

July 18, 1967

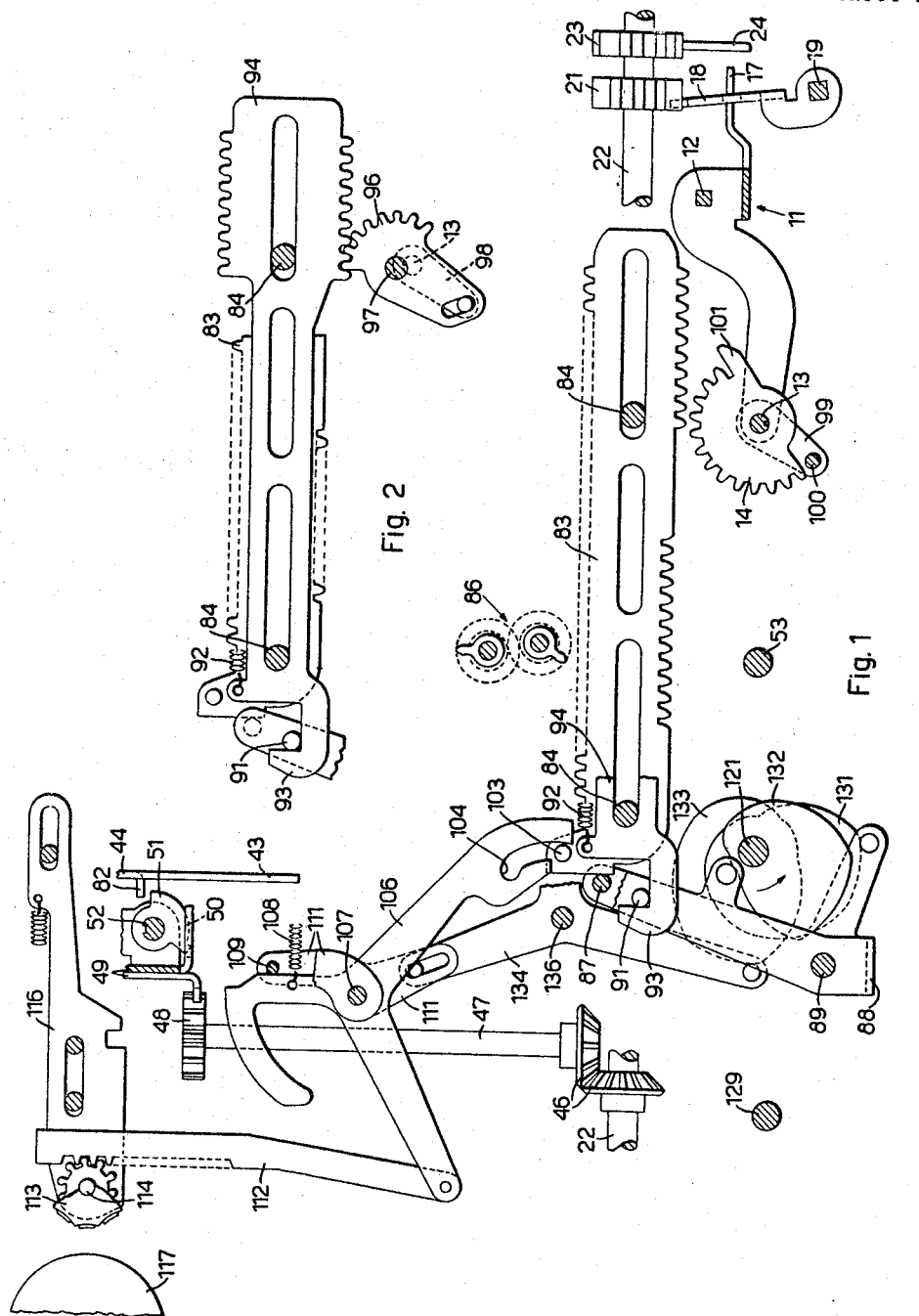
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3,331,556

