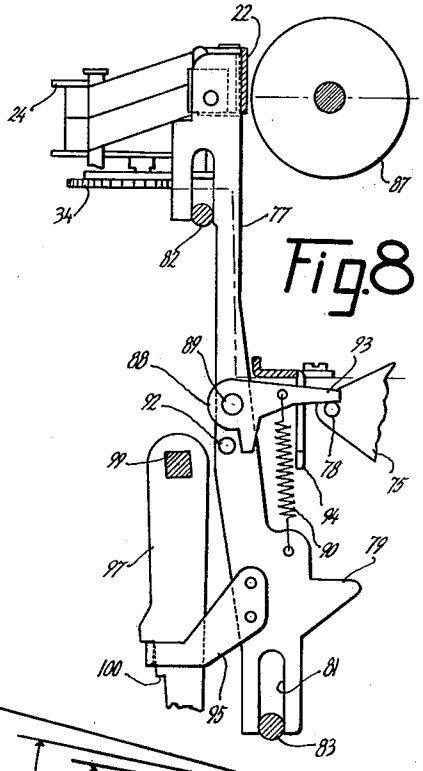

Fig. 8

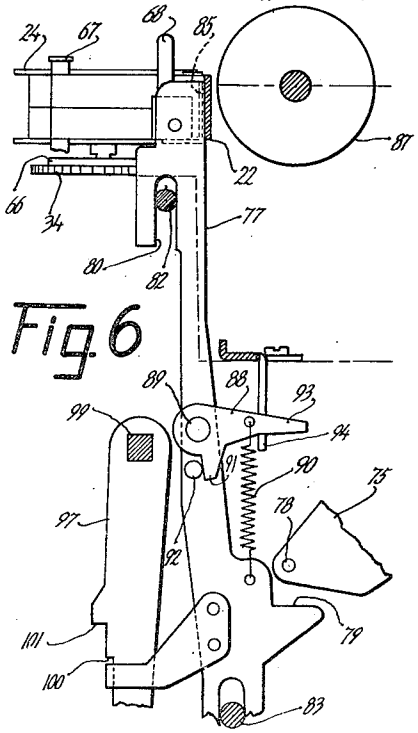

Fig. 6

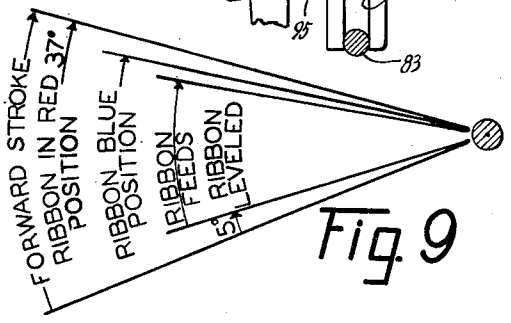

Fig. 9

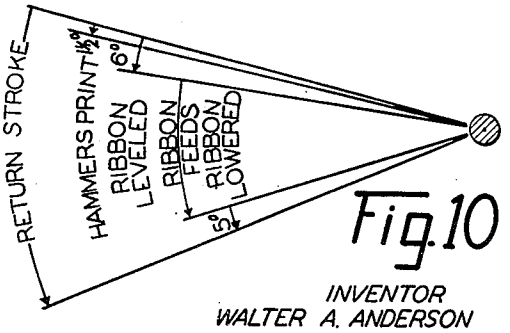

Fig. 10

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RIBBON FEEDING AND VIBRATING IN PRINTING MACHINES

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Application June 29, 1953, Serial No. 364,900

8 Claims. (Cl. 101—336)

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This invention relates to business machines of the class having printing means using a printing ribbon. More particularly this invention is concerned with means for feeding and vibrating the ribbon during the operation or cycling of the machine. Although shown and described in connection with a printing computer or calculator, the structure and concepts involved may be useful in registers, tabulators, typewriters, or other ribbon-printing machines.

