

April 28, 1942.

W. W. LANDSIEDEL

2,280,919

COMPUTING AND LISTING MACHINE

Original Filed March 13, 1936

6 Sheets-Sheet 1

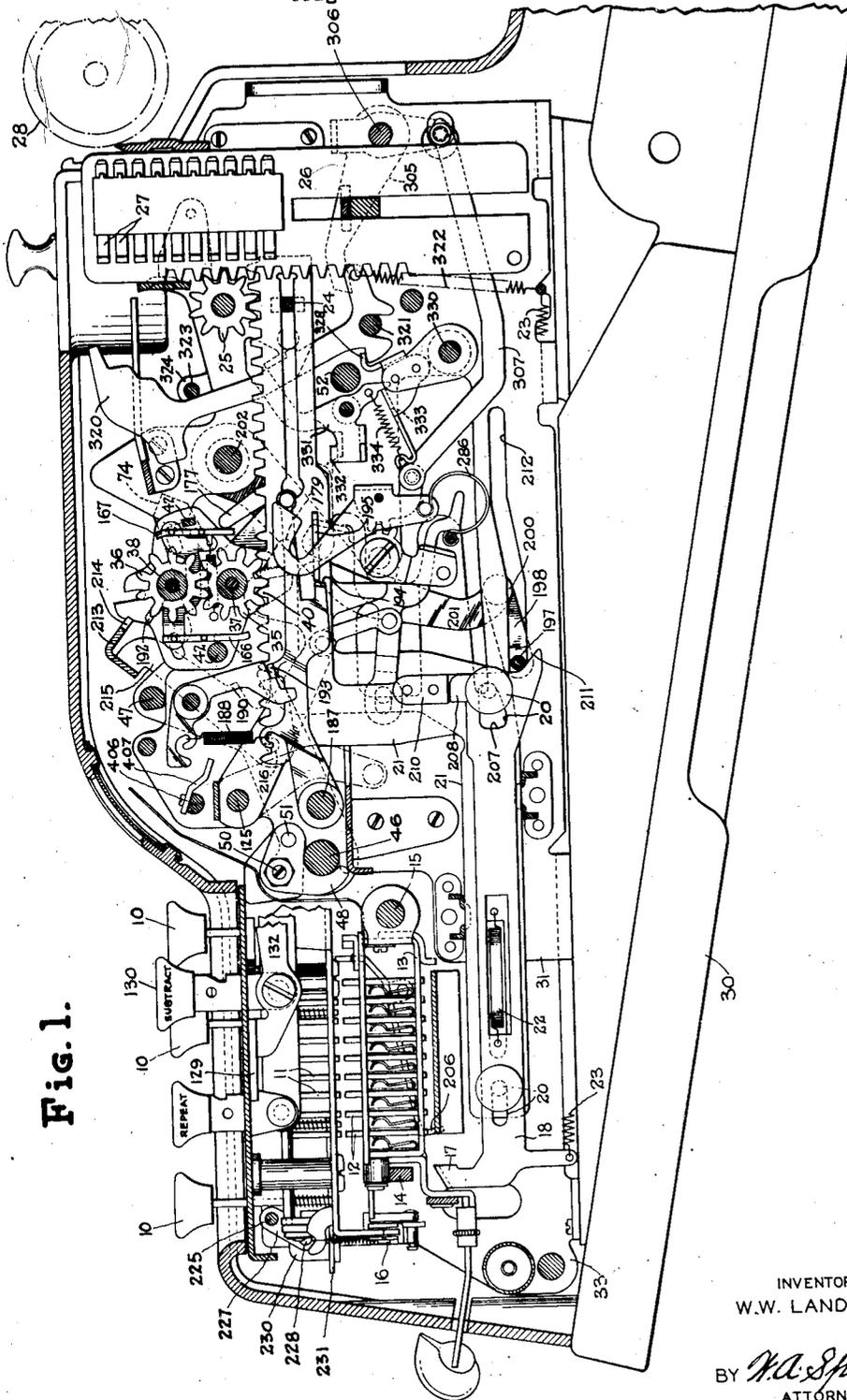


Fig. 1.

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6 Sheets-Sheet 2

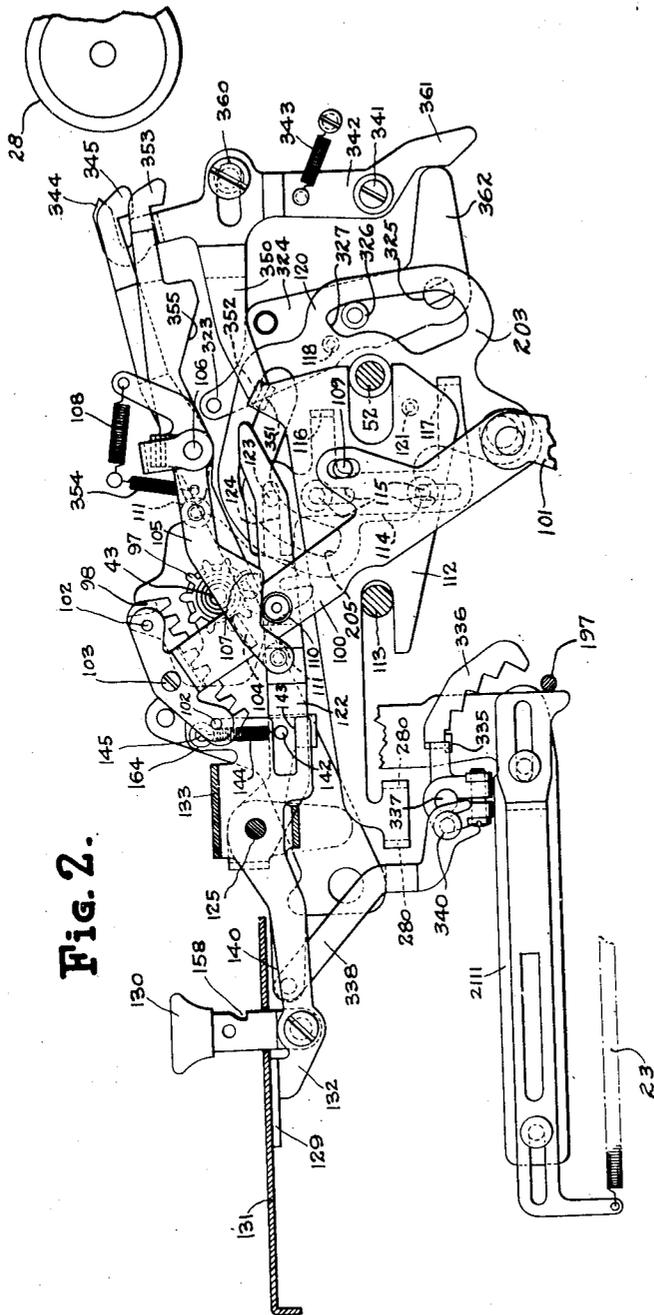


Fig. 2.