POWER DRIVING DEVICE FOR A CALCULATING MACHINE

Filed Nov. 9, 1965

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

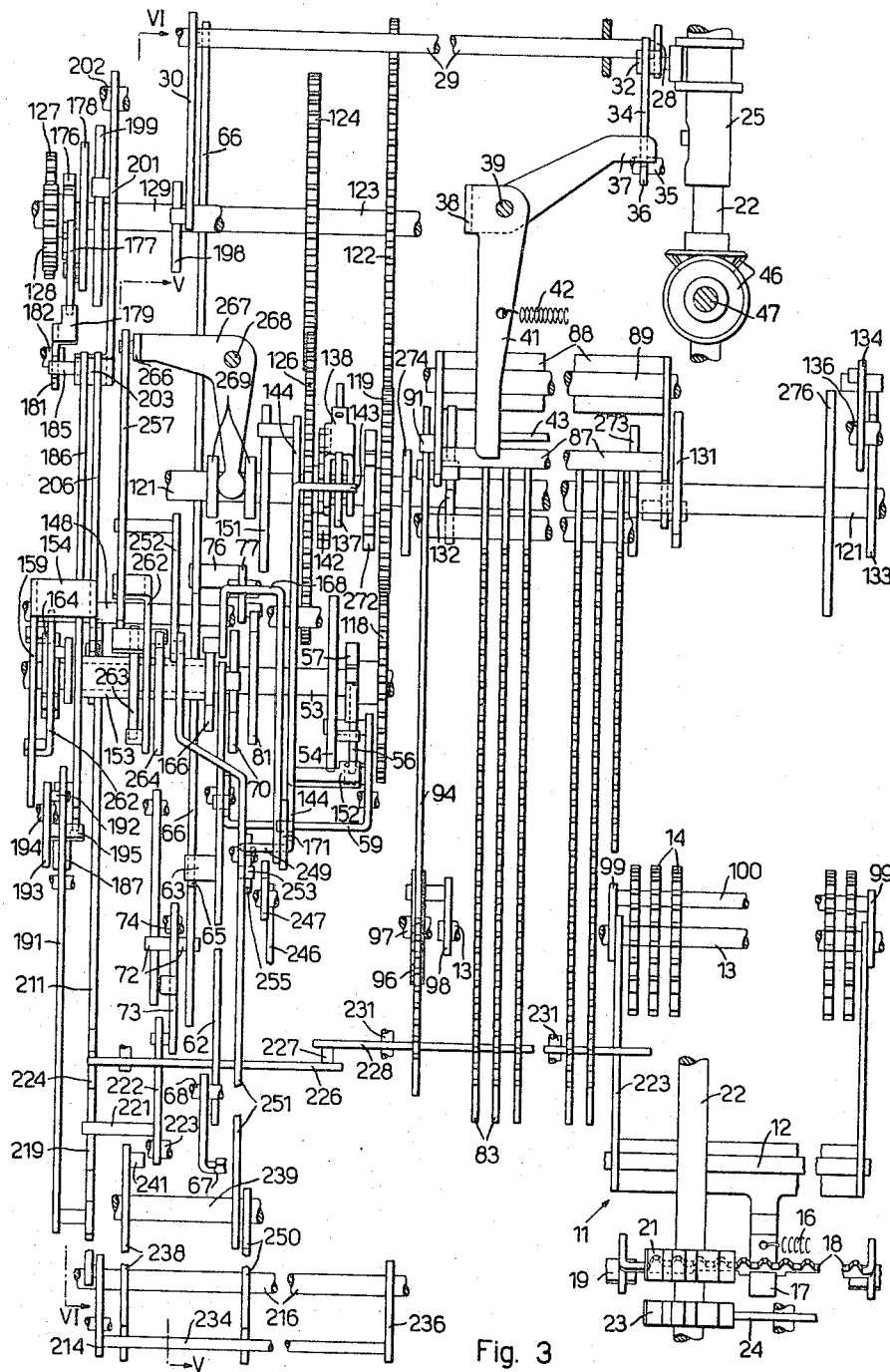


Fig. 3

