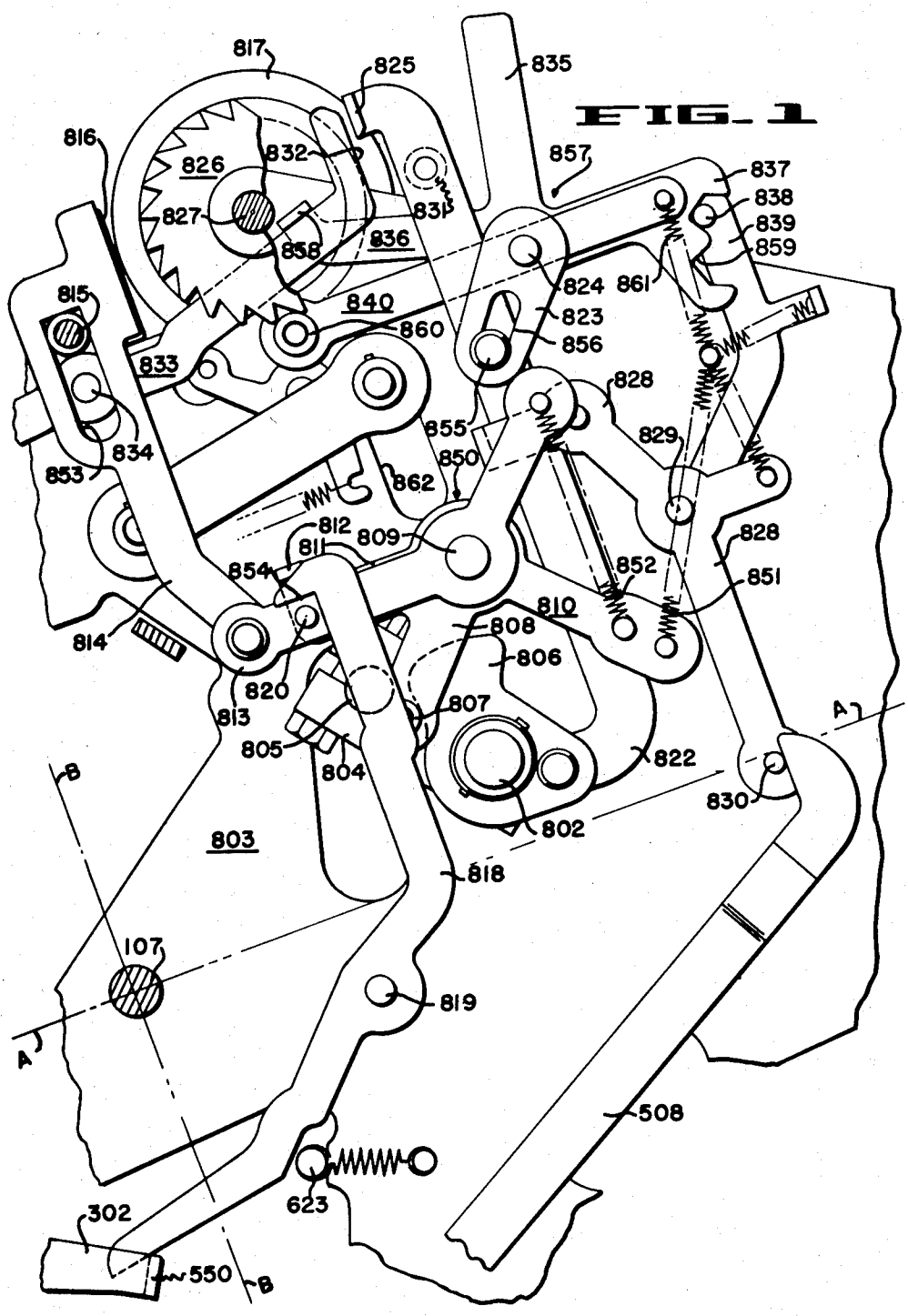
Jan. 31, 1956 N. F. HAWTHORNE 2,732,924

REVERSIBLE RIBBON FEED MECHANISM FOR ADDING MACHINES

Filed July 20, 1953 4 Sheets-Sheet 1

FIG. 1

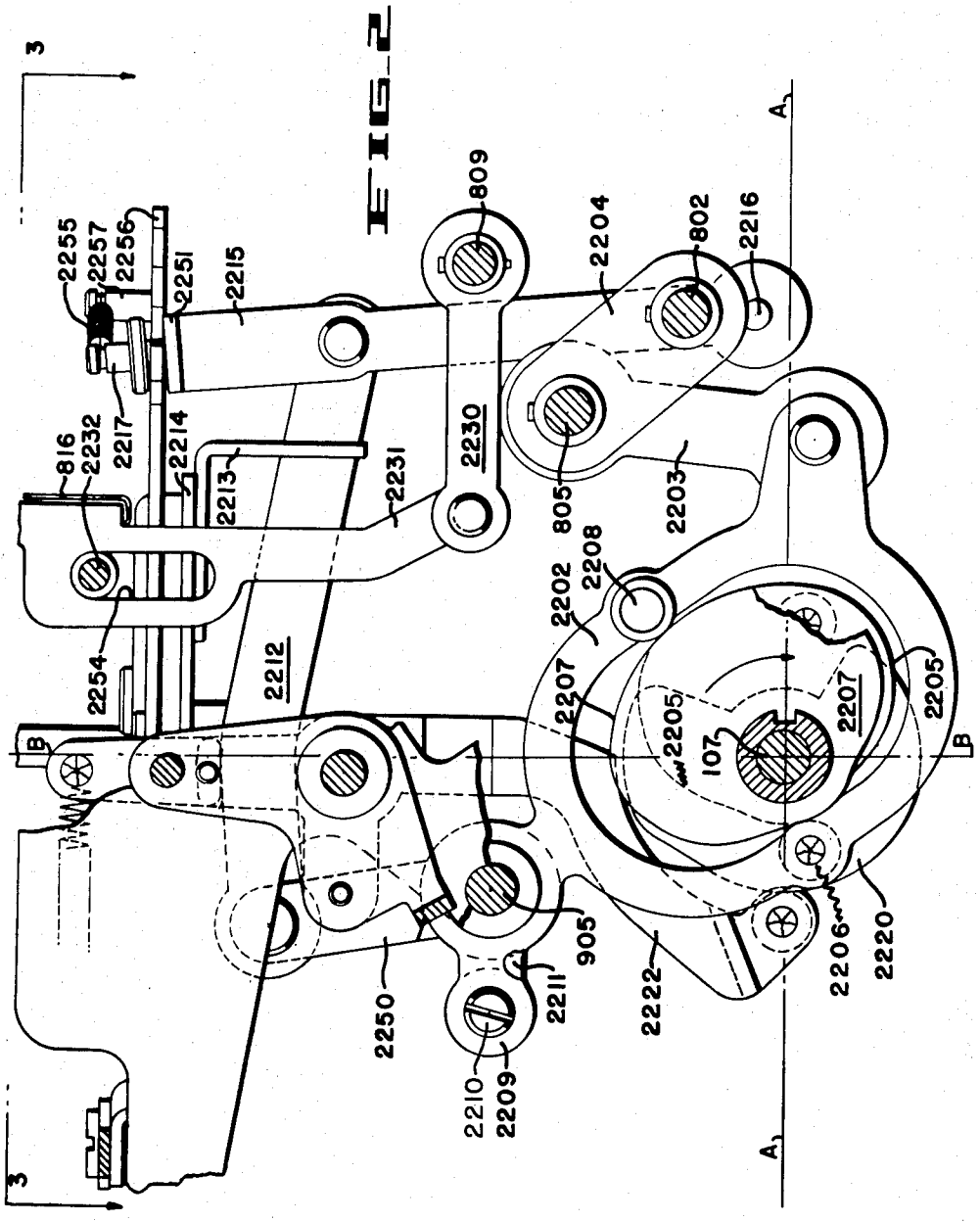


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REVERSIBLE RIBBON FEED MECHANISM FOR ADDING MACHINES