It is customary in many printing machines to support a printing ribbon under tension between two storage reels or spools located one each on either side of a printing area, and to feed the ribbon laterally from one spool to the other, in short steps, across the space between the spools. This is called ribbon "feeding." It is also usual to raise and lower the ribbon at different times during the machine cycle, so that at one time for visibility of the record the ribbon will be held below the characters being printed, and at another time for printing purposes the ribbon will be positioned in one or more different areas opposite the type bars or other printing means. This raising and lowering is accomplished by mechanisms called ribbon vibrators or lifts.

For conservation of space as in a calculator of the type here described, the ribbon vibrators are sometimes located close to the ribbon spools and the ribbon tensioning members. When this is so, the vibration of the ribbon between the lower visible record position and a raised printing position pulls the ribbon angularly considerably out of line with the ribbon spools. Consequently, in these machines, a ribbon feed while the ribbon is lifted or otherwise out of line will have a strong tendency to curl the edges of the ribbon where it is held by the guides on the ribbon lifters. Such curling or folding may enable the type bars to catch on the ribbon, or may jam the ribbon in the guides of the lifters, with resultant tearing or other damage to the ribbon.

The principal object of the present invention is to prevent curling, folding or tearing of the ribbon by the ribbon lift or the type bars, and to do this in a manner requiring the minimum addition of parts or changes in existing machines. The preferred manner consists in proportioning the parts of the machine and providing mechanism so that the movements of the ribbon lifts and of the ribbon feed cooperate to produce lateral feeding of the ribbon only at a time in the machine cycle when the ribbon is level (in line) with the ribbon spools and tensioning devices. This is done by an arrangement for arresting

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movement of the ribbon lift for a period of time when the ribbon is in line with the spools, and by an arrangement for actuating the lateral ribbon feed principally during that period in the operating cycle. Further improvement is obtained by mechanism insuring that there will be no lateral ribbon feed excepting when the ribbon is at spool level. Because the ribbon is fed laterally while the ribbon vibrators are stationary and while the ribbon is level with the spools and tensioning devices, there is no tendency for the ribbon guides on the vibrators to curl or tear the edges of the ribbon, and a smooth ribbon is presented to the type bars.

Incidental objects and further details of that which is believed to be novel and this invention will be clear from the following description and claims taken with the accompanying drawings in which are illustrated examples of ribbon feeding and vibrating mechanisms embodying the present invention and incorporating desirable vibrator arresting and feed timing arrangements.

In the drawings:

Figure 1 is a sectional side view of a portion of a printing calculator with the parts at rest;

Figure 2 is a top plan view of parts of the machine of Figure 1 involved in the ribbon feeding;

Figure 3 is a rear elevational view of the ribbon feeding parts of Figure 2;

Figure 4 is a plan view of the top end of a ribbon feeding cam lever which is shown in side view in Figure 1;

Figure 5 is a view similar to Figure 4 but showing a modified form of cam lever end;

Figure 6 is a side sectional view similar to a portion of Figure 1, with the ribbon vibrating parts in position for lateral ribbon feeding;

Figure 7 is a view similar to Figure 6, but with the parts in position for printing in one of the colors of the ribbon;

Figure 8 is a view similar to Figure 6, but with the parts in position for printing in the other color of the ribbon;

Figure 9 is a diagram indicating the timing of operation of parts of the machine during the forward stroke of the machine cycle; and

Figure 10 is a diagram showing timing of the parts during the return stroke of the cycle.

At the start of operation of the machine, the parts are biased toward the non-printing rest position shown in Figure 1. The machine is powered by hand or motor to start the forward stroke of the operating cycle and the main shaft 14 is thereby oscillated in a counterclockwise direction about bearings in a stationary supporting frame,

not shown in this portion of Figure 1. This movement drives the main operating lever 15, turning it about the main shaft axis as a pivot, and thereby raises and pulls forward the front end of a main driving link 16, pivoted as at 17 to the main lever. The other end of the link 16 is pivoted as at 18 to the lower end of a rear swinging lever 19, which itself is pivoted to the stationary machine frame as at 20. These parts control the actuation of all the other parts as to timing and direction of movement.

