Dec. 27, 1949 R. E. BOYDEN 2,492,263

TYPE WHEEL DETENT MEANS ON CALCULATING MACHINES

Original Filed March 13, 1945 4 Sheets-Sheet 1

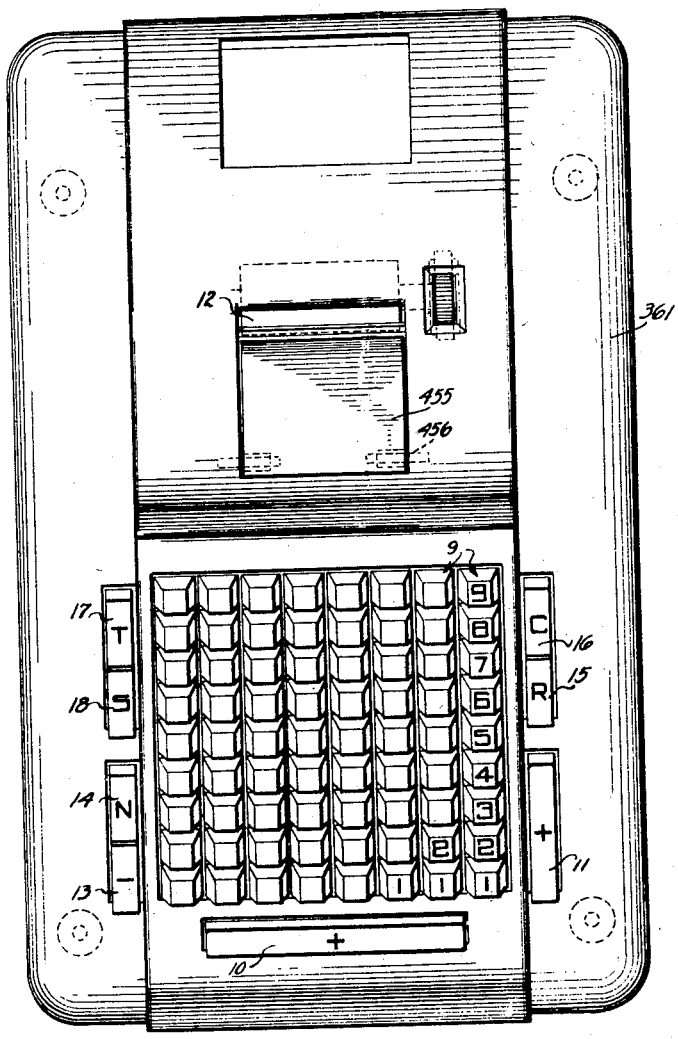

FIG_1.