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FIG. 2



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REVERSIBLE RIBBON FEED MECHANISM FOR ADDING MACHINES

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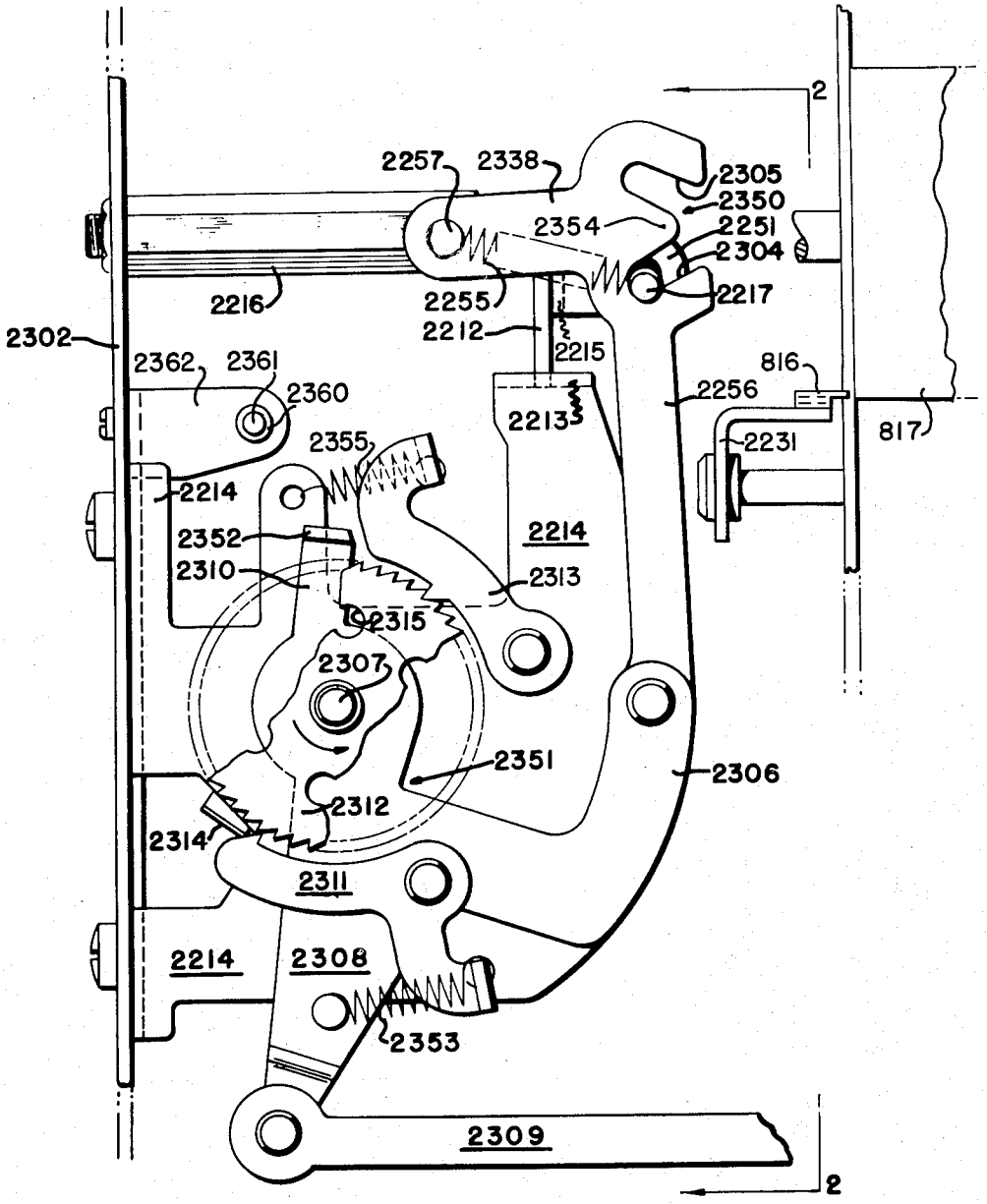