In the printing function of the machine, rocking of the rear swinging lever 19 in a clockwise direction around pivot 20 raises the type bars 21 through mechanisms not shown here, but which may be as described in Patent 1,965,611 issued July 10, 1934, to O. J. Sundstrand and assigned to the same assignee as the present invention. It is sufficient for an understanding of the present invention to note that the type bars are raised into their proper printing positions during the forward stroke of the machine, printing takes place, and the type bars are retracted during the return stroke of the operating cycle.

In order to present a fresh or changed surface of the ribbon to the type bars after each printing operation, the ribbon 22 is fed or stepped laterally during the operation cycle. Any suitable mechanism may be employed for this purpose, but it is preferred that something equivalent to the mechanism illustrated be used. This is shown in Figure 2 in a position for feeding the ribbon 22 on to the right-hand spool 23 from the left-hand spool or reel 24. With the parts in the position shown, the ribbon feeding will take place in a portion of the forward stroke of the cycle.

For reasons which will become obvious when the action of the ribbon vibrating mechanism is understood, it is desired to delay the ribbon feeding somewhat during the initial part of the forward stroke of the cycle. This delay is accomplished partially by the natural lost motion between pivotally connected parts of the linkage, and partially by the location and action of certain of the ribbon feeding elements which are controlled by the rear swinging lever 19 through the ribbon feeding link 26, pivoted at 27 at one end near the top of the swinging lever. The other end of the link 26 is pivotally connected as at 28 to the bottom of the ribbon feeding cam lever 29. This cam lever is pivotally supported near its center as at 30 to the stationary machine frame, and carries a top cam-slotted face 31 at its upper end, the diagonal cam slot 32 actuating the ribbon feeding elements to rotate the ribbon spools as the cam lever is rocked during the machine cycle.

Driving connection between the cam lever and the ribbon spools is made on the right-hand side through a ribbon feed ratchet 33 fixed to the right-hand spool, and through a right-hand hook 35 on the ribbon feed pawl 37. This pawl is carried by and moved sidewise together with a sliding ribbon reverse lever 39, which is slidably mounted as at 40 and 41 on bearings extending from the stationary frame. On the underside of the ribbon reverse lever is a cam roller post 42, which extends downwardly and rides in the cam slot 32 of the lever 29. Therefore, when the cam lever swings, it slides the ribbon reverse lever to the left, carrying with it the ribbon feed pawl. In the first part of travel of the pawl, the right-hand hook 35 will be moving toward engagement with one of the teeth on the right-hand ribbon feed ratchet 33. During this time, no movement of the ratchet or its connected spool will take place, and a desired delay will occur. Finally, the hook will become engaged with a ratchet tooth and will turn the ratchet 33 clockwise, winding the ribbon a short distance onto the spool. This completes movement of the ribbon feed in this direction and the parts stay in this position while the rest of the mechanism completes the forward stroke.

For reversing the ribbon feed, an arrangement is made for altering the position of the ribbon feed pawl in relation to the ribbon reverse lever, so that the left-hand ribbon feed ratchet 34 on the left-hand spool 24 is in position to be engaged by the left-hand hook 36 on the feed pawl 37. The reverse feed is made after setting the feed pawl 37 by manual or automatic means not of importance here, so that an outer right-hand notch 43 in the pawl rather than the inner right-hand notch 44 in the pawl will be seated against a right-hand headed stud 45 on the sliding lever 39. The stud is held in either one notch or the other by means of a tension spring 46, extending between an anchor 47 on the feed pawl and an anchor 48 on the sliding lever. With the stud 45 in the outer notch 43, the right-hand hook will be held away from the ratchet 33, but it may engage a nose 50 on a right-hand holding pawl 51, which otherwise would engage and hold the ratchet 33 against movement in a counterclockwise direction. The pawl 51 is pivoted as at 52 on the stationary machine frame, part of which is indicated at 49. The holding pawl is constantly urged toward engagement with its ratchet as by a spring 53, extending between the pawl and an anchor (not shown) on the frame. Thus, with the right-hand feed pawl and holding pawl parts in this altered position, no ribbon feeding drive will be effected by these parts during the right-to-left movement of the ribbon reverse lever in the forward stroke of the cycle.