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6 Sheets—Sheet 3

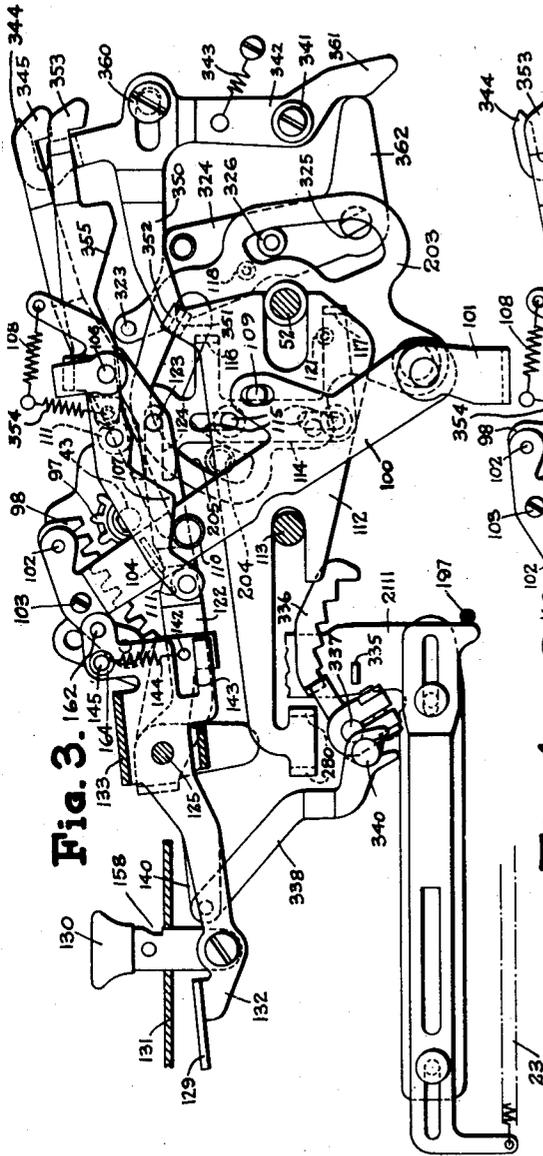


Fig. 3.

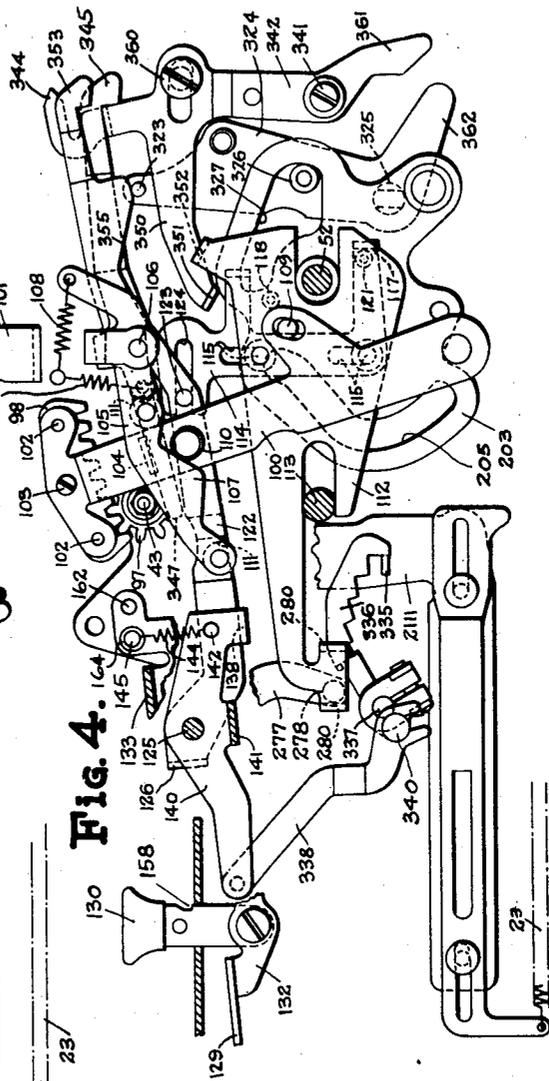


Fig. 4.