FIG. 3

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REVERSIBLE RIBBON FEED MECHANISM FOR ADDING MACHINES

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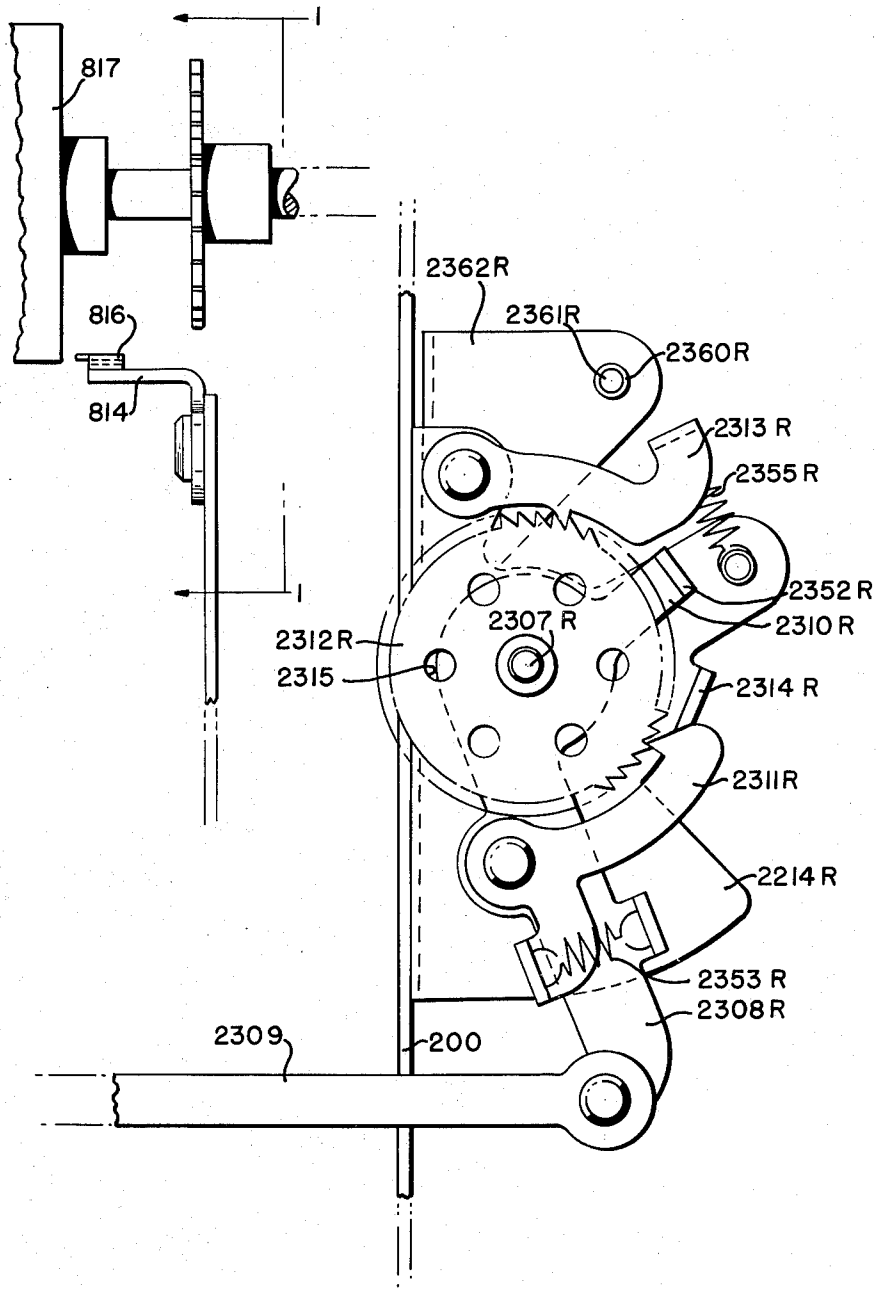


FIG_4

United States Patent Office 2,732,924
Patented Jan. 31, 1956

2,732,924

REVERSIBLE RIBBON FEED MECHANISM FOR ADDING MACHINES

Nathaniel F. Hawthorne, Alameda, Calif., assignor to Friden Calculating Machine Co., Inc., a corporation of California

Application July 20, 1953, Serial No. 369,204

4 Claims. (Cl. 197—162)

This invention relates to a ribbon feed and a paper feed mechanism for a listing calculator, and is particularly adapted for the adding machine covered by the application of Harold J. Chall entitled "Ten-Key Adding Listing Machine," filed May 11, 1953, S. N. 354,151, now abandoned in favor of continuation in part application S. N. 407,016, filed January 29, 1954, by Harold J. Chall for Calculating Machine.

A primary object of the present invention is to provide a ribbon feed mechanism for a listing adding machine.

A more particular and specific object of the present invention is to provide an automatic reversing mechanism for a ribbon feeding device by means of which the ribbon will be fed in one direction until the ribbon spool from which the ribbon is being fed, is empty, whereupon the feeding mechanism is reversed until the other spool is empty.

Another object of the present invention is to provide a reversible drive mechanism for feeding a ribbon spool at either end of a printing ribbon, e. g., to drive the right-hand spool in one direction and the left-hand spool in the opposite direction, the shift of the drive from one spool to the other being automatically controlled by the tension in the ribbon itself.

Another object of the present invention is to provide an automatic means for controlling the color to be printed through a conventional bichromatic ribbon, operating under the control of the manual and automatic control mechanisms of the machine.

Another object of the present invention is to provide a ribbon feed for an adding machine or the like, which is inoperative to feed the ribbon during the printing of a factor on the tape of such a machine.

Another object of the present invention is to provide an adjustable paper feeding mechanism of a listing calculating machine so as to provide a single or double spacing between items, at the will of the operator, and alternately, double spacing in certain machine cycles such as the taking of a total or a subtotal.

Another object of the present invention is to provide a paper feeding mechanism operated in timed relation to cycles of operation of the machine whereby the paper is fed immediately following the printing of a factor thereon.

The present invention is concerned with these and other objects which will become apparent from the following description of the preferred embodiment of the invention, which is shown in the accompanying drawings in which:

Fig. 1 is a right side view of the right side of the platen feeding mechanism of my invention, together with means for controlling the color of the printing when bichromatic ribbon is used.

Fig. 2 is a right side view of the drive for the ribbon feed mechanism of my invention.

Fig. 3 is a plan view of the left side of the ribbon feeding mechanism, showing particularly the means for driving the left-hand spool and the means for reversing the driving mechanism.

Fig. 4 is a plan view of the right side of the feeding mechanism, being in effect a right-hand extension of Fig. 3, showing particularly the means for feeding the right-hand spool.

The instant invention is shown, for purposes of exemplification, as associated with the ten-key adding machine shown and described in the application, S. N. 407,016, previously mentioned, although it will be understood that it could be associated with other machines of this general classification.