However, shifting of the right-hand stud 45 from the inner notch 44 to the outer notch 43 is accompanied by a similar shifting of parts on the left end of the sliding lever and feed pawl. On the reverse feed, the left-hand stud 55 on the lever 39 is shifted from the outer left-hand notch 56 in the feed pawl 37 (as in Figure 2) to the inner left-hand notch 57. A spring 58, extending between anchors in a manner similar to the spring 46, urges the left-hand stud into engagement with one or the other of the notches 56 and 57. In the shifted position, the left-hand hook 36 on the feeding pawl will be out of engagement with the nose 59 on the left-hand holding pawl 60. The holding pawl is thereby permitted to swing into engagement with the spool ratchet 34 through influence of the spring 62, and prevent clockwise rotation of the left-hand ratchet and spool 24.

Now, as the parts slide to the left on the forward stroke swing of the cam lever 29, hook 36 will ride over the teeth of left-hand ratchet 34, the spring 58 permitting this ratcheting to take place. No feed will occur during this forward stroke, therefore, because the right-hand parts are disengaged as explained above. However, in the return stroke, as the slide 39 is moved toward the right again, after the natural slack of the connected parts is taken up, the left-hand hook 36 will move toward and eventually engage a tooth on the ratchet 34 and turn the left-hand spool counterclockwise a slight amount to feed the ribbon. Note that the feed in this direction is preceded by a slight pause at the beginning of

the return stroke, just as in the case of the feed in the direction first described the ribbon feed was preceded by a pause at the beginning of the forward stroke. When the feed has completed, the parts stay in position while the rest of the mechanism makes its last movement into normal resting position.

In order to make it more positive that the ribbon feed is stationary during both the beginning and ending of the forward and return strokes of the cycle, a modified cam for the slotted face 31 on the top end of the feeding lever 29 may be used. This is shown in Figure 5, and it comprises a central diagonal portion 63, and two parallel straight end portions 64 and 65. When the cam roller 42 is in either of the straight end portions 64 or 65 of the slot, no sidewise motion of the sliding lever 39 can take place, and no lateral feeding in either direction will occur. Therefore it is only at a portion of the middle of the forward or return stroke that feeding will take place, when the cam roller is riding in the diagonal portion 63 of the slot.

Proper tension is maintained on the ribbon between the spools by any suitable means, and a spring biased pivoted tension arm 66 carrying upstanding posts 67 and 68 is shown in Figure 1 as on the left-hand side of the machine. This structure is mirrored on the right-hand side, as indicated in Figures 2 and 3.

At certain times during the forward and return strokes when the type bars are being moved and the ribbon is being fed or arrested in its lateral movement, the present invention provides vertical lifting or vibration of the ribbon. As follows from the previous description, when the rear swinging lever 19 is first moved by operation of the main link 16 in the forward stroke of the machine, the pivot 18 between these members will swing forwardly in a clockwise direction. This pivot 18 is in the form of an extended shaft with a roller on it which rides in a slot 69 in a restoring cam piece 70. This cam piece is guided during the forward stroke in a double swinging movement forwardly, then upwardly, and then forwardly again, by means of a cam roller 71, mounted on the stationary machine frame, which rides in a Z-shaped cam slot 73 in the cam piece 70, and is guided also by means of a pivotal connection as at 74 with a type bar lift restoring arm 75, itself pivoted as at 76 to the machine frame. There are preferably two of the restoring arms 75, located on either side of the machine, and tied together both at their pivots 76 and by extension of the pivot 74 to form a cross-bar. This cross-bar is used to restore the type bars to proper position after printing, by mechanism well understood in the art and shown in Sundstrand Patent 1,965,611. However, the forward tips of the restoring arms are used to govern movement of the ribbon vibrators or lifts 77, by a lost-motion connection through extended bearing posts 78, one each on the arms 75, which engage with shoulders 79, one each on the lifts 77. The lifts are guided for vertical sliding movement as by guide slots 80 and 81 in the lifts, which ride on suitable guide posts 82 and 83 on the machine frame. The timing of the vertical movement of the ribbon lifts is of extreme importance in this invention because each lift carries at its top end a ribbon guide 85 with a bent-over end portion 86, the ribbon being threaded through these guides and being positioned by the guides at various levels during operation of the machine. Binding of the ribbon in the guides may cause curling or cutting of the ribbon edges.