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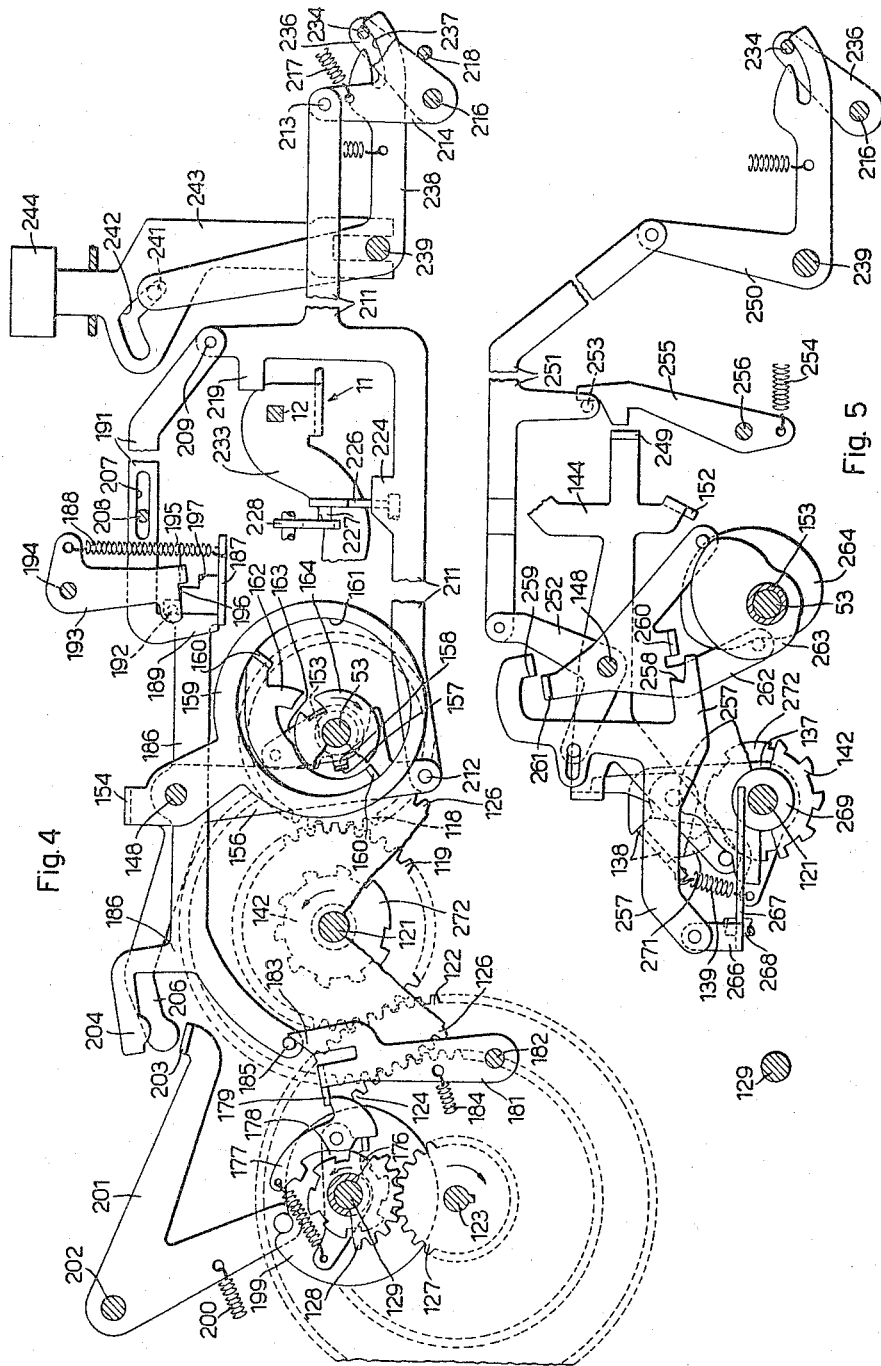
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4 Sheets-Sheet 3