It is conventional in machines of this kind that printing be done by means of ordinally arranged type bars or type wheels which are first differentially positioned and then operated to strike the ribbon which lies immediately above the paper that passes over a platen **817**. Normally two spools are required, one on the right and the other on the left side, the ribbon being wound upon one spool and unwound from the other until it is completely unwound from the latter, whereupon an automatic mechanism reverses the direction of feed so as to wind the ribbon upon the empty spool and unwind it from that which was previously filled. Thus, the ribbon will be fed step-by-step in one direction and then reversed. In the instant invention the ribbon is wound upon conventional spools, not shown, which are loosely mounted on spindles **2307** and **2307R** (see Figs. 3 and 4), the bottom flanges of the spools resting upon the feed plates **2312** and **2312R** which are formed integrally with the respective spindles. The ribbon spools are provided with suitable projections which engage in the apertures **2315** in the plates **2312** and **2312R**, and thus are rotated by the rotation of the plates. In the instant invention the ribbon will pass from the left-hand side of the spool mounted on stub shaft **2307**; pass rearwardly to and around guide spool **2360**, which spool is rotatably mounted on a pin **2361** riveted, or otherwise fixedly secured, to a bracket **2362** mounted on the left frame plate **2302**; then through the ribbon guide formed by the spring clip **816** mounted on the ribbon guide arm **2231**; then across the front face of the platen **817** into the ribbon guide formed by the spring clip **816** and the ribbon guide arm **814**; thence around the roller or spool **2360R** which is rotatably mounted on the stud **2361R**, which in turn is mounted on the bracket **2362R**; and finally down to the right-hand side of the right-hand spool which is mounted on the spindle **2307R** and which has a suitable projection engaging one of the apertures **2315** in the right-hand plate **2312R**. Assuming that the feed of the ribbon is toward the right-hand spool, this spool will be rotated in a clockwise direction as will hereinafter be described, the ribbon unwinding in a clockwise direction from the spool mounted on the left-hand spindle **2307**. When the left-hand spool has been completely unwound, the ribbon being attached to the spool by any conventional means, can unwind no more, whereupon the tension in the ribbon will automatically reverse the direction of feed of the drive mechanism, and thus disable the feeding of the right-hand feed plate **2312R** and enable the rotation of plate **2312**, which thereafter is fed in a counter-clockwise direction until the ribbon is again tensioned and causes a reversing of the feed mechanism. It can be mentioned at this point that the two feed plates **2312** and **2312R** are fed by a single drive mechanism which utilizes spring-biased pawls to rotate the feed plates and consequently the ribbon spools. However, at all times one or the other of the pawls is blocked from operating, so that feed can proceed in one direction only.

It can be mentioned at this point that the spool plates **2312** and **2312R** are driven by pawls **2311** and **2311R**,

respectively. These feed pawls are rotatably mounted on drive arms 2308 and 2308R which are interconnected by a link 2309. The two plates are driven by a link 2256 which in turn is reciprocated by a pin 2217. The oscillation of the pin 2217 will now be described with reference to Fig. 2.

Ribbon feed

The ribbon feeding mechanism is driven from the main drive shaft 107, upon which are mounted the various cam operated control mechanisms of the application above-referred to, the shaft being given a single cycle of rotation upon depression of any of the control keys of the machine. The shaft rotates in a clockwise direction as viewed from the right, as in Fig. 2. Adjacent the left side of the machine are two conjugate, or complementary, cams consisting of a lead cam 2205 and a follow cam 2207, rotating with the drive shaft 107. The two cams are located immediately adjacent one another, and are encircled by a cam follower yoke 2202, which is provided with a follower roller 2206 which extends to the left of the yoke in order to engage the periphery of the lead cam 2205, and a second roller 2208 extending to the right thereof, to engage the periphery of the follow cam 2207. The effect of the follow and lead cams, with their respective follower rollers mounted on the single follower yoke 2202, is to pivot the latter about shaft 905 on which it is pivotally mounted. It should be noted that the follow and lead cams with their single yoke form a closed pair for driving the yoke positively, avoiding any dependence upon either gravity or spring to maintain the follower rollers in contact with the cams. The rocking of the yoke 2202 serves two purposes: It operates the actuator bail 805 which is mounted on arms 2204 that pivot about a transverse shaft 802, the link 2203 serving to operate the bail 805 from the rocking of the yoke; and it operates the ribbon feed mechanism now to be described.

The follower yoke 2202 has an integral arm 2209 which lies forwardly of the shaft 905 on which the yoke is mounted. This arm 2209 is connected by a relatively long spacing pin 2210 to a similarly shaped arm 2211, which latter arm is part of a bellcrank including the arm 2250. The bellcrank consisting of the arms 2211 and 2250 is likewise pivotally mounted upon shaft 905 and thus rocks synchronously with the follower yoke 2202. As far as the present invention is concerned the upwardly extending arm 2250 of the bellcrank could be integral with the yoke 2202, but the parts are separated in the machine of the application above-referred to in order to avoid interference with intermediate mechanisms pertinent to the machine as a whole. The upwardly extending arm 2250 extends slightly forwardly and upwardly as shown, and is pivotally connected to the forward end of a ribbon feed drive link 2212. The rearward end of the ribbon feed drive link is connected to a ribbon feed drive lever 2215, which lever is pivotally mounted at its lower end to the left side frame (not shown herein) by a suitable stud 2216. The ribbon feed drive link 2212 is guided in a fork 2213 depending from a ribbon spool bracket 2214 in order to prevent lateral displacement of the link and drive lever 2215 due to a camming action to be described shortly. The upper end of the drive lever 2215 is bent over to form an ear 2251 on which is riveted or otherwise rigidly secured, a drive pin 2217 that forms the driving connection between the cam-operated mechanism just described and the ribbon feed mechanism. It can be noted at this point, however, that the reciprocation of the pin 2217 reciprocates a drive link 2256.

It should be noted that the lever 2215 and pin 2217 reciprocate through a fixed path with each cycle of machine operation. The mechanism of my invention provides an automatic means for reversing the direction of the ribbon feed drive when the ribbon completely unwinds from one of the spools. This object can most readily be accomplished by attaching the ribbon to the spools, and using the tension caused by an attempted feed of the mechanism when the end has been reached to actuate the reversing mechanism. The reversing mechanism in my invention, lies in the connection between the pin 2217 and the drive link 2256. The formation of the connection between the pin 2217 and the link 2256 is best shown in Fig. 3, and the operation of this mechanism will best be understood by a reference to that figure. Fig. 3 is a plan view taken approximately at the plane indicated by the line 3—3 of Fig. 2, and shows only the left side ribbon feed mechanism without a ribbon or ribbon spool—the right side ribbon feed mechanism being shown in Fig. 4.