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6 Sheets-Sheet 5

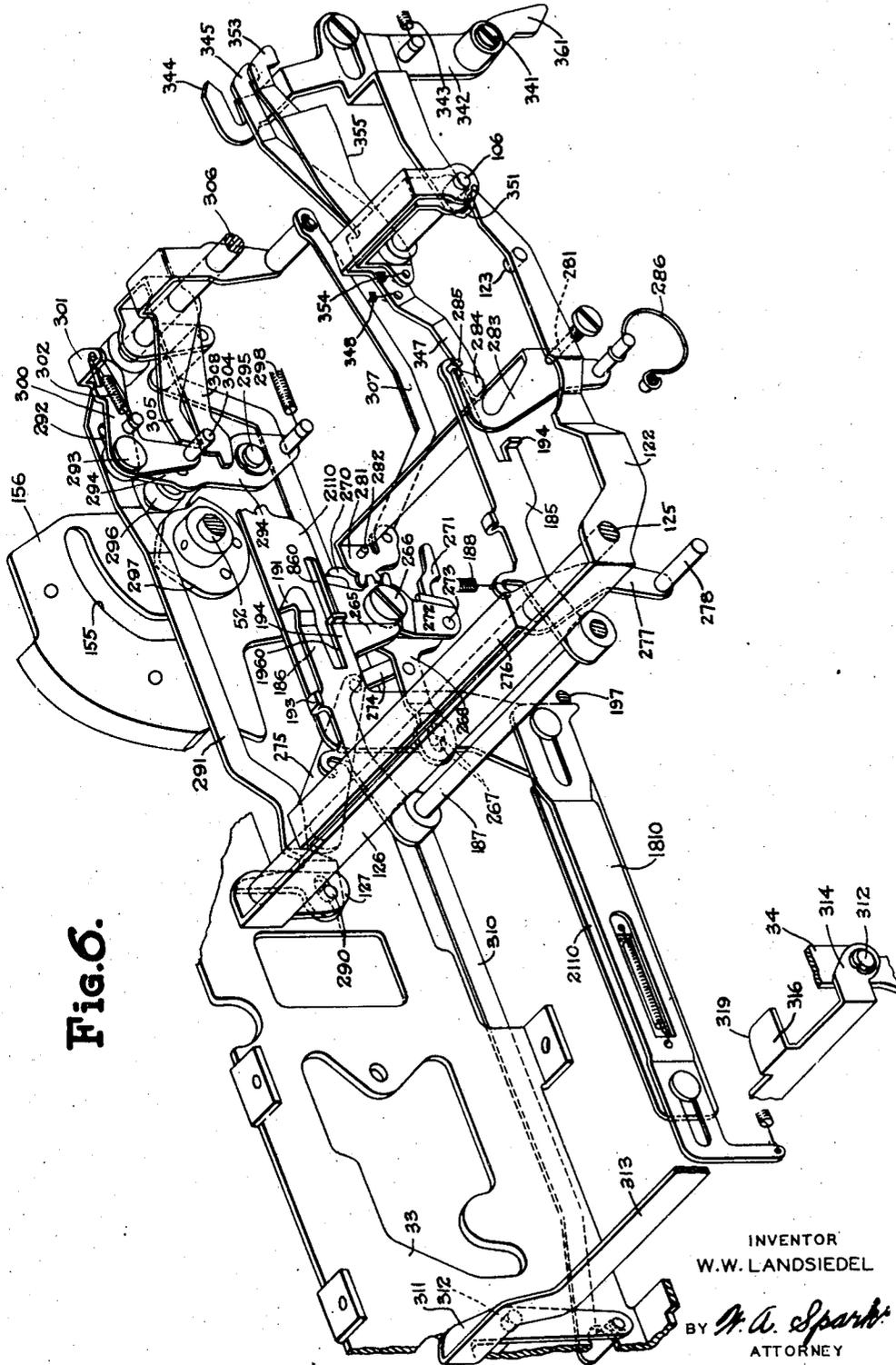


Fig. 6.

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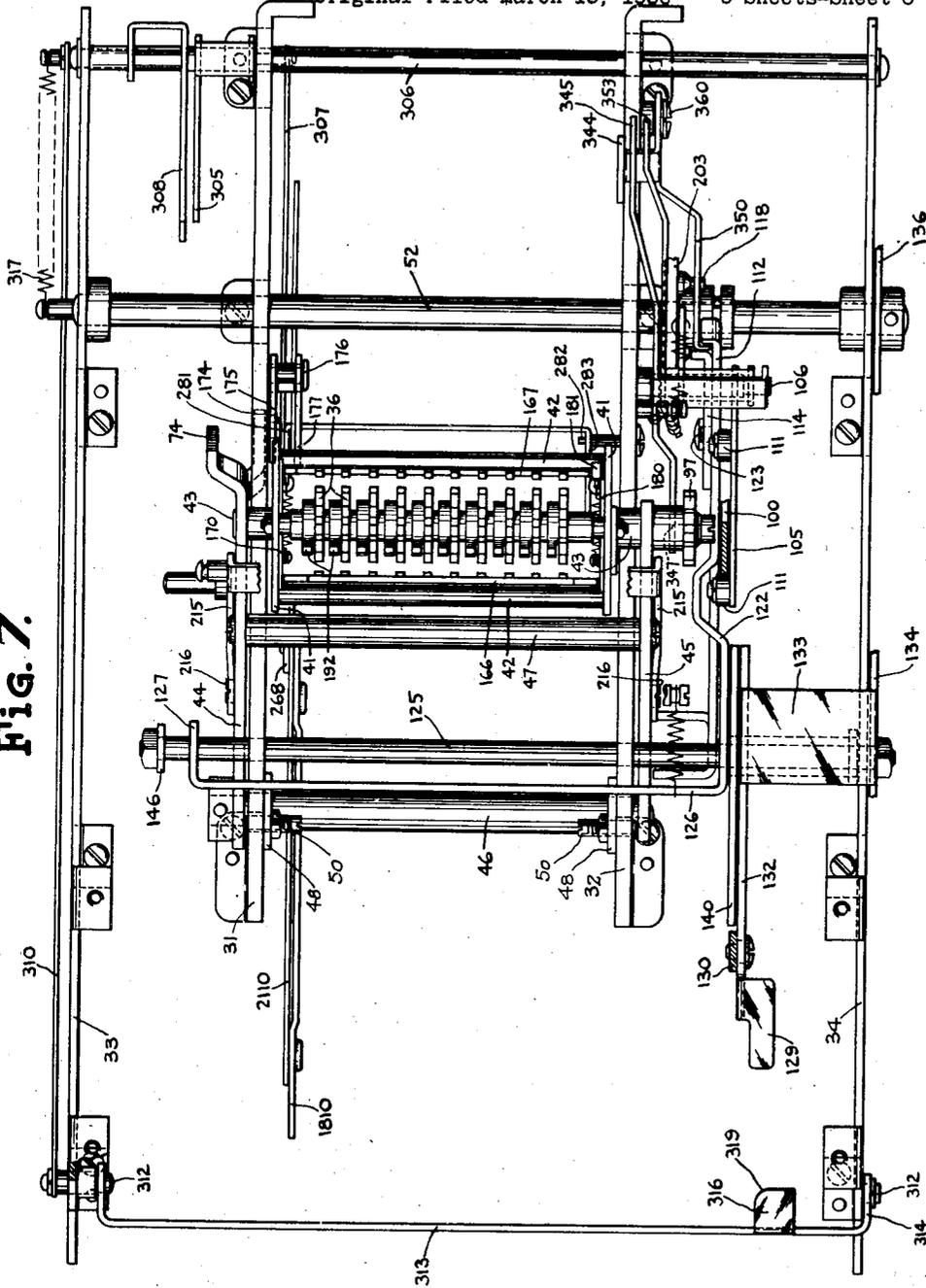
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6 Sheets-Sheet 6

Fig. 7.