When the machine is at rest (Figure 1) the bearing posts 78 on the arms 75 press against the tops of the shoulders 79 on the lifts 77, and hold the guides and ribbon in a lowered position at a level below the printing on a sheet of paper (not shown) on the platen or roller 87. The bent-over portions or hooks 86 on the guides prevent the ribbon from sliding upwardly even though the ribbon is under tension and is below the level of the ribbon spools.

As the forward stroke is started, the arms 75 are raised by upward swinging of the cam pieces 70 as above described, allowing each lift 77 to raise itself through a ribbon lift spring arm 88, pivoted as at 89 to the lift, and urged downwardly (clockwise) as by a tension spring 90, extending between the arm 88 and the lift proper, as shown. A projection 91 on the spring arm will limit movement of the arm in clockwise direction when the projection strikes a stop pin 92 on the ribbon lift 77. When the machine is in normal rest position, however, the projection 91 will be held away from the stop 92 by engagement of an extension 93 on arm 88 with a ribbon lift stop in the form of a hook 94. One of these hooks is mounted on a ledge on each side of the machine frame 49, in the path of movement of the spring lift arm on that side. The location of the hooks 94 is such that when the lift restoring arms 75 are not pressing on the shoulders 79, the spring arm 88 will engage stop pins 92 and hold the ribbon lifts 77 in a position so that the ribbon guides 85 are directly in line or on a level with the common level of the ribbon spools. It is at this position (Figure 6) that the ribbon feeding mechanism moves the ribbon laterally as above described, if the ribbon feed is on the forward stroke. Each of the ribbon vibrators is arrested or held in this level feeding position by engagement of extension 93 with hook 94 while the post 78 leaves the shoulder 79 and travels freely upwardly, until the post on the arm 75 strikes the extension 93 and lifts the spring arm and the vibrator upwardly away from the hook. When this occurs, the ribbon feed is timed to stop.

The machine shown is preferably designed for a bichrome ribbon, and stop mechanism may be used for two color printing according to Patent 2,011,310, which issued August 13, 1935, to W. A. Anderson and is assigned to the same assignee as the present invention. This mechanism includes a ribbon hook stop 95 secured to each ribbon lift 77 near the bottom thereof, and a cradle composed of a ribbon hook catch arm 97 on each side of the machine, the cradle catch arms being joined together by cross-bars 98 to pivot about an axle 99 in the frame. By mechanisms more fully disclosed in the above noted Anderson patent, the catch arms 97 of the cradle are optionally positioned so that either a lower shoulder 100 or an upper shoulder 101 on each arm 97 will be in the path of movement of the hook stop 95, stopping upward movement of the ribbon lifts in either the lower blue printing position (Figure 7) or the upper red printing position (Figure 8). The springs 90 on the arms 88 will allow lifting of the extensions 93 by the posts 78 of the arms 75 even though the lifts are stationary because of engagement of stops 95 with shoulders 100 or 101.

Printing will take place with the ribbon vibrating parts in the raised position of either Figure 7 or Figure 8, preferably in the first part of the return stroke of the machine, as is usual in mechanisms of this character. Although the present disclosure provides for bichrome printing, there

is no intention to limit the invention in this respect, because a single color ribbon could be used, and the two position hook catches and stops could be eliminated.

On the return stroke, the arm **75** lowers the bearing post **78** and the extension **93** of arm **88** until the extension **93** again rests on the hook stop **94**. The spring **90** will pull the projection **91** against the stop pin **92** and support the lift **77** against further downward travel. This is a pause in the ribbon vibration during which the lateral ribbon feed may take place (as in Figure 6) if the ribbon feed is operating in the return stroke of the machine as above described. After a suitable interval for the simultaneous ribbon feeding, the arm **75** will again take over downward movement of the lift **77** by engagement of the post **78** with shoulder **79**, until the parts are returned to the rest position of Figure 1.