The left side ribbon spool and its immediate mechanisms are mounted on the left side ribbon spool bracket 2214 which is secured to the left side frame 2302 near its upper edge and on the right side thereof. The right side ribbon spool and its immediate mechanisms are mounted on a right side ribbon spool bracket 2214R (see Fig. 4), which is secured to the right side frame 200 near its upper edge and on the right side thereof. The ribbon is driven by the oscillations of the ribbon feed drive lever 2215 which, in turn, receives its oscillations directly from link 2212, bellcrank 2211, cam yoke 2202, and the actuator lead and follow cams 2205, 2207, as above described. Cooperating with the drive pin 2217, carried by the upper end of the ribbon feed drive lever 2215, are two transverse slots 2304, 2305 formed in the rear end of a ribbon drive shift link 2256, the forward slot 2304 being the left side spool drive slot and the rearward slot 2305 being the right side spool drive slot. These slots converge to, and have, a single opening 2350 on the right edge of the lever, the converging slots forming a V-shaped cam nose 2354 between them. The drive pin 2217 is resiliently held in either of these slots by a spring 2255 tensioned between the drive pin 2217 and a pin 2257 riveted, or otherwise rigidly secured, to a leftwardly extending projection 2338 formed on the rear end of the link 2256. The drag of the ribbon when a reel is completely unwound forces the drive pin to move from one slot to the other, as the ribbon when it reaches its end acts as a brake to the free movement of the shift link 2256. The shifting link 2256 is pin connected to a drive arm 2306, which is one arm of a multiarmed wrist plate 2351 pivoted on a ribbon spool spindle 2307, the latter being rotatably journalled in the ribbon mounting bracket 2214. A tie arm 2308, integral with the wrist plate 2351, has a tie bar 2309 pivotally connected to it, which tie bar connects the left side ribbon feed tie arm 2308 to the right side tie arm 2308–R (Fig. 4), and furnishes the drive for the right side ribbon spool. This link 2309 also acts as a control link between the two sides for adjusting the mechanism so that the ribbon will be wound on either the right or left spool. Another, and rearwardly extending, arm 2310 of the wrist plate 2351 has its end turned upwardly to form a check pawl throwout ear 2352. Pivotally mounted on the top of the wrist plate 2351, and swinging in a plane parallel to the wrist plate, is a drive pawl 2311 which is spring urged, as by spring 2353, into engagement with a ribbon spool ratchet wheel 2312. The ratchet 2312 is preferably rigidly mounted on the ribbon spool spindle 2307 which is rotatably carried by bracket 2214.

A check pawl 2313 is also pivotally mounted on the ribbon bracket 2214, which pawl has a tooth about midway of its arm cooperating with the teeth of ratchet wheel 2312 to prevent clockwise rotation of the ratchet wheel. This check pawl is biased toward engagement with the periphery of the ratchet wheel 2312 by a suitable spring 2355, tensioned between an ear on the end of the pawl and a spring seat formed in bracket 2214.

Also secured to, and forming a part of, the bracket 2214, and formed by an upturned portion of the bracket, is a drive pawl throwout ear 2314. This drive pawl throwout is located adjacent the outer end of the drive pawl 2311, when the wrist plate is in the left ribbon

feed drive position shown in Fig. 3, i.e., when the pin **2217** lies in slot **2304**.

The construction provides means for rotating the left side ribbon spool in a counter-clockwise direction from the oscillation of feed arm **2215** while preventing a reverse rotation when the parts are as shown in Fig. 3, but disables the feed pawl **2311** and locking pawl **2213** when pin **2217** lies in slot **2305** (which rotates the wrist plate **2351** and related parts to reciprocate in a sector lying clockwise to that shown). When the drive pin **2217** is in engagement with the left side drive slot **2304**, the other parts are as shown in Fig. 3. Rearward travel of the drive pin (toward the top of this figure) will cause engagement between the drive pawl **2311** and the ratchet wheel **2312** to give the ratchet wheel counter-clockwise rotation. Upon forward movement of the drive pin following its rearward movement, clockwise rotation of the ratchet wheel will be prevented by the check pawl **2313**. However, when the drive pin **2217** is moved from the left spool drive slot **2304**, to the right spool drive slot **2305**, the link **2256** will be moved forwardly and the wrist plate **2351** with its arms will be rotated clockwise a distance corresponding to the extreme recesses of the two slots **2304** and **2305**, thereby causing the wrist plate and its arms to reciprocate (on operation of pin **2217**) in a sector located clockwise to that shown. The clockwise rotation of the wrist plate **2351** will then cause the drive pawl **2311** to ride on the outer face of the drive pawl throwout ear **2314**, and the check pawl throwout ear **2352** will be moved into engagement with, and inside, the outer end of the check pawl **2313** to disengage the check pawl from the ratchet. The two throwout ears are so positioned and made of a sufficient peripheral extent so that rearward motion of the drive pin **2217**, when in the right side spool drive slot **2305**, and resultant return rotation of the wrist plate, will still leave the pawls in engagement with their respective throwout ears, and they will have no effect upon their associated ratchet wheel **2312**.

The right spool drive is substantially a mirror image of the left spool drive shown in Fig. 3. The control link **2309** is pivotally connected to the drive arm **2308R** which is pivotally mounted on the spindle **2307R**. A feed pawl **2311R** is pivotally mounted on the arm **2308R** and is biased into engagement with the teeth of the ratchet wheel **2312R** by a suitable spring **2353R**. A throwout ear **2314R**, formed integrally with the right-hand bracket **2214R**, cams the feed pawl **2311R** away from the periphery of the ratchet wheel during the operating stroke when the mechanism is in the left spool feed position shown in Figs. 3 and 4, determined by the pin **2217** lying within slot **2304**. In this event the pawl **2311R** is prevented from engaging the teeth of the ratchet wheel during the reciprocation of the pawls and during the return stroke of the mechanism. A check pawl **2313R** is pivotally mounted on the bracket **2214R**, and is biased into engagement with the periphery of the ratchet wheel by a suitable spring **2355R** tensioned between an ear on the end of the pawl and a spring seat stud formed on the bracket. The feed arm **2308R** has an integral arm **2310R** provided at its distal end with an upturned throwout ear **2352R** which, during the counter-clockwise reciprocation of the feed arm **2308R**, is moved into engagement with the check pawl **2313R**, camming the latter away from the periphery of the ratchet wheel and thus permitting the turning of the latter from the tension in the ribbon caused by rotation of the left ribbon spool.

However, the moving of the drive pin **2217** from slot **2304** to the right side spool drive slot **2305** also shifts the tie bar **2309** to a position to the left of that shown, whereupon it and arm **2308R** will reciprocate in a path, or sector, to the left of that shown. Thereafter the feed pawl **2311R** will lie in a position clockwise of the throwout ear **2314R** at the beginning of the stroke, and will only approach the throwout ear at the very end of the stroke, thereby enabling the feed pawl to engage the ratchet wheel on the return movement and thus rotate the right-hand feed spool. At the same time the throwout ear **2352R** has been rotated clockwise so that it will not engage the latching pawl **2313R** at any time during the stroke, thereby rendering the latching or check pawl effective to prevent reverse rotation of the feed spool.