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TYPE WHEEL DETENT MEANS ON CALCULATING MACHINES

Original Filed March 13, 1945 4 Sheets-Sheet 2

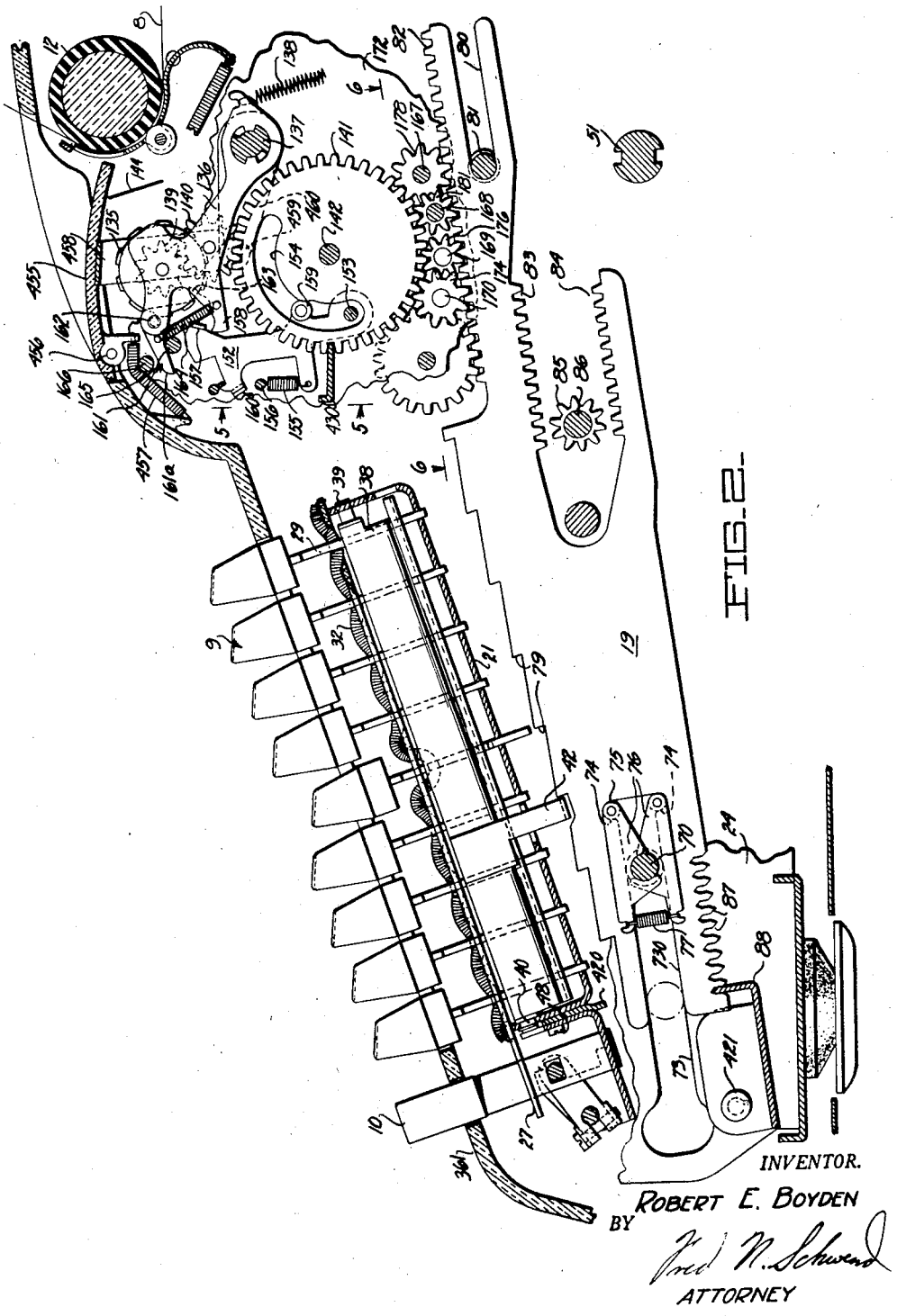

FIG. 2.

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TYPE WHEEL DETENT MEANS ON CALCULATING MACHINES

Original Filed March 13, 1945 4 Sheets-Sheet 3

FIG. 3.

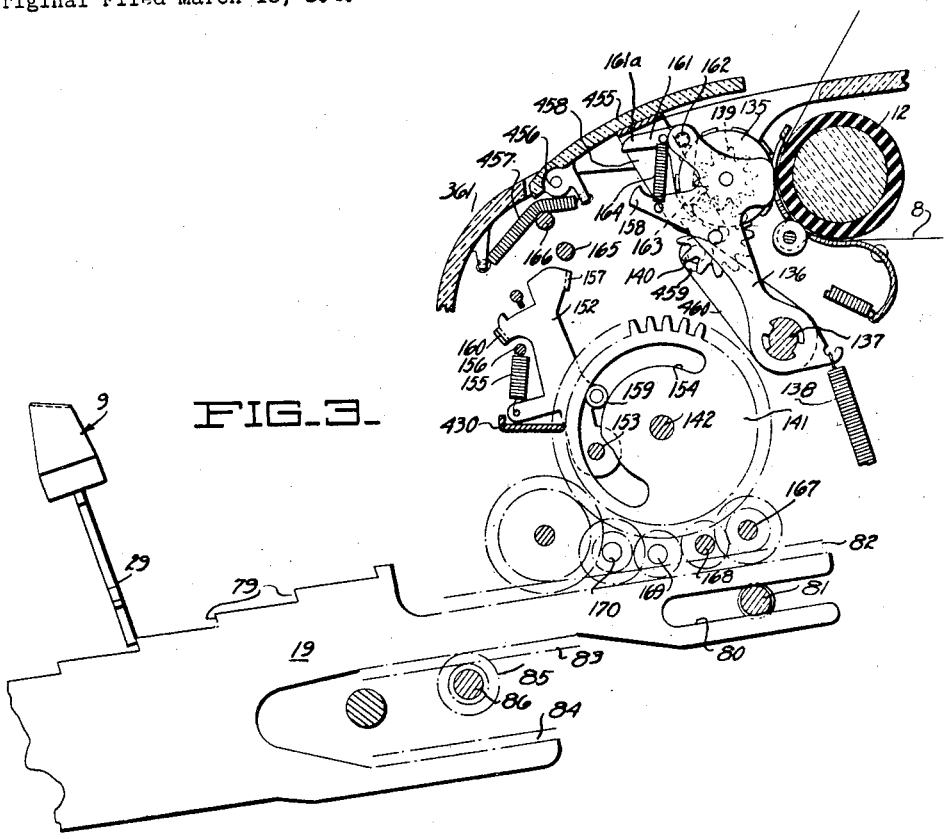
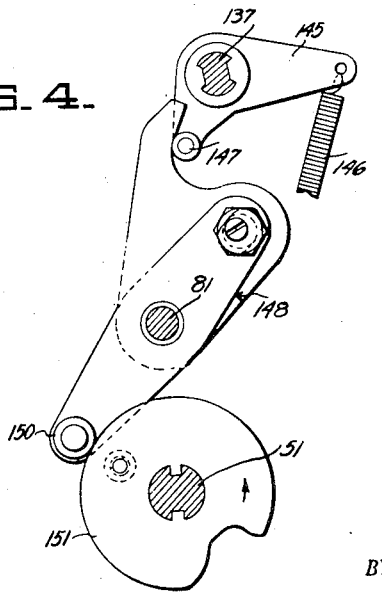