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UNITED STATES PATENT OFFICE

2,280,919

COMPUTING AND LISTING MACHINE

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Original application March 13, 1936, Serial No. 68,694. Divided and this application November 3, 1938, Serial No. 238,596

4 Claims. (Cl. 235-60)

This invention relates to computing and recording machines and particularly to printing a special character whenever a true negative total is taken.

The present invention is herein shown and described in connection with a portable adding, subtracting and recording machine of the ten key class of the type shown in United States Patent No. 1,899,444 to Thomas O. Mehan, issued February 28, 1933, wherein the keys set stops in a traveling carriage. While the invention may be readily embodied in said machine with but slight changes in the existing structural features thereof, it should be understood that the invention may be embodied in other forms of computing machines, wherever found available.

This application is a division of my copending application S. N. 68,694, filed March 13, 1936 and which has since been issued as Patent No. 2,203,336 on June 4, 1940.

The object of this invention is to print a character to designate a true negative balance.

Another object is to latch a character bar to prevent printing thereby when a positive total is taken and release said bar when printing a negative total.

Another object of this invention is to cause the character bar to print at approximately the same time with the numerical type bars.

Still another object is to prevent the type bar from printing during computing cycles.

Other objects of this invention and details of construction will be apparent from the following description when read in conjunction with the accompanying drawings, in which:

Fig. 1 is a front to rear vertical section through the machine, with the parts in normal position;

Fig. 2 is a fragmentary right hand elevation illustrating the subtraction mechanism and some associated parts, the subtraction key and associated parts being in normal position;

Fig. 3 is a fragmentary right hand elevation of the subtraction mechanism with the subtract key depressed for performing a subtraction operation but the mechanism otherwise normal;

Fig. 4 shows the same setting as Fig. 3 but with the parts as they appear at the end of the forward stroke of the operating mechanism during a listing operation of a subtracted amount;

Fig. 5 is an enlarged left hand elevation of the mechanism used for shifting the register into and out of mesh with the actuating racks;

Fig. 6 is an isometric view illustrating the credit balance or negative total mechanism and associated parts; and

Fig. 7 is a partial plan view of some of the framing and some of the mechanism.

General construction

The machine comprises the usual ten numeral keys 10, Fig. 1, the stems 11 of which are adapted to set stops 12 in a step by step moving stop carriage 13, which carriage travels on rails 14 and 15 under the control of an escapement which is partially shown in Fig. 1 and designated 16. The escapement mechanism for controlling the travel of the stop carriage 13 may be of any well known construction. In the present instance the mechanism shown is similar to that disclosed and described in the above mentioned Mehan patent. In view of this and the fact that in no way affects the invention it will not be described in detail herein. The stops 12 when set are adapted to arrest ears 17 on slides 18 which latter are mounted by pin and slot connections 20, on horizontally movable differential slides 21. The slides 18 and 21 are connected by a spring 22 for the purpose of transfer and these slides are urged towards the rear of the machine by actuating springs 23. The slides 21 have their rear parts off-set upward and guided by a comb bar 24. Rack teeth on these bars mesh with pinions 25 which also mesh with vertical rack teeth on type carriers 26 having slidable type 27 for cooperation with platen 28.

The framework of the machine comprises a base casting 30, here shown so shaped as to tilt the rear end of the machine up somewhat, which is sometimes convenient in operation and which also serves to furnish room for a motor at the rear of the machine if desired. The mechanism is mostly supported on an inner frame comprising frame plates 31 and 32, (Figs. 1 and 7,) having ears which are screwed to the base plate and said upright plates 31 and 32 being united by various cross members. At some distance outside of these plates there are also a left hand vertical frame plate 33 and a right hand plate 34, these being mainly for supporting controls etc. The slides 21, type bars 26 and the computing mechanism are mounted between the plates 31 and 32.

Register

The register or accumulating mechanism, shown in Figs. 1, and 7, comprises in each denomination two register or accumulating wheels 35 and 36 in constant mesh, the former journaled on a shaft 37 and the latter on a shaft 38. In adding operations the wheels 35 mesh with rack teeth 40 on the slides 21 as shown, for ex-

ample, in Fig. 1, and in subtracting operations the wheels 36 mesh with said racks, and we may, therefore, refer to the wheels 35 and 38 as the adding wheels and the subtracting wheels, respectively.

The shafts 37 and 38 are rigidly mounted in a register frame consisting of two end plates 41 secured together by two frame rods or bars 42. Trunnions 43, Figs. 5 and 7, projecting from the plates 41 are journaled in side-arms 44 and 45 of a cradle which also comprises a rock shaft 46 to which the arms 44 and 45 are rigidly secured. Said cradle is stiffened by a cross bar 47. The shaft 46 is journaled in the frame plates 31 and 32, and it is by a rocking of this cradle that the register wheels are moved into and out of mesh with the racks.

Register engaging and disengaging

The operating mechanism comprises a main rock shaft 52, which carries certain cams and other operating devices, which shaft may be rocked by any suitable means such as a handle or motor. The means for moving the register into and out of mesh with the racks is best shown in Fig. 5 which is a view of the mechanism as seen from the left and with the outside frame plate 33 removed. Pivoted at 53 to the left hand arm 44 of the register cradle is a plate-like link 54 of special shape, somewhat like an inverted Y. The crotch at the lower end of this link comprises two shallow slots 55 and 56 for the reception of pins 57 and 58 projecting rightward from a plate 60 pivoted on a stud 61 projecting from an offset arm 62 of the left hand frame plate 31. Said plate 60 carries on its left hand face two pins 63 and 64 which project through suitable openings in a bracket 65 secured to the base casting of the machine and which bracket also helps to support the stud 61. The end crotch or notch of the link 54 is of a sort of diamond shape as shown in Fig. 5 so as to form cam edges which cooperate with the pins 57 and 58 to guide the latter into the notches or slots 55 and 56. The link 54 is normally held by a spring, to be hereinafter described, in its forward position with the pin 58 in the notch 56 so that if the plate 60 be rocked clockwise in Fig. 5 the register wheels will be lifted out of mesh with the racks on slides 21.