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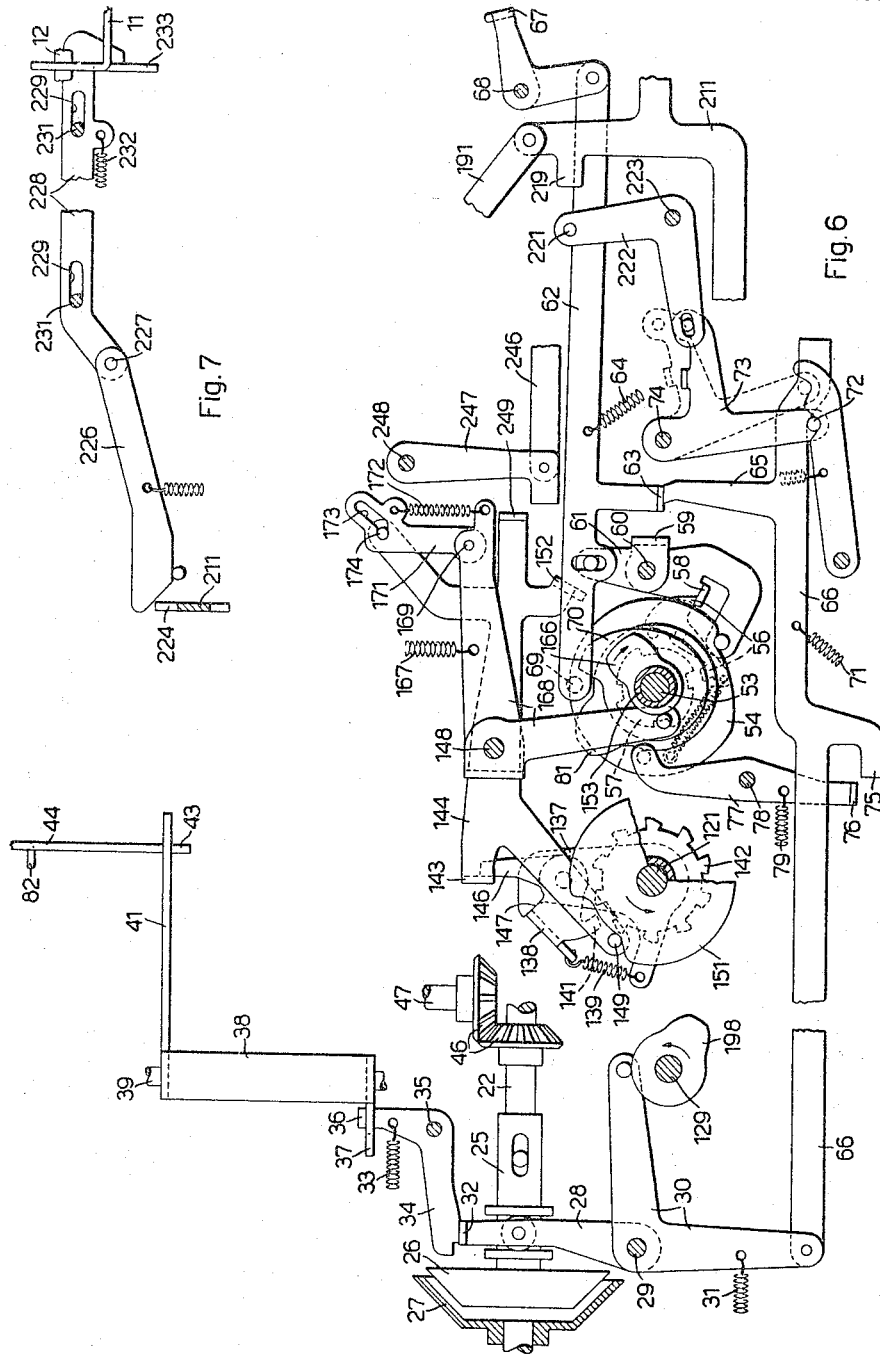
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POWER DRIVING DEVICE FOR A CALCULATING MACHINE

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4 Sheets-Sheet 4



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POWER DRIVING DEVICE FOR A CALCULATING MACHINE

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Filed Nov. 9, 1965, Ser. No. 506,958

Claims priority, application Italy, Nov. 11, 1964,
26,781/64, Patent 743,283
8 Claims. (Cl. 235—62)

This invention relates to a power driving device for a printing calculating machine having a set of differentially reciprocable actuators, comprising a first cyclically power operating mechanism for said actuators, said first mechanism being normally adapted to be operated at a predetermined speed sequentially with a second cyclically power operating mechanism for effecting predetermined machine functions.