FIG. 4.



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TYPE WHEEL DETENT MEANS ON CALCULATING MACHINES

Original Filed March 13, 1945 4 Sheets-Sheet 4

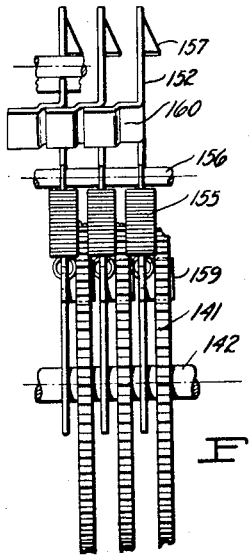

FIG. 5.

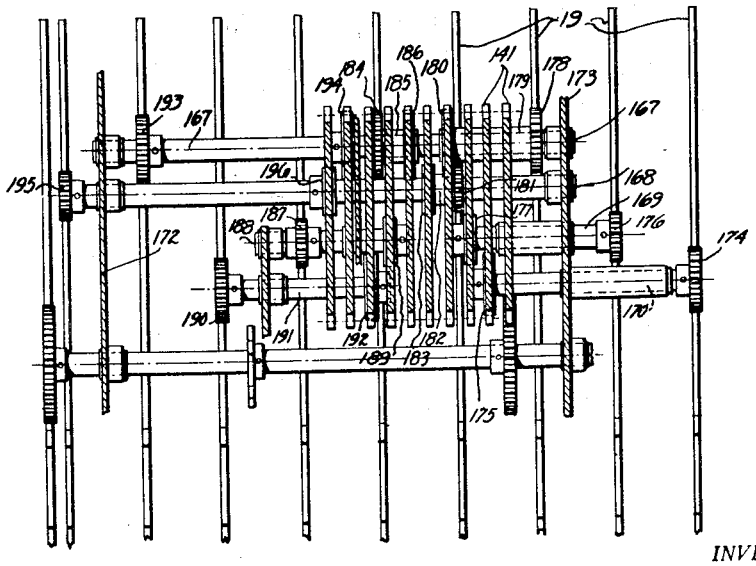

FIG. 6.

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Patented Dec. 27, 1949 2,492,263

UNITED STATES PATENT OFFICE

2,492,263

TYPE WHEEL DETENT MEANS ON CALCULATING MACHINES

Robert E. Boyden, Los Angeles, Calif., assignor to Clary Multiplier Corporation, Los Angeles, Calif., a corporation of California

Original application March 13, 1945, Serial No. 582,553. Divided and this application December 6, 1946, Serial No. 714,587

6 Claims. (Cl. 101—94)

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This invention relates to calculating and the like machines and has particular reference to printing mechanisms for use in connection therewith.

In the last few years, the speed of machines of the above type has been increased to obtain better efficiency and, as a consequence, the detenting of different intermittently operating parts in order to prevent overthrow or rebound thereof has become a problem of considerable importance.

Among the most serious problems of this type is the provision of detenting devices for geared elements, such as type wheels, which are meshed with drive gears therefor and are thereafter demeshed therefrom after being driven to selected angular positions.

Generally, in mechanism of this type, the speed of the machine must be restricted to a point where the usual yieldable detenting devices may operate safely or the timing of the machine is so arranged that the driven element or the unit is safely arrested by its driver before the demeshing operation is commenced so that the element cannot overthrow or rebound from its yieldable pawl. However, such arrangement of timing generally results in crowding of other phases of the machine cycle with consequent final limiting of the machine speed.