Such rocking of the plate 60 is normally effected by a wipe pawl 66 of the type usual in these machines, said pawl being pivoted to an arm 69 rigidly projecting from the main shaft 52. Said wipe pawl has a projecting finger 67 and two shoulders, one, 68, for cooperation with the pin 64 and another, 70, for cooperation with the pin 63. The pawl is influenced by a spring 71 but it is normally rocked clockwise by the action of a branch 72 thereof on a stud 73 projecting from the bracket 65. On the forward (clockwise) stroke of the shaft 52, as the arm 69 descends and the branch or finger 72 moves away from the stud 73, the wipe pawl swings counter-clockwise and the shoulder 68 acting on pin 64 rocks plate 60 clockwise and forces the register cradle upward to disengaging position, all in the first part of the stroke. After this the pawl 66 automatically reverses by wiping over the pin 63 and at the first part of the return stroke the shoulder 70 acting on said pin rotates the plate 60 counter-clockwise and draws the register wheels into mesh. In order to take totals the plate link 54 is swung clockwise, Fig. 5, whereupon the pin 57 will be cammed into the notch 55 and pin 64 will

be swung to a position where it will not be further moved by the pawl 66 on the forward stroke but the pin 63 will be engaged at the beginning of the return stroke and rock the plate 60 counter-clockwise. As the pin 57 is at the right of the pivot of said plate this motion will swing the register wheels out of mesh at the beginning of the return stroke. This mechanism is only briefly described because it is of a familiar type. The means for swinging the plate 54 to its different positions will be described hereinafter.

As best shown in Fig. 5 the arm 44 of the register cradle terminates in a V-tooth 74 cooperating with a detent lever 75 pivoted on a stud 76 projecting from the frame plate 31, said detent being drawn into engagement with tooth 74 by a spring 77. Its V-shaped tooth 78 serves to yieldingly hold the cradle in either of its two positions. The motion of said cradle downward is limited by the cross bar 47 striking the top edges of the frame plates 31 and 32. The motion of the cradle in the upward direction is limited by one of its arms striking a washer or roller 81 conveniently mounted on a cross rod 82.

Register reversing mechanism

The means for rotating the register frame 41 etc., through 180° from the adding to the subtracting position has been brought out in detail in my above mentioned patent and only so much of the mechanism will be described herein as is necessary to an understanding of the present invention.

In order to rotate the register frame as above mentioned, the right hand one of the trunnions 43 is prolonged beyond the arm 45 (Fig. 7) and has mounted thereon a pinion 97. When the register is lifted out of mesh, this pinion (Fig. 4) engages an internal segmental rack 98 which is secured to the end of an arm 100 which arm is pivoted at its lower end to a U-shaped bracket 101 secured to the base casting 30.

In the present machine the mechanism is set for subtraction in computing operations under the control of a subtract key, and on a blank stroke preparatory to total-taking it is also sometimes set for subtraction under the control of certain mechanism due to the fact that the register indicates a negative balance; and in computing operations the mechanism is automatically returned to adding condition upon the restoration of the subtract key and also sometimes on a blank stroke preparatory to total-taking due to the register indicating a positive total. In any of these events the arm 100 is actuated by a slide 112 having suitable slots by which it is guided for front and rear sliding motion, one of said slots being guided on the main shaft 52 and the other on a frame rod 113. The slide 112 is operatively connected with the arm 100 by pin and slot 109.

In order to operate the subtract slide 112 in one direction or the other as required during the proper part of the forward stroke of the main shaft said slide has a vertically slidable piece 114 mounted thereon by pin and slot connections 115, (Figs. 2 and 4) said piece 114 having formed thereon two ears 116 and 117. In adding operations the slide 114 occupies its lower position, shown in Fig. 2, and in that position the ear 116 lies in the path of a stud 118 on a main actuating cam 203 fast on the main shaft 52 so that on the forward rotation (counter-clockwise) of said shaft and cam said stud will force the slide 112 to its forward position carrying

with it the arm 100 and setting the mechanism for addition. In this position the ear 117 is beneath the path of another stud 121 fast on the cam 203. In order to set the machine for subtraction the slide 114 is moved to its upper position shown in Fig. 3 in which the ear 118 is out of the path of the stud 118 and the ear 117 is in the path of the stud 121 which stud being below the shaft 52 moves rearwardly during the forward rotation of said shaft and carries with it the slides 114 and 112 setting these to their rear positions and setting the register mechanism for subtraction, as shown in Fig. 4, which figure represents the position of the parts at the end of the forward rotation of the main shaft. It will be understood that the register will be dropped into mesh with the racks at the first part of the return rotation (clockwise) of the shaft. The slide 112 and arm 100 will remain in the position shown in Fig. 4 as long as the machine is set for subtraction.

The control slide 114 is set to its two positions by a lever 122 having a stud 123 playing in a horizontal slot 124 in the slide 114, said lever being pivoted on the subtraction shaft 125.

As best shown in Fig. 6 this lever 122 is one arm of a bail, the bar 126 of which extends across the machine to the left hand side thereof and is integral with a depending arm 127 which is also pivoted on the shaft 125.

The lever 122 is raised to its subtract position (Fig. 3) by means of a subtract key 130, the stem of which is connected to a key lever 132 secured to the shaft 125.

Referring to Fig. 4, the arm 122 rests on an ear 138 bent off from a lever 140 pivoted on the shaft 125, at two points connected by a yoke piece 141. The lever 140 lies to the left of the key lever 132 and between said lever and the lever 122 and it has a stud 142 projecting through a slot 143 in the key lever 132 which slot is of a width greater than the diameter of the stud. The stud is normally held against the upper edge of the slot by a spring 144 connected to a stud 145 on the key lever 132. The lever 122 is prolonged rearwardly so as to limit on a collar on the stud 106 as shown in Fig. 4, so that in case the subtract key is down the spring 144 can yield without putting any binding friction on the stud 123 and slot 124.

Transfer mechanism

The transfer mechanism employed in the present machine to transfer from one wheel to the next one of higher order includes transfer pawl 179 (Fig. 1) essentially similar to those used in the machine of the above mentioned patent.