There are known calculating machines wherein some machine functions, for example the operation of the totalizer reversing device and the clearing of the set up device, are effected by mechanisms cyclically operable independent from the mechanism for cyclically operating the actuators. However there are cases wherein some functions are not to be effected, as for example the case of repeated cycles of a multiplication or a division wherein no printing is effected and the set up device is not cleared. Since in the known calculating machines the mechanism for operating the actuators is always operated at a constant speed, these machines have a relatively unsatisfactory speed in the above specific cycles. In another known calculating machine of the Thomas drum type provided with a printing device, the calculating shaft may be operated at a lower speed when the printing device is to be operated, the time required by the printing device being longer than that required by the calculating device. This known driving device is unadapted for printing calculating machines having reciprocable actuators because in said machines the type carriers of the printing device are controlled by the actuators during their actuating reciprocation, said typecarriers being then moved toward the paper while the actuators rest in their reached position.

In a further known calculating machine the speed of the electric motor may be increased in specific cases. However since the speed of the various mechanisms is increased according to a constant ratio, the machine is not reliable in the operation.

To obviate these disadvantages in a printing calculating machine comprising a set of differentially reciprocable actuators, a power driving device having a main shaft cyclically power operable through a one-revolution main clutch for operating said actuators, an auxiliary shaft cyclically power operable through a one-revolution auxiliary clutch for effecting predetermined machine functions, and a member operated by said auxiliary shaft for causing said main shaft to be operated and for temporarily arresting said auxiliary shaft in an intermediate position, I now provide a normally effective first main clutch for driving said main shaft at a predetermined angular speed, a normally ineffective second main clutch for driving said main shaft at an angular speed higher than said predetermined angular speed, a first group of cams on said main shaft, a group of cam followers normally cooperating with said first group of cams for controlling said machine functions in a predeterminate timing relationship with respect to the angular position of said main shaft, means operable for displacing said main shaft in an axial direction for rendering said first main clutch and said first group of cams ineffective and for rendering said second main clutch effective, a function control member, a shifting member controlled by said

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control member and operated by said auxiliary shaft for operating said displacing means, and a second group of cams on said main shaft adapted to cooperate with said cam followers when said main shaft is so displaced for controlling said machine function in a different timing relationship with respect to the angular position of said main shaft.

This and other characteristics of the invention will become apparent from the following detailed description of a preferred embodiment thereof made by way of example, and from the accompanying drawings, wherein:

FIG. 1 is a left hand longitudinal partial sectional view of a calculating machine incorporating a power driving device according to the invention;

FIG. 2 is another left hand partial sectional view of the machine;

FIG. 3 is a partial plan view of the machine;

FIG. 4 is a further left hand partial sectional view of the machine;

FIG. 5 is a partial sectional view taken according to the line V—V of FIG. 3;

FIG. 6 is a partial sectional view taken according to the line VI—VI of FIG. 3;

FIG. 7 is a frontal view of a detail of the machine.

General description

The power driving device is incorporated in a ten key printing calculating machine comprising a set up carriage 11 (FIG. 1) transversely movable step by step along a square shaft 12 rockably mounted on the machine frame, and along a shaft 13 vertically movable on said frame. The carriage 11 comprises a set of toothed sectors 14 rotatably and shiftably mounted in the shaft 13 and differentially settable clockwise from the zero position shown in FIG. 1. The carriage 11 is urged by a spring 16 (FIG. 3) rightwards and it is provided with a projection 17 entering a notch of a rack 18 transversely slidable on a square shaft 19 rockably mounted on the machine frame. The rack 18 normally engages a pinion 21 secured to a shaft 22 rotatably mounted on the machine frame and normally locked against the urge of the spring 16 by a latch 24 engaging another pinion 23 secured to the shaft 22.