Also, attempts made heretofore to positively detent the driven elements have met with difficulty in view of the bodily movement of such elements into and out of mesh with their drivers.

One object of the present invention to provide a detenting device which positively prevents overthrow or rebound of a driven element such as a printing wheel, regardless of such tendencies when the element is disengaged from its driver.

Another object is to provide a spring urged detenting device of the above type which is normally sufficient under its spring urge to effect a detenting function which will be positively operated if the spring urge is insufficient.

Another object is to provide a detenting device for a geared element, such as a printing wheel, which element is carried to and from meshing engagement with the driving device therefor, such detenting device being effective to positively prevent overthrow of the geared element and which is renderfed ineffective to perform a detenting function when the geared element is brought into meshing engagement with its driver.

Another object is to facilitate removal of a printing unit from a calculating machine.

The manner in which the above and other objects of the invention are accomplished will be readily understood on reference to the following specification when read in conjunction with the accompanying drawings, wherein:

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Fig. 1 is a plan view of a machine embodying a preferred form of the invention.

Fig. 2 is a longitudinal sectional view, with parts broken away, of the machine, illustrating the printing mechanism and the means for controlling registration thereof.

Fig. 3 is a sectional view similar to that of Fig. 2 but illustrating the printing mechanism in a phase partially through its operation.

Fig. 4 is a side view illustrating the control shaft operating means.

Fig. 5 is an enlarged front view of part of the printer control mechanism and is taken substantially along the line 5—5 of Fig. 2.

Fig. 6 is a sectional plan view of the condensing arrangement for transmitting a drive from the drive racks to the printer mechanism and is taken along the line 6—6 of Fig. 2.

The present invention is disclosed in connection with a motor operated, key controlled adding machine of the type disclosed and claimed in the copending application of Robert E. Boyden, Serial No. 582,553, filed March 13, 1945, and entitled "Calculating machine." The present application is a division of said copending application and reference is hereby made thereto for an understanding of details of the machine not specifically disclosed herein. However, it is to be understood that at least certain phases of the invention may be applicable to other types of mechanisms and other types of machines.

Referring in general to Fig. 1, an amount to be added or subtracted is entered in the machine by depressing appropriate "amount" keys 9. In order to add this amount into an accumulator, one or the other of two add bars 10 and 11 is depressed. This amount is then added into the accumulator and is also printed on a paper strip 8 (Figs. 2 and 3) guided over a platen 12. If the amount set on the keys 9 is to be subtracted from an amount stored in the accumulator, a "minus" bar 13 is depressed.

If it is desired to print an amount set up on the keys 9, but not to add the same in the accumulator, a "non-add" bar 14 is depressed. If it is desired to add the same amount in the accumulator two or more times, a "repeat" bar 15 is depressed and held down until the requisite number of additions are made by the machine.

If a wrong amount is set up on the keys 9, the keyboard may be cleared by depressing a "cor-

rection" bar 16 which releases the keyboard without starting the motor.

If it is desired to obtain a total of a value registered on the accumulator, a "total" bar 17 is depressed. In the event it is desired to obtain a sub-total, a "sub-total" bar 18 is depressed.

The control mechanism rendered effective by depression of the various aforementioned control bars, as well as the operating mechanism of the machine, is omitted in this application for the sake of brevity and clarity, since it is not deemed necessary for an understanding of the invention. However, it should be noted that the operating mechanism includes a cyclic shaft 51 (Figs. 2 and 4) which, upon a momentary depression of any of the control bars 10, 11, 13, 14, 15, 17 or 18 is given a single complete rotation to effect a cycle of operation of the machine.

The keyboard comprises a series of rows of amount keys 9, the key stems 29 of which are slidable in aligned slots formed in a top plate 27 and a key frame 21. The keys in each bank are yieldably pressed upward by a tension spring 32 extending the length of the keyboard and suitably attached at opposite ends to the plate 27. Upon depression of a key, the adjacent portions of the spring are stretched to yieldably urge the key toward its raised position.

Means are provided for locking depressed keys in their lowered positions and for releasing any such depressed keys. Each key stem has a cam (not shown) formed thereon which, when the key is depressed, rocks a locking bail 38 pivoted at opposite ends thereof to the front and rear side walls of the frame 21 by trunnion bearings 39 and 40. At the end of its stroke, the cam lobe passes below the bail, enabling the latter to retract partially under the action of a spring (not shown) to a position where it latches the key depressed.