The drawings show two pawls, one, 185 for controlling the wheels of lowest order and another, 186 (Fig. 6) controlled by the wheel of highest order. The pawls 179, 185 and 186 are pivoted on a transverse shaft 187 and are drawn upward by springs 188, each against the end of a detent 190, said detent being urged counter-clockwise by the spring 188. At its free end each of these pawls except pawl 185 has a cam tooth 191 adapted when a register wheel 35 passes from "9" to "0" or a register wheel 36 passes from "0" to "9" to be depressed by the carry or transfer tooth 192, of which each register wheel carries one at the left of its gear teeth. These transfer teeth project radially beyond the gear teeth as shown. When one of the transfer pawls is depressed by a transfer tooth the detent 190 snaps over the cooperating lug 193 of the pawl

and retains it in depressed position until released at a later period in the cycle. When the pawl is in its upper position a finger 194 thereof arrests a flange 195 secured to the right hand side of the next higher rack 21 arresting said rack one unit short of the point to which the slide 18 on said rack is restored. When the pawl is in its lower position, this flange 195 and the rack to which it is attached can move an extra unit distance until arrested by the end of the notch above the finger 194. This is substantially the ordinary transfer mechanism of this machine.

Zero stop

The means for arresting the register wheels at zero in total-taking comprises a bar 213, (Figs. 1 and 5), said bar having a series of teeth 214 on its lower edge for engagement with the transfer teeth 192 but out of the planes of the gear teeth. This plate is in effect a bail bar, the arms 215 of the bail being pivoted to the arms 44 and 45 of the cradle on pivot screws 216. The left hand one of these arms 215 has a radial slot into which a stud 217 projects from an arm of the plate link 54 which regulates the engagement and disengagement of the register. The construction is such that when said link 54 is in its forward or computing position, shown in Fig. 5, the bar 213 is held up in the position shown in Figs. 1 and 5 out of engagement with the register wheels; but when the link 54 is swung to its rear position for the purpose of taking a total the bar 213 is rocked downward until its teeth 214 are in the path of movement of the transfer teeth 192 of whichever set of register wheels 35 or 36 is at the time out of engagement with the racks. When the racks are moved towards the front of the machine the wheels that are in engagement with it are turned clockwise and those that are out of engagement are turned counter-clockwise until their transfer teeth are arrested in exact zero position by these teeth 214 and entirely independently of the transfer pawls.

In an algebraic register, positive "0" is the same as negative "9" and, vice versa, negative "0" is the same as positive "9." In the described arrangement, positive totals are taken with the add wheels 35 in engagement with the racks, by arresting the subtract wheels 36 at "9"; and negative totals are taken with the subtract wheels 36 in engagement, by arresting the add wheels 35 at "9." In short both kinds of totals are taken by the use of the same stop bail 213 which arrests in "9" position, the set of register wheels which, at the time is out of engagement with the actuators.

Total-taking controls

Totals are taken automatically without the use of a total key by merely giving two strokes to the main shaft, 52, the first being a blank stroke and the second the total stroke. As the total taking control mechanism is fully described in my above mentioned patent, it is not necessary to describe the mechanism herein except to state that the first idle stroke following the computing operation results in unlocking of the total slide (not shown) so that every succeeding stroke will be a total stroke in character.

Fugitive one mechanism

In order to obtain true negative balances provision is made for transferring the fugitive one from the register wheel of highest order to that of lowest order (Fig. 6). To this end a special

slide 2110 is provided similar to the slides 21 but without rack teeth and without provision for controlling any printing hammer, said slide having on it a slide 1810 like the slides 18, but without the ear 17 and without the special locking provision at the rear end of it. This slide 2110 has a flange 880 the same as the slides 21 and is controlled in the same manner by a finger 194 of a transfer pawl but with this difference, namely, that the slot 1980 into which the flange 88 moves when the lug 191 is depressed by the transfer tooth of the wheel of highest order is longer than the slots in the ordinary slides, so as to give to the slide 2110 a substantial extent of motion, when, on a change of sign in the total, this slide is released. The slide 2110 is also made with a depending finger 265 adapted to strike a pivot screw 266 to limit its rearward motion. Pivoted to the vertical section of the slide 2110 by pin and slot connection 267, is a Y-shaped link or hook 268 having the upper branch thereof shaped into a hook 270 and the lower branch into a hook 271. The two branches of this member pass between the two cheek plates of a lever 272 pivoted on the screw 266, said cheek plates being connected by two shouldered rivets 273. When the link 268 is swung up, its upper hook 270 engages the upper rivet 273 and if at this time the slide 2110 be released said hook will rock the lever 272 counterclockwise. When said link 268 is swung to its lower position, if then the slide be tripped off, the lower hook 271 will swing the lever 272 clockwise. The link 268 is swung to its two said positions by means of a link 274 pivoted thereto and to an arm 275 constituting one arm of a long bail pivoted on the shaft 125, hereinbefore referred to, and the bar 276 which extends across to the right hand side of the machine where the other arm of the bail is prolonged into a lever arm 277 hanging downward and having at its end a stud 278. As best shown in Figs. 4 and 6 the subtract slide 112 has an arm projecting toward the front of the machine and having two ears 280 bent off therefrom toward the left and embracing the stud 278. The construction is such that when said slide moves to the add position shown in Fig. 3 it rocks the ball 275—276—277 clockwise and swings the hook member 268 to its lower position. When, however, the subtract slide 112 moves to its rear or subtract position, shown in Fig. 4, it swings the hook member to its upper position.

The lever 272 is operatively connected by a few gear teeth with an arm 281 of a ball pivoted at 282 and extending across beneath the register mechanism to a point just to the right of the units wheel where the ball has its right hand arm 283 also pivoted. Said arm 283 extends upward and terminates goose-neck fashion in a V-shaped tooth 284 whose inclined edges are adapted to act cam fashion on a stud 285, projecting from the transfer pawl 185 which controls the slide 21 of units order. The whole construction is such that when the lever 272 is rocked in either direction the ball 281—283 is rocked in the opposite direction. The arm 283 and tooth 284 have two positions, in one of which the tooth 284 is forward of the stud 285 and in the other of which said tooth is at the rear of said stud; and in the act of swinging from either of these positions to the other, the tooth 284 trips the transfer pawl 185 and causes the fugitive one to be registered on the units wheel. An expansion spring 286 engaging a fixed stud at one end and a stud on the arm 283 at its other end is so ar-

ranged as to cross its dead center when the parts swing from one of the said positions to the other so that said spring tends to retain the parts in either position.