Bodily rotatable with the shaft 22 is a hub 25 (FIG. 6) axially slidable thereon. The hub 25 is integral with a conic clutch driving member 26 adapted to cooperate with a clutch driving member 27 continuously rotated by a conventional electric motor of the machine not shown in the drawings. The clutch 26, 27 is controlled by a lever 28 secured to a shaft 29 rotatably mounted on the machine frame. Secured to the shaft 29 is also a second lever 30 normally urged clockwise by a spring 31, as to disengage the clutch 26, 27. A latch 34 fulcrumed on a pivot 35 is normally urged by a spring 33 to contact a lug 32 of the lever 28. The latch 34 is provided with a projection 36 cooperating with an arm 37 (FIG. 3) of a bail 38 fulcrumed on a vertical shaft 39. Another arm 41 of the bail 38 is normally urged by a spring 42 to contact a projection 43 of a transversely slidable slide 44 (FIG. 1).

The shaft 22 is adapted to transversely displace a rack 49 along a shaft 52 through a pair of bevel gears 46, a vertical shaft 47 and a pinion 48. The rack 49 is provided with a toothed edge 50 cooperating with a sector 51 bodily rotatable with the shaft 52, but axially slidable with respect thereto. As long as the rack 18 engages the pinion 21, the rack 49 is transversely located according to the transverse position of the carriage 11.

The sectors 14 may be set order by order by a cyclically operating shaft 53 under the control of the ten key keyboard. Fulcrumed on a cam 54 (FIG. 6) of the shaft 53 is a clutch pawl 56 adapted to engage a clutch wheel 57 rotatably mounted on the shaft 53 and continuously

rotated clockwise by the electric motor of the machine. A lug 58 of a bail 59 fulcrumed at 60 normally holds the pawl 56 disengaged from the wheel 57. The bail 59 is provided with an arm 61 pin and slot connected with a slide 62 having a bent lug 63 normally urged by a spring 64 to contact a projection 65 of a link 66. The slide 62 is linked with a bail 67 fulcrumed on a stationary shaft 68. The spring 64 urges the bail 67 counterclockwise and the bail 59 to contact the cam 54. Finally, the slide 62 is provided with a pin 69 adapted to cooperate with another cam 70 of the shaft 53.

The link 66 is rearwards linked with the lever 30 and is normally urged by a spring 71 to contact a pin 72 of a lever 73 fulcrumed on a pivot 74. The lever 73 is located in the position of FIG. 6 upon effecting an accumulating or total taking operation, whereas it is rocked counterclockwise to the position shown by broken lines upon setting up in the carriage 11 the first order of a new amount, substantially in the manner described in the applicant's United States Patent application, Ser. No. 398,915 dated September 24, 1964. The link 66 is also provided with a projection 75 adapted to cooperate with a lug 76 of a lever 77 fulcrumed on a pivot 78 and urged by a spring 79 to contact a cam 81 secured to the shaft 53.

When the lever 73 is located in the position of FIG. 6, the projection 75 is located below the path of the lug 76. Upon depressing each key on the ten key keyboard, the bail 67 is rocked clockwise and displaces the slide 62 rearwards. The lug 63 of the slide 62 disengages now the projection 65 of the link 66, while the bail 59 is rocked counterclockwise, thus causing the clutch 56, 57 to be engaged for a one-revolution set up cycle of the shaft 53. At the beginning of the first set up cycle the lever 73 is rocked to the position shown by broken lines. The link 66 is thus displaced upwards by the pin 72 of the lever 73 and places its projection 75 on the path of the lug 76 of the lever 77.