A zero stop 42 is attached to each locking bail 38 and, when no key in any one order is depressed, the bail 38 of that order will be spring held in an extreme inwardly rocked position in which the zero stop lies directly in front of one of a series of shoulders 79 formed on an associated drive rack 19, thereby preventing any substantial forward movement of the rack during subsequent phases of a machine operation. However, when any amount key in that order is depressed and latched down, the locking bail will be held outward sufficiently to maintain the associated zero stop out of the path of the aligned rack while the key stem of the depressed key will be positioned in front of one of the series of shoulders 79 on the aligned rack 19. The shoulders are so spaced that the rack will subsequently be allowed to move forward a number of increments equal to the value of the depressed key before being arrested thereby.

Referring to Fig. 2, each of the drive racks 19 is provided with elongated slots 80 and 730 fitted over shafts 81 and 70, respectively, forming supporting and guiding means for the racks.

Each of the slots 730 terminates in opposed lateral depressions 74 at its closed end. Each of these depressions is normally engaged by a roller 75 carried by a drive element 76 which is rockably fitted within a groove in the shaft 70. The adjacent drive elements 76 associated with any one rack 19 are spring urged in opposite directions about shaft 70 by a tension spring 77 connected between the tails of the two elements, thus forming a yieldable connection between the shaft and the respective drive rack 19.

During a cycle of operation of the machine the shaft 70 is moved forwardly along slots 73 formed in machine frames (one of which is shown at 24) and in so doing, the various drive elements 76 carry therewith the racks 19 until they are stopped by the key stems of any depressed keys, or a stationary "9" stop bar 420 in the event a "9" amount key is depressed. In case no key in any one order is depressed, the drive elements 76 in that order will be ineffective to drive the associated rack. At such time the rollers 75 will ride out of the depressions 74 against the action of spring 77, thus breaking the connection between the shaft and the racks.

A pair of opposed rack gear sections 83 and 84 are disposed on opposite sides of an associated accumulator gear or element 85 and thus serve to selectively rotate the gear in either of opposite directions, depending upon the vertical setting of a shaft 86 supporting the latter gears.

In order to accurately locate each drive rack 19 in any of its incremental positions, a locking bail 88 is provided, being pivoted on trunnion bearings 421 and movable into any of a series of notches 87 which are spaced apart distances equal to the different increments of movement of the rack. The bail is normally in locking engagement with the rack but is moved outward from engagement therewith during the forward and return travel of the rack.

Printer

The printer comprises a series of numeral printing dials or elements 135 equal in number to the number of drive racks 19. Each numeral dial has thereon a series of type characters ranging progressively in value from 0 to 9, and these dials are so connected to the associated racks that each will print a digit corresponding to the value of the amount key depressed in the associated key bank or to the numerical position to which the rack is moved in its forward stroke.

Each printer dial 135 is rotatably mounted on a separate arm or carrier 136 which is loosely keyed on a printer control shaft 137 and spring urged clockwise by a tension spring 138 extending between the arm and a suitable portion of the machine frame. Each dial 135 has integrally secured thereto a gear 139 permanently meshed with a gear 140 also rotatably mounted on the associated arm 136. When an arm 136 is held in its normal position illustrated in Fig. 2 by the shaft 137, the gear 140 is meshed with an aligned one of a series of large idler gears 141 rotatably mounted on a cross shaft 142. The latter idlers are continuously entrained with respective ones of the drive racks 19 through a series of pinion assemblies to be described presently.

At approximately the mid-point in a machine cycle, and after the racks have digitized the accumulator and printer, the printer control shaft 137 is rocked clockwise permitting the springs 138 to rock those printer arms 136 which are otherwise allowed to do so, and thus carry the printing dials 135 forward into contact with a printing ribbon 144 and the paper strip 8 carried around the periphery of the platen 12, whereby the value registered on the dials will be printed onto the paper at the printing point.

Referring to Fig. 4, the shaft 137 is securely fastened to a lever 145 urged clockwise by a strong tension spring 146 and provided with a roller 147 held against a camming lever assembly 148 pivoted on a shaft 81. A roller 150 on the lower end of the lever assembly rides on the

periphery of a cam 151 keyed to the aforementioned cyclic shaft 51. Thus, as the shaft 51 rotates through approximately 180 degrees of its cycle, the spring 146 becomes effective to rock the shaft 137 clockwise to effect the printing operation. The contour of the cam 151 is such that immediately after impact of the printing dial 135 with the printing ribbon and paper, the arms 136 are returned to their original positions illustrated in Fig. 2.