This mechanism is effective to disable the right-hand feed and check pawls when the left-hand feed and check pawls are in effective position and render the left-hand feed and check pawls ineffective when the right-hand feed and check pawls are in operative position. Thus, the reciprocation of the feed link **2256** resulting from reciprocation of the arm **2215** and its integral pin **2217**, will be effective to rotate the left-hand feed pawl in a counter-clockwise direction or to rotate the right-hand feed spool in a clockwise direction, depending upon the position of pin **2217** in slot **2304** or clot **2305**—but both sets of pawls cannot be in effective or ineffective position at the same time.

It can be noted that operation of the left-hand feed ratchet plate is effective during the first portion of the cycle, as the wrist plate **2351** moves in a counter-clockwise direction, and is effective to rotate the right-hand ratchet plate clockwise on the return stroke when the wrist plate **2351** and feed arm **2308R** are moving in a clockwise direction. However, the operation of this mechanism is so timed with relation to the printing mechanism that the feed will operate either before or after the printing operation, the printing operation being controlled by cam **2220** shown in Fig. 2, and the follower arm **2222** there shown.

Rotation of the feed, or ratchet, plates **2312** and **2312R** is effective to rotate the ribbon spools in which such ribbon is conventionally marketed. In the preferred form of my invention, the plates are provided with apertures **2315** which serve as sockets into which projections from the lower flange of the ribbon spool may be located. This construction provides a positive drive connection between the ratchet wheel and the ribbon spool, so that rotation of the ratchet plate causes a corresponding rotation of the related spool.

Bichromatic printing

It is conventional in printing mechanisms of this kind to provide for bichromatic, or two-color, printing in order to distinguish particular transactions, such as subtractions from addition, or a credit balance from a true balance, or the like. In my present invention I control such printing by the raising or lowering of the ribbon guides **2231** and **814** in synchronism. In my preferred form the color normally used (usually black) is above the contrasting color (usually red). The ribbon is passed between the ribbon guide arms **2231** and **814**, respectively, and their attached spring guide clips **816**. In normal printing these guides are in their lowermost position shown in Figs. 1 and 2, and when the contrasting printing is called for the guides are automatically lifted to bring the contrasting color into the line of the printing elements, not shown. Referring first to Fig. 2, it is seen that the ribbon guide arm **2231** is pivotally connected to an arm **2230** that is affixed to a transverse shaft **809**, the vertical position of the guide arm **2231** being determined by the angular position of shaft **809**. The upper portion of the guide link **2231** is provided with a slot **2254** which embraces a stud **2232** mounted on an intermediate frame plate, not shown. To the right of the platen, a similar guide arm **814** (see Fig. 1) is pivotally mounted on an arm **813** which is likewise affixed to shaft **809** and has at its upper end a longitudinally extending slot **853** receiving a fixed stud **815**. Thus, it will be apparent that rocking of the shaft **809** will determine the vertical position of

the arms 2231 and 814 and thus control the color of printing from the two-color ribbon.

The mechanism for controlling operation of shaft 809 is shown in Fig. 1, which shows particularly the ribbon shift control mechanism, as well as the platen or tape feed mechanisms and the controls therefor. Both of these mechanisms are powered from rocking of the actuator bail shaft 802, the operation of which has already been mentioned, the ribbon shift mechanism being yieldingly operated thereby while the tape feed or platen feed mechanism is positively powered thereby.

Referring now to Fig. 1, it will be seen that the right ends of the shaft 802 and the bail 805 are connected by an arm 804, similar to arm 2204 of Fig. 2. To the right of the actuator bail arm 804 and secured to the bail shaft 802 is a ribbon shift cam, or feed arm, 806. This cam arm 806 will oscillate forward and backward with the oscillating movement of the bail shaft 802 and the actuator bail 805. The cam surface of the cam arm 806 is contacted by a ribbon cam follower roller 807. This ribbon shift cam follower roller 807 is mounted on the follower arm 808 of a three-armed crank 850, which is rotatably mounted on the ribbon shift shaft 809 that extends across the machine. The other arms of this crank 850 are the spring arm 810 which has connected to its outer end a spring 851 that urges the three-armed crank to the counter-clockwise position shown, in which position the follower roller 807 is held in engagement with the periphery of the cam 806; and the forwardly extending feed, or drive, arm 811, which has formed integral therewith, and from the upper edge thereof, a rightwardly extending ear 812.

Secured to the right-hand end of the ribbon shift shaft 809, and outboard of the three-armed crank, is a ribbon shift rocker 813. The rearward arm of the rocker 813 is spring-connected by a tension spring 852 to the spring arm 810 of the three-armed crank 850; and the forward, or ribbon shift arm, of the rocker underlies the ear 812 of the drive arm 811 of the three-armed crank and is biased against such ear by the force of the spring 852. The forward and outer end of the ribbon shift rocker 813 is pivotally connected to a ribbon guide link 814, previously mentioned.

A ribbon shift blocking lever 818 is rotatably mounted on the extreme right-hand end of a subtract pendent trunnion 819. The upper end of this blocking lever is formed with a hook 854 which is normally positioned over a ribbon shift blocking pin 820 secured to the ribbon shift arm of the ribbon shift rocker 813. The blocking lever 818 is adapted to be rotated rearwardly out of contact with the blocking pin 820 by a subtract lever 302 (described in said application) which has at its rearward end an inwardly turned ear 550 underlying the lower end of the blocking lever. The lower portion of the blocking lever 818 is also adapted to be contacted by forward and upward movement of a pin 623 which is the rightward extension of a subtract pendent drive pinion arbor. Such movement of ear 550 or pin 623 is, therefore, operative to rock hook 854 out of register with the blocking pin 820, thereby enabling rocker 813 to follow the cyclic rocking of lever 850.