Figure 9 is a diagram of different related movements of parts of the machine during different angular positions of the arm **75** on the forward stroke. It will be noted that for the first 5 degrees of movement the ribbon is raised to level feeding position; during the major portion of the rest of the stroke, the ribbon can feed; and thereafter the ribbon is raised to either blue or red printing position in the small remainder of the forward stroke. In the return stroke of the cycle, shown in Figure 10, the hammers strike the type bars and printing takes place in the first 1½ degrees of movement of arm **75**; the ribbon is lowered to level feeding position after the first 6 degrees of movement; during most of the rest of this stroke the ribbon can feed; and thereafter the ribbon is lowered in the last 5 degrees of movement to a position where the printed record is visible. During the last portion of the return stroke, the platen may also be actuated if desired, to advance the paper sheet or roll in order to increase visibility of the printed record and to present a clean paper surface for the next machine cycle.

For clarity in illustration the thickness of the ribbon is greatly exaggerated in the cross-sections shown in Figures 1, 6, 7 and 8 of the drawings. The dimensions of other parts and clearances in the drawings have also been distorted somewhat for better understanding of the structure and action involved. However, as will be evident from the foregoing description, certain aspects of the invention are not limited to the particular details of construction of the examples illustrated, and it is contemplated that various and other modifications and applications of the invention will occur to those skilled in the art. It is therefore intended that the appended claims shall cover such modifications and applications as do not depart from the true spirit and scope of this invention.

What is claimed as new and is desired to be secured by Letters Patent of the United States is:

1. In a machine of the class described, a printing area, printing means movable toward and away from the printing area, a printing ribbon for cooperating therewith, a pair of spools supporting the ribbon generally adjacent the printing means opposite the printing area, a feed for moving the ribbon between the spools, a ribbon lift for positioning the ribbon in a plurality of locations including a visible record location with the ribbon at a level below the printing area, a printing location with the ribbon opposite the printing area, and a feeding location with the ribbon in line with the pair of spools, mechanism for arresting movement of the lift when in the feeding location, and a device for operating the ribbon feed simultaneously with operation of the lift-arresting mechanism.

2. In a machine of the class described, a printing area, printing means movable toward and away from the printing area, a pair of spools generally adjacent the printing means, a printing ribbon extending between said spools opposite the printing area, a feed for moving the ribbon laterally in small steps between the spools, a ribbon lift for positioning the ribbon in a plurality of locations at levels below the printing area, directly opposite the printing area, and in line with the spools, delay mechanism for arresting movement of the lift when the ribbon is in line with the spools, and a connection for operating the lateral ribbon feed substantially concurrently with operation of the lift delay mechanism.

3. In a machine of the class described, a platen having a printing area, printing means movable toward and away from the printing area, a printing ribbon cooperating with the printing means, a pair of spaced spools supporting said ribbon under tension opposite the printing area, a feed mechanism for stepping the ribbon laterally between the spools, a ribbon lift slide for vertically positioning the ribbon in a plurality of levels including a visible record level below the printing area, a printing level directly opposite the printing area, and a feeding level in line with the spools, a lost-motion connection for halting movement of the lift when at the feeding level, a drive for operating the ribbon feed during halting of the ribbon lift, and a cam connection preventing operation of the ribbon feed when the ribbon lift is not halted.

4. In a machine of the class described, having printing means cyclically movable toward and away from a printing area, the combination of a pair of spaced rotatable ribbon storage spools located at a common level, a printing ribbon carried by said spools and extending laterally across the space between the spools and adjacent the printing area, a ribbon feed for cyclically rotating one of said spools and moving said ribbon laterally from one spool to the other, a ribbon vibrator for cyclically moving said ribbon between a lower visible record position below the printing area and an upper printing position opposite the printing area, said vibrator occupying a position during its cycle where the ribbon is level with said spools, mechanism for arresting movement of said vibrator when said ribbon is level with the spools, and connecting linkage causing operation of said ribbon feed substantially only while said vibrator arresting mechanism is effective and said ribbon is level with said spools.