Means are provided for preventing printing of zeros to the left of the highest significant digit being printed while enabling all zeros to the right thereof to be printed. For this purpose, a latch 152 (Figs. 2, 3 and 5) is provided adjacent each arm 136 and is journalled on a stationary cross rod 153 extending through cam slots 154 in the various idler gears 141. The levers 152 are urged clockwise by tension springs 155 extending between the levers and a cross rod 156, and are provided with ears 157 adapted to normally overlie a foot 158 extending forwardly from an aligned arm 136 when the associated drive rack 19 is located in a zero or home position.

A roller 159 rides in the cam slots 154 and, when the associated idler 141 and the printing dial 135 are retained at zero position, the contour of the cam slot enables the spring 155 to maintain the lever 152 in its full clockwise rocked position, as illustrated in Fig. 2, wherein it overlies the foot 158 and thus prevents the latter from being rocked clockwise during the printing operation. However, when any idler gear 141 is rotated to its "one" or any other position, its cam slot 154 will rock the associated lever 152 outward to the position illustrated in Fig. 3, thereby enabling the associated arm 136 to be subsequently rocked by its spring 138.

As will be noted in Fig. 5, each of the latch levers 152 is provided with an ear 160 overlying the corresponding ear on the similar lever located to the left in the next denominationally higher order. Therefore, when any latch lever 152 is rocked outwardly by its idler 141, all of the levers 152 to the right thereof will likewise be rocked outwardly by virtue of the overlapping ears 160.

In order to hold the various idler gears 141 in registered positions after being angularly adjusted thereto by the drive racks 19, a locking bail 430 is provided which normally engages between two of the teeth of each of the idlers 141. During a digitizing operation of the racks, however, and also during return of the racks to their home positions, the bail is disengaged from the idlers.

According to the present invention, means are provided for retaining each printing dial 135 in its angularly adjusted or registered position after the associated gear 140 entrained therewith is demeshed from its idler 141 upon clockwise rocking movement of the associated arm 136.

For this purpose a detenting or centralizer pawl 161 is pivoted at 162 on the associated arm 136 and has a tooth 163 adapted to engage between two adjacent teeth of the dial gear 139. A tension spring 164 extending between the pawl and the lever continuously urges the pawl toward engagement with the gear. However, when the printing arms are rocked into their normal positions illustrated in Fig. 2, a tail 161*a* on each of the pawls engages a stationary crossbar 165, thus holding the pawls out of engagement with the gears 139 so as to reduce any drag on the entrained gearing and the drive racks during their forward digitizing movement.

It should be noted that the arrangement of the stationary rod 165 is such that the pawls 161 are not disengaged from the dial gears 139 until the gears 140 move at least partially into mesh with their respective idlers 141.

During the printing operation, and when the arms 136 are rocked clockwise by their springs, the pawls 161 recede from the rods 165, enabling the springs 164 to rock the latter into engagement with their respective dial gears 139. This engagement of the pawls is intended to become effective before the gears 140 become demeshed from the idlers 141 so as to prevent any rotation of the dial gears after the arms 136 rock toward the platen. At speeds up to a certain amount, the springs 164 are normally effective in themselves to move the pawls into detenting position and thus prevent any overthrow or rebound of the dials beyond their registered positions. However, at higher speeds, and, particularly, where the timing is so close that the idlers 141 come to rest just as the arms 136 move toward the platen the momentum of the dials might be sufficient to normally force the pawls 161 against the action of their springs and out of engagement with the gears 139 or the dials may be able to rotate because of their momentum after the gears 140 leave mesh with the idlers 141 and before the spring 164 is effective to force the pawl 161 into detenting position. In order to prevent this possibility and to render the pawls 161 absolutely positive in operation, a second stationary rod 166 is located above the tail 161*a* of the pawls so that as the arms 136 carry the latter upwardly and rearwardly during the printing operation, the tails are adapted to strike the rod 166 in the event that they are not moved sooner by their springs 164 and may thus be positively forced in a counterclockwise direction relative to the arms 136 and into engagement between adjacent teeth of the gear 139. It will be noted that this positive detenting movement of the pawls 161 will become effective before the gears 140 are completely demeshed from idler gears 141.