During this first set up cycle, as well as during the following set up cycles, the figure corresponding to the depressed key is set up on a sector 14 of the carriage 11. Thereafter the cam 81 (FIG. 6) rocks the lever 77 counterclockwise, whereby the lug 76 through the projection 75 displaces the link 66 forwards. The lever 30 is thus rocked counterclockwise together with the shaft 29 and the lever 28, thus engaging the clutch 26, 27, while the latch 34 latches its lugs 32 in the rocked position. Simultaneously, under the control of the lever 73 the shaft 52 (FIG. 1) is rocked counterclockwise to temporarily disengage the sector 51 from the toothed edge 50, and then to return to an intermediate position wherein it is re-engaged with the next following tooth of the edge 50 and may cooperate with a lug 82 of the slide 44.

Now, when the sector 51 encounters the lug 82, the bail 38 (FIG. 3) is rocked clockwise thus rocking the latch 34 (FIG. 6) counterclockwise. Then the spring 31 through the levers 30 and 28 causes the clutch 26, 27 to be disengaged, upon having displaced the rack 49 (FIG. 1) one step leftwards together with the carriage 11. At the end of the cycle, the cam 70 (FIG. 6) engages the pin 69, thus restoring the slide 62 which latches its lug 63 above the projection 65 of the link 66.

As it has been described in the cited patent application, at the end of any accumulating operation the sectors 14 (FIG. 1) of the carriage 11 return to the set position until a new amount will be set up, whereas the carriage 11 is transversely restored rightwards by the spring 16 (FIG. 3) upon causing the latch 24 to release the pinion 23. Since the lever 73 has been returned to the position of FIG. 6, the rack 49 displaces rightwards the sector 51, which thus represents a record of the number of orders set up on the carriage 11.

The square shaft 12 is adapted to be rocked clockwise to engage the set up sectors 14 with a set of differentially reciprocable actuators, each one formed of a rack 83 longitudinally slidable on a pair of stationary shafts 84.

The racks 83 are also adapted to cooperate with a totalizer 86, and are controlled by a first universal bar 87 secured to a bail 88 fulcrumed at 89. A projection 93 of a rack 94 is normally urged by a spring 92 to contact a pin 91 secured to the bail 88. The rack 94 is slidably mounted on the shafts 84 and engages a toothed sector 96 fulcrumed on a stationary pin 97, and pin and slot connected with an arm 98 secured to the shaft 13. A second universal bar 100 is secured to a pair of arms 99 bodily rockable and axially slidable on the shaft 13, and it is adapted to cooperate with a shoulder 101 provided on each sector 14.

Furthermore, the calculating machine comprises a printing device conditionable for printing amounts according to the differential reciprocation of the racks 83. To this end each rack 83 is provided with a pin 103 adapted to cooperate with a notch 104 of a corresponding lever 106 fulcrumed on a stationary shaft 107. Each lever 106 is normally urged by a corresponding spring 108 to contact another universal bar 109 secured to a pair of arms 111 fulcrumed on the shaft 107. Each lever 106 is adapted to predispose through a rack 112 a corresponding typewheel 113 fulcrumed at 114 on a printing hammer 116 adapted to bring the wheel 113 to effect an imprint on the conventional paper platen 117.

Driving device

The calculating machine comprises a first power operating mechanism formed of a main shaft 121 (FIG. 4) adapted to operate the actuators 83. First means are provided for operating the shaft 121 at a predetermined speed, said first means comprising a pinion 126 engaging a gear 124 secured to a shaft 123 continuously rotated clockwise by the electric motor. Furthermore, second means are provided for operating the shaft 121 (FIG. 4) at a higher speed, said second means comprising a pinion 119 rotatably mounted on the shaft 121 and engaging another gear 124 secured to the shaft 123. The diameter of the pinion 119 is such as to cause same to be rotated at a speed twice the speed of the pinion 126. The pinion 119 engages also a gear 118 secured to the wheel 57 (FIG. 3). Secured to the shaft 123 is also a pinion 127 (FIG. 4) engaging a similar pinion 128 rotatably mounted on a third cyclically operable shaft 129. The pinion 128 is rotated at a speed twice the speed of the pinion 126, whereas the pinion 118 is rotated at a speed twice and the half the speed of the pinion 126.