5. In a machine of the class described, having printing means cyclically movable toward and away from a printing area, the combination of a pair of spaced ribbon storage spools located at a common level, a printing ribbon carried by said spools and extending laterally between the spools adjacent the printing area, a ribbon feed for moving said ribbon laterally a short distance from one spool toward the other during a machine cycle, a ribbon vibrator for moving said ribbon vertically from a lower position below the printing area to an upper position opposite the printing area and back to the lower position during a machine cycle, said vibrator occupying positions during its cycle where the

ribbon is level with said spools, mechanism for arresting movement of said vibrator when said ribbon is level with the spools, driving linkage operating said ribbon feed while said vibrator arresting mechanism is effective, and a device for rendering said lateral ribbon feed inoperative when said ribbon vibrator moves out of its arrested level-ribbon position.

6. In a machine of the class described, having a driving mechanism operated in a cycle and type bars cyclically raised and lowered by said mechanism to print through a printing ribbon on a printing area, the combination of rotatable ribbon spools for holding the ribbon on either side of the printing area, a ribbon feed for winding the ribbon from one spool to another, a ribbon feeding lever operated by said driving mechanism for actuating the ribbon feed one step at a time during a machine cycle, a vertically movable ribbon lift for raising and lowering the ribbon between a lower visible record position below the printing area and an upper printing position opposite the printing area, a lifting lever operated by said driving mechanism for effecting movement of said ribbon lift from lower to upper position and back again during a machine cycle, a support urging said ribbon lift toward a position where the ribbon is level with said spools, a lost-motion connection between said ribbon lift and said lifting lever, said connection permitting said resilient support to govern the position of said ribbon lift during portions of the machine cycle, and a cooperating cam and roller connection between said ribbon feeding lever and said ribbon feed for driving said feed only in those portions of the cycle when said ribbon lift is supported in the level ribbon position.

7. In a machine of the class described, having a driving mechanism operated in a cycle including a forward and a return stroke, the combination of a printing ribbon, a pair of rotatable ribbon spools on a common level for holding the ribbon, a ribbon feed for rotating one of the spools and winding the ribbon from one spool to another, a ribbon feeding lever operated by said driving mechanism for actuating the ribbon feed one step at a time during a single machine cycle, a vertically slidable ribbon lift for raising and lowering the ribbon between a lower position below the level of the spools and an upper position above the level of the spools, a lifting lever operated by said driving mechanism for effecting movement of said ribbon lift from lower to upper position during the forward stroke and from upper to lower position during the return stroke of the cycle, a resilient support constantly urging said ribbon lift toward a position where the ribbon is level with said spools, connection between said ribbon lift and said lifting lever, said connection permitting said resilient support to govern the position of said ribbon lift during the major portion of the forward and return strokes, and a cam on said ribbon feeding lever for driving said ribbon feed only in those parts of the cycle when said ribbon lift is supported in the spool level ribbon position.

8. In a machine of the class described, having a driving mechanism operated in a cycle including a forward and a return stroke, the combination of a printing ribbon, rotatable ribbon spools on a common level for holding the ribbon, a ribbon feed for rotating one of the spools and winding the ribbon laterally from one spool to another, a ribbon feeding lever operated by said driving mechanism principally in the middle of the forward and return strokes for actuating the ribbon feed during a machine cycle, a slidable ribbon lift for raising and lowering the ribbon between a lower position below the level of the spools and an upper position above the level of the spools, a lifting lever operated by said driving mechanism for effecting movement of said ribbon lift from lower to upper position during the forward stroke and from upper to lower position during the return stroke of a cycle, a resilient supporting arm on the ribbon lift constantly urging said lift toward a position where the ribbon is in the common level of said spools, and a lost-motion connection between said ribbon lift and said lifting lever, said connection permitting said resilient supporting arm to govern the position of said ribbon lift during the middle portion of the forward and return strokes, whereby said ribbon is fed laterally principally while held in a level with the spools.

No references cited.