Describing now the means for connecting the various idler gears 141 with their associated drive racks 19 in order to register the printing dials in accordance with the numerical positions to which their associated drive racks 19 are moved, a series of shafts 167 to 170, inclusive (Figs. 2, 3 and 6), are journalled on stationary frame plates 172, 173, etc., and carry various pinion assemblies which are arranged to entrain the idlers 141 with their respective racks 19. For example, a rack gear section 82 (Fig. 2) of the rack in the #1 or right hand order of the machine is meshed with a pinion 174 fixed on the shaft 170 to which is also fixed a pinion 175 meshing with the #1 idler 141 and entrained with the "cents" column numeral printing dial 135 (Figs. 2 and 3). In Figs. 6, this idler is located next to the right hand idler 141, the latter being reserved to print a symbol character in a manner not shown. Similarly, the rack in the second order from the right is connected by a pinion 176, shaft 169 and pinion 177 to the #2 idler. The rack in the third order is connected by pinion 178, sleeve 179 (rotatably mounted on shaft 167) and pinion 180 to the #3 idler. The rack in the fourth order is connected by a pinion 181, sleeve 182 (rotatably mounted on shaft 168) and idler 183 to the #4 idler. The rack in the fifth order is connected by a pinion 184, sleeve 185 and pinion 186 to the #5 idler. The rack in the sixth order is connected by a pinion 187, shaft 188

(coaxial with shaft 169) and pinion 189 to the #6 idler. The rack in the seventh order is connected by pinion 190, shaft 191 (coaxial with shaft 170) and pinion 192 to the #7 idler. The rack in the eighth order is connected by pinion 193, shaft 167 and pinion 194 to the #8 idler. The rack in the ninth order is connected by pinion 195, shaft 168 and pinion 196 to the #9 idler.

The various supporting plates 172 and 173 support the various elements of the printer, including the shafts 142 and 167 to 170, inclusive, independently of the supports for the racks 19 so that the printer may be readily removed as a unit from the machine, the various pinions demeshing from the racks.

The machine is encased in a cover 361 of plastic or similar material and in order to obtain maximum visibility of values recorded on the paper strip 8 (Figs. 2 and 3) and also to effectively cover the printing mechanism, a movable cover section 455 is mounted in an opening formed in the cover section adjacent the platen 12. The cover section is pivoted on trunnion bearings 456 adjacent the forward end thereof to the casing 361 and extends over the printer mechanism to a point adjacent the platen 12. The section 455 is urged downwardly into its normal position shown in Fig. 2 partly by its own weight and partly by a spring 457 extending between projections on the section and on the casing 361. An arm 458 attached to the section 455 extends downward and has a cam surface on the lower edge thereof which overlies a roller 459 carried by an arm 460 which is securely keyed to the aforementioned printer control shaft 137.

Normally, except during a printing operation, the section 455 lies in the position illustrated in Fig. 2 the rearmost edge of the latter being positioned directly below the location of the last printed value appearing on the paper tape 8 (the tape having been advanced an increment by means not shown as an incident to printing of said last value).

During a printing operation, the shaft 137, when rocked to allow the printer arms 136 to rock clockwise will cause arm 460 to cam the arm 458 and cover section 455 upward sufficiently to allow the printing dials 135 and pawls 161 to pass thereunder into the position illustrated in Fig. 3.

Certain of the subject matter disclosed but not claimed herein is disclosed and claimed in my copending applications, Serial No. 718,706, filed on December 27, 1946, and Serial No. 116,253, filed on September 17, 1949.

Although I have described a preferred embodiment of my invention in detail and have therefore used certain specific terms and languages herein, it is to be understood that the present disclosure is illustrative rather than restrictive, and changes and modifications may be made without departing from the spirit or scope of the invention as set forth in the claims appended hereto.

Having thus described the invention, what I desire to secure by United States Letters Patent is:

1. In a calculating machine, printing mechanism comprising the combination of a platen, a pivotal type element having type characters on the periphery thereof, a first gear attached to said element, a second gear meshing with said first gear, means including a drive gear adapted to mesh with said second gear for advancing said type element to position selected type characters in printing relation to said platen; a rockable arm supporting said first and second gears and said type element, means for rocking said arm between a normal position wherein said drive gear meshes with said second gear and a printing position wherein said second gear is out of mesh with said drive gear and said type element contacts said platen, a detenting device carried by said arm and engageable with said first gear, camming means engageable by said detenting device upon movement of said arm from said normal position and before the teeth of said second gear are demeshed from the teeth of said drive gear for moving said detenting device into detenting engagement with said first gear, and camming means engageable by said detenting device upon movement of said arm toward said normal position and after the teeth of said second gear are meshed with the teeth of said drive gear for releasing said detenting device from detenting engagement with said first gear.