The mode of operation of the above mechanism is as follows: Assuming that the machine contains a positive total, as long as numbers are added the mechanism will at the end of each cycle come to the position shown in Fig. 6. Whenever, however, the mechanism is set for subtraction the hook link 268 will be moved to its upper position. If now a number be subtracted greater than the sum already registered, the wheel of highest order will be turned from "0" to "9" and the transfer pawl 185 will be depressed and the slide 2110 will jump towards the front of the machine, the hook 270 will rock the lever 272 counter-clockwise and the arm 283 clockwise causing the tooth 284 to pass over the pin 285, momentarily depressing it, and said tooth will pass on beyond said pin. This trips the transfer affecting the units rack and subtracts one from the units wheel. It will be perceived that the levers 272 and 283 will occupy these positions as long as the total indicated on the register remains negative. Even if the capacity of the register should be exceeded so that there was another transfer from the wheel of highest order, the slide 2110 would jump forward as before but the hook 270 would find the lever 272 already in its rocked position and nothing would happen. If now on further computation the machine is set for addition then the link 268 will rock back to its lower position but the lower rivet 273 will then be in its rear position instead of in its forward position. If now a number be added in excess of the negative total already registered, then when the slide 2110 is tripped and jumps forward the hook 271 will rock the lever 272 and the arm 283 back to their positive positions, where they will remain as long as the total indicated on the register continues positive. In this return motion of the lever 283 the tooth 284 will again act on pin 285 and cause the fugitive one to be added into the units wheel. It will be perceived that the position of the parts 272 and 281 serve as an index to the sign of the total registered on the wheels.

Automatic register reversing mechanism

The so-called credit balance mechanism includes not only means for indicating a true negative balance on the register wheels, but also means for automatically setting the machine for subtraction on the blank stroke in case the balance indicated on the wheels is negative, and for automatically setting the machine for addition in case the balance is positive. Thus the operator, to take a total, has only to give two strokes to the operating mechanism and the total will automatically be printed in its true character whether positive or negative.

The means for automatically setting the machine for addition or subtraction as the case may be on taking totals, is controlled by the member 281 the position of which indicates the state of the register. It will be recalled that the machine is set for subtraction by lifting the arm 122, Fig. 6, also that said arm, which is on the right hand side of the machine, is connected through yoke bar 126 with a depending arm 127 on the left side of the machine. This depending arm has lost motion pin and slot connection 290 with a horizontal bar 291 extending therefrom towards the rear of the machine. Said bar has

near its rear end a horizontal slot 292 by which it is guided for longitudinal motion on a stud 293 secured to a lever 294 which lever is pivoted to the frame plate 31 on a fixed stud 295. Said lever 294 carries a follower roller 296 adapted to bear against a cam 297 fast on the main shaft 52, the lever 294 being urged counter-clockwise by a spring 298 to press said roller against said cam. In the normal position of the parts the roller rests on a low part of the cam or rather against a rather steep incline so that in the very first part of the forward stroke of the shaft the roller is forced towards the rear of the machine which motion can be affected without moving the bar 291, the stud 293 merely sliding in the slot. When the lever 294 is thus rocked it will, however, carry the bar 291 with it and set the machine for subtraction in case the register indicates a negative total. To this end there is pivoted on the stud 293 a pawl 300 adapted to engage beneath a flange 301 bent off of the rear end of the bar 291, said pawl having a shoulder adapted to engage the forward edge of said flange and to move the bar 291 rearward. The pawl is urged upward into engagement with the ear 301 by a spring 302. Said pawl has a depending arm from which a stud 304 projects across the forward end of a blocking piece or lever 305 pivoted on a transverse shaft 306. This blocking member or lever gets a wide bearing on the shaft 306 by reason of its yoke form, as shown in Fig. 6, and it has a depending arm which is connected by a link 307 with a depending arm of the member 281 hereinbefore described. It will be recalled that this part 281 stands in the position shown in Fig. 6 whenever the register contains a positive total. In this position of the parts the link 307 holds the blocking member 305 with its end squarely behind the stud 304 with the result that if the shaft 52 be rocked and the lever 294 be rocked clockwise the stud 304 will be arrested by the part 305 and as the pivot 293 moves rearward the pawl 300 will be deflected downward so that its tooth will pass under the flange 301 without operating it. If, however, the part 281 is in its alternative position indicating a negative total the link 307 will have been moved towards the front of the machine and the member 305 will have been rocked upward and the stud 304 will not be blocked and the pawl 300 will draw the link 291 towards the rear of the machine. This link will rock the arm 127, bail bar 126 and subtract lever 122 and cause the machine to be set for subtraction on the blank stroke of the machine.

The mechanism just above described is prevented from setting the machine automatically for subtraction at every operation thereof by a device 308, which cooperates with the stud 304 in such a manner that it always blocks the stud except when the stop carriage 13 is in its initial right hand position. As the control of the above device 308 is fully described in my above mentioned patent, and inasmuch as it does not form the subject matter of the present invention, it is not deemed necessary to describe said control in detail herein.

By the mechanism just described the machine will automatically be set for subtraction only on blank strokes; and it will be so set on every blank stroke when the mechanism finds a negative total on the register wheels. In case the last computing operation was a subtraction and the register indicates a positive total, the mech-

anism will automatically be set on the blank stroke to addition in the same manner as hereinbefore described.