Cyclic oscillation of the shaft 802 and the ribbon shift cam arm 806 will cause the cam follower arm 808 of the three-armed crank 850 to oscillate. The spring connecting the spring arm 810 of the three-armed crank 850 and the ribbon shift rocker 813 yieldingly maintains the ribbon shift arm of the rocker against the drive arm ear 812 of the drive arm 811 of the three-armed crank, and unless restrained by hook 854, the rocker will follow the movement of the three-armed crank. Clockwise rocking of rocker 813 will cause the ribbon guide links 814, 2231 to be raised, and with them the raising of the ribbon guides and the ribbon that may be held therein. This upward movement of the ribbon guides is blocked in many operations of the machine by the ribbon shift blocking lever 818 having its upper hooked end 854 positioned over the blocking pin 820 which is secured to the ribbon shift arm of the rocker 813. In this condition, the spring 852 yields to permit rocker 813 and connected members to remain in the inoperative position shown while the three-armed lever 850 oscillates with each machine cycle.

Operation of the subtract key will raise the rearward end of the subtract lever 302 to rotate the ribbon shift blocking lever 818 clockwise. This will remove the hook from the blocking pin 820 and allow the rocker to rotate clockwise and raise the ribbon guides when the machine cycles. Also, in the taking of a true credit balance, or negative total, the right end of the subtract pendent drive pinion arbor 623, on the negative pendent, will move forwardly and upwardly to rotate clockwise the ribbon shift blocking lever 818, which allows the ribbon shift guides and ribbon to be raised, or shifted. This means that when a two-color ribbon is used it will, during these operations, print in one color, and in other operations print in another color, as is fully described in said application.

Platen feed

A platen feed pawl 822 is pivotally connected at its lower end to the cam arm 806, and is guided in an up and down reciprocal movement by a pin and slot connection comprising pin 855 on pawl 822 and slot 856 in a pawl-guide arm 823 which is pivoted on a stud 824 secured to the right side inboard frame 803. The upper end of the platen pawl is provided with a right-turned hooked tooth, or ear, 825 which is adapted to engage the ratchet teeth of a ratchet 826 which is secured to the platen shaft 827 and, hence, to the platen 817. The slotted pawl-guide arm 823 with its slot and pin connection with the platen pawl 822 allows the pawl to ratchet or pass over the ratchet teeth of the ratchet 826 in its upward movement and then to engage a tooth of said ratchet and rotate such ratchet in its downward movement.

A selectively adjustable guide for the platen pawl 822 is provided by a pawl-guide rocker 828 controlled from the tape feed blocking lever 508. This guide rocker 828 is pivoted to the right inboard frame 803 by a stud 829. The upper end of this pawl guide rocker 828 is shaped around the stem of the platen pawl 822 to form a guide therefor. The lower end of the pawl-guide rocker 828 is provided with a pin 830 to be contacted by the rear and upward end of the tape feed blocking lever 508. This lever is operated so that its upper end moves forwardly upon operation of certain controls not here pertinent. Operation of this tape feed blocking lever serves to pull the platen pawl 822 away from the platen ratchet 826 to prevent engagement of the tooth 825, of the platen pawl with the platen ratchet 826.

Single or double spacing of the platen and a tape therearound, is had by securing to the platen pawl 822 near its upper end a single space cam follower roller 831. This cam follower roller 831, for single space operations, contacts a cam face 832 on the rearward and upturned end of a single space cam lever 833, which face limits the forward movement of the platen pawl hook 825 so that upon downward movement of the pawl, the ratchet 826 will be moved only a one tooth distance. When the parts are as shown in Fig. 1, single spacing of the platen and tape will be had.

This cam lever 833 is supported on a stud 834 secured to the right side inboard frame 803 at a position just below the ribbon guide link pin 815 for the ribbon guide link 814. The forward end of this single space cam lever 833 can be lifted by certain controls not here pertinent, as, for example, the total arm of said copending application, against the bias of a spring, not shown, which resiliently holds the lever in the single space position shown. Rotation of the lever 833 clockwise will cause a depression of the cam surface 832. This allows the single space cam follower roller 831, when the pawl 822 is raised, to rise above the upper end of the single spaced

cam lever 833; and allows the tooth 825 to move forwardly sufficiently to enable it, upon downward movement of the pawl, to rotate the ratchet a distance of two teeth. Upon such downward movement of the ratchet pawl 822, the cam follower roller 831 will strike the upper end of the single space cam lever 833 and rotate it clockwise until the pawl-guide arm 823 pulls the platen pawl 822 rearwardly a sufficient distance to allow the lever to be released from the roller 831 and to again rise to its uppermost position as determined by the aforesaid controls.

Means for controlling the operation of the platen feed so that double spacing may be had at all times, is had by providing the machine with a three-armed spacing lever 857 which is pivoted on the stud 824 along with the pawl-guide arm 823. This spacing lever has an upwardly extending, manually operated, positioning arm 835 shown in single space position. Integral with the key arm is a forward arm 836 with a rightwardly turned end, or ear, 858 that overlies the spacing lever 833. Forward rotation of the arm 835 (counter-clockwise in Fig. 1) will place it in double space position, in which the forward arm 836 will rotate the single space cam lever clockwise to lower the cam surface 832 to give the platen double spacing upon machine cycling. The spacing lever has a third and rearwardly extending arm 837 having, in the rear edge thereof, detent notches 859 which are engaged by a detent pin 838 secured to a detent arm 839, carried on the pawl guide rocker stud 829, which detent arm is spring-urged to hold the detent pin in one or the other of such detent notches, depending upon which position the spacing lever has been set to, and thus hold the spacing lever in a set position.

Also pivoted upon the stud 824 with the guide link 823 and spacing lever 857 is a ratchet detent arm 840 which has at its forward end a roller 860 in engagement with the ratchet teeth. The ratchet detent arm is spring-urged, such as by tension spring 861, to cause the roller 860 to engage the teeth on ratchet plate 826. This ratchet detent serves to align the ratchet 826 as it is moved one or two spaces, to prevent unduly easy rotation of the platen, and to prevent overthrowing of the platen by its operating pawl 822.

The operation of the mechanism of my invention is believed obvious from the above description. It can be briefly summarized by pointing out that on each cycle of operation the shaft 107 will be rotated a full cycle. The two cams 2205 and 2207 mounted on shaft 107 will cause reciprocation of the yoke 2202 about its pivot shaft 905, thereby rocking arm 2250 and reciprocating the link 2212. Reciprocation of the link 2212 causes reciprocation of lever 2215 and its integral pin 2217. The pin 2217 will consequently reciprocate the connecting link 2256, which in turn causes reciprocation of the wrist plate 2351, connecting link 2309 and drive arm 2308R. The reciprocation of the wrist plate 2351 and drive arm 2308R will be effective to rotate one or the other of the ratchet plates 2312 or 2312R depending upon the slot 2304 or 2305 in which the pin 2217 is located. When one spool is completely unwound the tension of the ribbon resulting from attempting to wind it around the other spool, will block operation of the feed arm 2308R, link 2309, wrist plate 2351 and connecting link 2256 to cause the pin 2217 to slide into the other notch against the tension of spring 2255 and thus cause a reversal of the ribbon feed mechanism.