2. In a calculating machine, printing mechanism comprising the combination of a platen, a pivotal type element having type characters on the periphery thereof, a gear device operatively connected to said type element, means including a drive gear adapted to mesh with said gear device for advancing said type element to position selected type characters in printing relation to said platen; a rockable arm supporting said gear device and said type element, means for rocking said arm between a normal position wherein said drive gear meshes with said gear device and a printing position wherein said gear device is out of mesh with said drive gear and wherein said type element contacts said platen, a detenting device carried by said arm and engageable with said gear device, means engageable by said detenting device upon movement of said arm from said normal position and before the teeth of said gear device are demeshed from the teeth of said drive gear for positively moving said detenting device into detenting engagement with said gear device, and means engageable by said detenting device upon movement of said arm toward said normal position and after the teeth of said gear device are meshed with the teeth of said drive gear for positively releasing said detenting device from detenting engagement with said gear device.

3. In a calculating machine, printing mechanism comprising the combination of a platen, a pivotal type element having type characters on the periphery thereof, a gear device operatively connected to said type element, means including a drive gear adapted to mesh with said gear device for advancing said type element to position selected type characters in printing relation to said platen; a rockable arm supporting said gear device and said type element, means for rocking said arm between a normal position wherein said drive gear meshes with said gear device and a printing position wherein said gear device is out of mesh with said drive gear and wherein said type element contacts said platen, a detenting device carried by said arm and engageable with said gear device, spring means for normally urging said detenting device into detenting engagement with said gear device, means engageable by said detenting device upon movement of said arm from said normal position and before the teeth of said gear device are demeshed from the teeth of said drive gear for positively moving said detenting device into detenting engagement with said gear device against the action of said spring means, and means engageable by said detenting

device upon movement of said arm toward said normal position and after the teeth of said gear device are meshed with the teeth of said drive gear for positively releasing said detenting device from detenting engagement with said gear device.

4. In a calculating machine, printing mechanism comprising the combination of a platen, a pivotal type element having type characters on the periphery thereof, a gear device operatively connected to said type element, means including a drive gear adapted to mesh with said gear device for advancing said type element to position selected type characters in printing relation to said platen; a support for said gear device and said type element, means for moving said support between a normal position wherein said drive gear meshes with said gear device and a printing position wherein said gear device is out of mesh with said drive gear and wherein said type element contacts said platen, a detenting device carried by said support and engageable with said gear device, means engageable by said detenting device upon movement of said support from said normal position and before the teeth of said gear device are demeshed from the teeth of said drive gear for positively moving said detenting device into detenting engagement with said gear device, and means engageable by said detenting device upon movement of said support toward said normal position and after the teeth of said gear device are meshed with the teeth of said drive gear for releasing said detenting device from detenting engagement with said gear device.

5. In a calculating machine, printing mechanism comprising the combination of a platen, a pivotal type element having type characters on the periphery thereof, a gear device operatively connected to said type element, means including a drive gear adapted to mesh with said gear device for advancing said type element to position selected type characters in printing relation to said platen; a support for said gear device and said type element, means for moving said support between a normal position wherein said drive gear meshes with said gear device and a printing position wherein said gear device is out of mesh with said drive gear and wherein said type element contacts said platen, a detenting device carried by said support and engageable with said gear device, camming means stationary with respect to said support and engageable by said detenting device upon movement of said support from said normal position and before the teeth of said gear device are demeshed from the teeth of said drive gear for positively moving said detenting device into detenting engagement with said gear device, and second camming means stationary with respect to said support and engageable by said detenting device upon movement of said support toward said normal position and after the teeth of said gear device are meshed with the teeth of said drive gear for releasing said detenting device from detenting engagement with said gear device.

6. In a calculating machine, printing mechanism comprising the combination of a platen, a pivotal type element having type characters on the periphery thereof, a gear device operatively connected to said type element, means including a drive gear adapted to mesh with said gear device for advancing said type element to position selected type characters in printing relation to said platen; a support for said gear device and said type element, means for moving said support between a normal position wherein said drive gear meshes with said gear device and a printing position wherein said gear device is out of mesh with said drive gear and wherein said type element contacts said platen, a detenting device carried by said support and engageable with said gear device, a spring for normally urging said detenting device into detenting engagement with said gear device, camming means stationary with respect to said support and engageable by said detenting device upon movement of said support from said normal position and before the teeth of said gear device are demeshed from the teeth of said drive gear for positively moving said detenting device into detenting engagement with said gear device against the action of said spring means, and second camming means stationary with respect to said support and engageable by said detenting device upon movement of said support toward said normal position and after the teeth of said gear device are meshed with the teeth of said drive gear for releasing said detenting device from detenting engagement with said gear device.

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