Numeral printing mechanism

The numeral printing mechanism has not been substantially changed from prior disclosures of this machine. The types, at the proper moment, are driven against the paper by hammers 320 pivoted at 321, Fig. 1, and actuated by springs 322. The hammers are restored by a ball bar 323 (Figs. 1 and 3), joining two arms 324, one at each side of the machine and each pivoted at its lower end at 325. The right hand one of these arms, shown in Figs. 3 and 4, carries a follower roller 326 cooperating with an internal cam cutout in the main actuating cam 203 on the shaft 52. The forward edge of this cutout is concentric with the shaft but the rear edge is inclined outward and in the normal position of the shaft said rear edge has forced the roller 326 and the ball frame 323—324 to their forward position against the tension of a suitable spring, thus forcing the type hammers to their forward positions. Fig. 4 shows the parts in the position they occupy at the end of the forward stroke where the cam edge 327 has widened out so as to permit the roller 326 and the ball frame to resume their rear positions leaving the hammers free of the ball. When the hammers are restored they are locked by a bail 328 mounted on a shaft 330 and released automatically at the proper instant in the usual manner. The hammers are also equipped with the usual individual latches 331, Fig. 1, each having a forwardly extending arm 332 controlled in the usual manner by the slides 21, these latches being normally held up by bail bar 333 and influenced by springs 334.

Having thus described the machine in general the following is a description of the present invention embodied therein.

Negative total designation mechanism

In order to indicate automatically in the printing when a printed total is negative, the following mechanism is provided (Figs. 3, 4, and 6): On a stud 341 projecting rightward from the frame plate 32 there is mounted a printing lever 342 urged rearward by a spring 343. The upper end of this lever is made into a V-shaped device 344 adapted to strike the paper or the ribbon and to make a horizontal minus mark. The upper end of the lever 342 is given a double bend to offset it towards the left so as to bring this mark just to the right of the characters printed by the character types above referred to. The offset bend in this lever furnishes a horizontal portion thereof which is utilized as a means for controlling the lever 342. To this end a latch lever 345 is pivoted on the stud 106, said lever having a forwardly extending arm 347 which lies beneath a collar on the right hand trunnion 43 of the register frame, and this latch is urged into engagement by a spring 348. The construction is such that the latch always engages the type lever 342 when the register is out of engagement with the racks and is moved out of engagement with the type lever when the register is moved into engagement with the racks. In computing cycles the register is not moved into the racks until after the printing operation takes place and, therefore, at that time the special type bar 342 is locked. In total taking operations the register is in engagement at the time

of printing and this special minus type bar is, therefore, free of the latch 345 at that time and in case the total is negative the minus sign will be printed but it will not be printed should the total be positive.

In order to prevent the printing lever 342 from printing when the total is positive, said lever is made with a forwardly extending arm 350 having an ear 351 bent off rightward therefrom as shown in Fig. 4. The subtract slide 112 has a cooperating ear 352 bent off leftward therefrom in such a position that when, as in Fig. 3, the lever 342 is in its retracted position and the slide 112 is in adding position the interlocking engagement of these two ears will lock the lever 342 against operation. When the total is negative, however, slide 112 is always moved to its rear position shown in Fig. 4 and the ear 352 is thus moved out of the path of the ear 351 and the minus sign is printed.

An additional lock for lever 342 may be provided to cause it to be held in inactive position until the proper moment at which time the total printing occurs. This lock consists of a latch lever 353 pivoted on the stud 106 and urged into engagement by a spring 354. The lower edge of this latch is made with an incline 355 by which the latch is lifted by the ball 323 when the latter swings to its rear position just before printing takes place.

The lever 342 is suitably guided by a headed screw 360 passing through an arcuate slot in said lever. In order to restore the lever to its retracted position it is made with a cam shaped lower arm 361 and finger 362 on the right hand arm 324 acts on this arm 361 to restore the lever 342 at the same time that the type hammers are restored.

While I have described what I consider to be a highly desirable embodiment of my invention, it is obvious that many changes in form could be made without departing from the spirit of my invention, and I, therefore, do not limit myself to the exact form herein shown and described, nor to anything less than the whole of my invention as hereinbefore set forth, and as hereinafter claimed.

What I claim as new, and desire to secure by Letters Patent, is:

1. In a listing and computing machine, the combination of a register including register wheels adapted to register true positive and negative balances, actuating racks for said wheels, printing mechanism including printing hammers controlled by said actuating racks for printing said positive and negative balances, a bail movable from and to normal position for restoring said printing hammers, a type for printing a character to identify a printed negative balance, a latch for restraining said type from operation, and a cam on said latch cooperative with said restoring bail whereby said latch is disabled when said restoring ball moves from normal position.

2. In a listing and computing machine, the combination of a register cradle frame in which

is supported two sets of intermeshed register wheels, actuators for said wheels, means for moving said cradle frame toward and from said actuators to engage and disengage said wheels and said actuators, a device for reversing said cradle whereby positive and negative amounts may be entered in said register wheels, a type for printing a character to identify a printed negative total contained in said register wheels, a latch to restrain said type from moving to printing position, and a trunnion for said cradle frame to engage said latch and disable same when said cradle is moved toward said actuators.

3. In a listing and computing machine, the combination of a register cradle frame in which is supported two sets of intermeshed register wheels, actuators for said wheels, means for moving said cradle frame toward and from said actuators to engage and disengage said wheels and said actuators, a device for reversing said cradle whereby positive and negative amounts may be entered in said register wheels, a fugitive one mechanism for controlling said cradle reversing device, printing mechanism including printing hammers controlled by said actuating racks for printing said positive and negative totals, a bail movable from and to normal position for restoring said printing hammers, a type bar for printing a character to identify a printed negative total, a latch for restraining said type bar from moving to printing position, a trunnion for said cradle frame to engage said latch and disable same when said cradle is moved toward said actuators, a second latch for restraining said type bar from moving to printing position, a cam on said second latch cooperative with said restoring bail whereby said latch is disabled when said restoring bail moves from normal position, holding means to restrain said type from moving to printing position, and means under control of said cradle reversing device whereby said holding means is effective when said register wheels contain a positive total and rendered ineffective when said register wheels contain a negative total.

4. In a listing and computing machine, the combination of a register; a transfer mechanism for said register including means for inserting the fugitive one to accumulate true positive and negative totals; a slide member under control of the fugitive one mechanism, said member being movable to add position when said register contains a positive total and to subtract position when said register contains a negative total; a type bar for printing a character to identify a printed negative total; a lug on said type bar; and an obstruction on said slide member, said obstruction being engageable with said lug to restrain said type bar from moving to printing position when said member moves to add position, and movable out of the path of said lug to permit said type bar to move to printing position when said member moves to subtract position.

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