The rotation of the cams 2205 and 2207 also is operative to rock shaft 802 and the cam arm 806 secured to the right end thereof. The rocking of the cam 806 positively rocks the three-armed lever 850, and the spring connection between that lever and arm 813, biases the ribbon shift links 814 and 2231 upwardly. In most operations such elevation of the shifting links will be blocked by the hook 854 on arm 818 engaging the pin 820. However, in certain operations, when a contrasting color print is desired, the arm 818 is rocked by controls not here pertinent, to permit the spring bias to lift the two shift links 814 and 2231 to lift the ribbon guides.

The rocking of the cam 806 is also effective to cause vertical reciprocation of the platen feed pawl 822, which normally is in its forward position, to engage a single tooth on the ratchet wheel 826. The feed pawl, however, can be rocked rearwardly by means of lever 828 to disable the platen feed completely. The engagement of the feed pawl 822 with the ratchet wheel 826 is controlled by means of a control lever 833 which, when in the raised position shown in Fig. 1, limits rotation to a single tooth space. However, the arm can be rocked automatically, or by means of the lever 835 to enable a double space drive of the feed cam by enabling the pawl 822 to advance two teeth in its engagement with the ratchet wheel 826.

It will be understood that the machine shown and described herein is a preferred embodiment of my invention and that the mechanisms shown are capable of considerable modification by persons skilled in the art without departing from the spirit and scope of this invention. Accordingly the invention should be determined from the appendent claims which should be given an interpretation commensurate with the novelty herein disclosed and as broad as may be permitted by the prior art.

I claim:

1. A reversible ribbon feed for an office machine having a printing platen comprising ratchet wheels for mounting ribbon spools one at each end of the platen, a rockable drive arm associated with each ratchet wheel, drive pawls mounted one on each drive arm and engaging the teeth of the corresponding ratchet wheels, a connecting link connecting said drive arms, a power-driven oscillatable member, a drive link directly connecting one of said drive arms to said power-driven member and having means for engaging said power-driven member in either one of two positions spaced apart longitudinally of said link, resilient means between said link and said oscillatable member for biasing said drive link and said oscillatable member into engagement in either of such positions, and throwout ears disposed one adjacent each ratchet wheel and operable in one connecting position of said link with said oscillatable member to disable one of said drive pawls, and in the other position of said link and said oscillatable member to disable the other of said drive pawls.

2. A reversible ribbon feed for an office machine having a printing platen comprising ratchet wheels for mounting ribbon spools one at each end of the platen, a rockable drive arm associated with each ratchet wheel, drive pawls mounted one on each drive arm and engaging the teeth of the corresponding ratchet wheels, a connecting link connecting said drive arms, a power-driven oscillatable member, a drive link directly connecting one of said drive arms to said oscillatable member and having means for engaging said oscillatable member in either one of two positions spaced apart longitudinally of said link, resilient means connected between said link and said oscillatable member for biasing said drive link and said oscillatable member into engagement in either of such positions, throwout ears disposed one adjacent each ratchet wheel and operable in one connecting position of said link with said oscillatable member to disable one of said drive pawls and in the other connecting position of said link and said oscillatable member to disable the other of said drive pawls, check pawls cooperating one with each ratchet wheel to maintain a driven ratchet wheel against reverse rotation, and throwout ears mounted one on each drive arm and operable to disable either check pawl when the position of said drive link relative to said oscillatable member

disables the drive pawl associated with the corresponding ratchet wheel.

3. In a calculating machine having a cam shaft, cams on said cam shaft, and a yoke surrounding said cams and rockably mounted at one end on a fixed pivot, a reversible ribbon feed mechanism, a crank arm on the pivotally mounted end of said yoke, an oscillatable member mounted at one end on a fixed pivot and having its other end disposed adjacent said ribbon feed mechanism, means connecting said crank arm to said oscillatable member to oscillate said member, and means drivingly connecting said other end of the oscillatable member to said ribbon feed mechanism in a manner to periodically reverse the ribbon feed.

4. In a calculating machine having a cam shaft, cams on said cam shaft, and a yoke surrounding said cams and rockably mounted at one end on a fixed pivot, means for supporting a printing ribbon and reversibly feeding the ribbon in a step-by-step manner comprising supporting brackets mounted in spaced apart relationship to each other, spindles projecting upwardly one from each bracket, drive arms mounted one on each of said brackets for angular movements about the corresponding spindles, ratchet wheels journalled one on each spindle and disposed on the corresponding drive arms, said spindles being adapted to receive ribbon spools to which the corresponding ends of a ribbon are connected and said ratchet wheels being adapted to drivingly engage the corresponding ribbon spools, a cross link connected between said drive arms and effective to maintain simultaneous and coextensive movements of said arms, drive pawls carried one by each of said drive arms and engageable with the corresponding ratchet wheels to impart increments of rotation to said ratchet wheels coincident to angular movements of said drive arms, check pawls carried one by each of said brackets and engageable with the corresponding ratchet wheels to hold the ratchet wheels against reverse rotation, throwout formations carried one by each bracket and alternatively engageable with drive pawls to disable one of said drive pawls when said drive arms move within one predetermined range of angular movement and to disable the other drive pawl when said drive arms move within an alternative range of angular movement, throwout formations carried one by each of said drive arms and alternatively engageable with said check pawls to disable the check pawl corresponding to the disabled drive pawl when said drive arms move in said one range or said alternative range of angular movement, an oscillatable member mounted at one end on a fixed pivot and having its other end disposed adjacent one of said drive arms, a crank arm extending from the pivotally mounted end of said yoke, a link connecting said crank arm to said oscillatable member at a location intermediate the length of the member to oscillate said member, a drive link connected to said one drive arm and provided with interconnected notches spaced apart longitudinally thereof and alternatively receiving the other end of said oscillatable member, said drive arms being moved in said one range of angular movement when said other end of the oscillatable member is in one of said notches and in said alternative range of angular movement when said other end of the oscillatable member is in the other of said notches and said oscillatable member being moved from one to the other of said notches by resistance opposed by an associated ribbon to further rotation of the driving ratchet wheel when the ribbon has been fully wound from one ribbon spool onto the other ribbon spool to thereby reverse the drive of the ribbon feed mechanism, and means resiliently biasing said other end of the oscillatable member into said notches.

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