Secured to the main shaft 121 (FIGS. 1 and 3) is a first group of cams comprising a pair of cams 131, 132 normally cooperating with the bail 88, and a cam 133 normally cooperating with a lever 134 fulcrumed on a pivot 136 and pin and slot connected with the right arm 111. The shaft 121 (FIG. 6) is adapted to be operated through a main clutch comprising a clutch wheel 142 secured to the pinion 126 (FIG. 3) and a clutch pawl 141 formed on a bail 138. This latter is fulcrumed on a crank lever 137 secured to the shaft 121 (FIG. 6) and is connected thereto by a spring 139.

The bail 138 is provided with a projection 146 normally arrested by a lug 143 of a clutch control lever 144 fulcrumed on a stationary shaft 148. Therefore, the pawl 141 normally disengages the wheel 142, whereas a shoulder 147 of the lever 137 contacts the bail 138. The lever 144 is provided with a pin 149 cooperating with a cam 151 of the shaft 121. Furthermore the lever 144 is provided with a lug 152 adapted to cooperate with the clutch pawl 56 for arresting same in an intermediate position, but it is normally out of the path of the pawl 56.

The calculating machine is provided with a second cyclically operating mechanism comprising a sleeve 153 rotatably mounted on the shaft 53 and adapted to be bodily rotated therewith to effect an auxiliary cycle sequentially with the main cycle of the shaft 121. Therefore, the shaft 53 will be hereinafter called auxiliary shaft, whereas the clutch 56, 57 will be called auxiliary clutch. The sleeve

153 is provided with a projection 158 (FIG. 4) normally engaging a notch 157 formed on an arm 156 of a bail 154 fulcrumed on the shaft 148. Another arm 159 of the bail 154 is provided with a circular hole 161 cooperating with a pair of lugs 160 bent from a pawl 162. This latter is fulcrumed on a crank lever 163 secured to the sleeve 153.

The sleeve 153 is provided with a set of cams adapted to control a set of machine functions, for example for engaging and disengaging the sectors 14 with the racks 83, and for returning the set up carriages 11 rightwards, said functions being not effected in the set up cycles of the auxiliary shaft 53. Secured to the sleeve 153 is also a cam 166 (FIG. 6) cooperating with a bail 168 fulcrumed on the shaft 148 and urged counterclockwise by a spring 167. Fulcrumed on a pivot 169 of the lever 168 is a lever 171 connected thereto by a spring 172 and provided with a cam slot 173 entered by a pin 174 of the lever 144.

The shaft 129 (FIG. 4) is adapted to be rotated through a corresponding one-revolution clutch comprising a clutch wheel 176 secured to the pinion 128 and a clutch pawl 177 fulcrumed on a crank lever 178 secured to the shaft 129. The pawl 177 is normally arrested by a lug 179 of a lever 181 fulcrumed on a stationary pivot 182 and provided with a projection 183 normally urged by a spring 184 to contact a pin 185 of a lever 186 fulcrumed on the shaft 148. The lever 186 is provided with a lug 187 normally urged by a spring 188 to contact a projection 189 of a slide 191. A pin 192 of a lever 193 pivoted at 194 is normally urged by the spring 188 to contact a vertical edge of the projection 189. The lever 193 is provided with a lug 195 adapted to cooperate alternately with each one of a pair of shoulders 196 and 197 of the lever 186, the lug 195 being normally located into the path of the shoulder 197.

Secured to the shaft 129 is a first cam 198 (FIG. 6) cooperating with the lever 30, and a second cam 199 (FIG. 4) cooperating with a lever 201 fulcrumed on a pivot 202 and urged clockwise by a spring 200. A lug 203 of the lever 201 is adapted to engage both a projection 204 of the lever 186 and another arm 206 of the bail 154. The slide 191 is provided with a slot 207 slidable on a pin 208 and is linked at 209 with a starting member formed of a slide 211. This slide is also linked at 212 with the arm 156 of the bail 154, and at 213 with an arm 214 secured to a shaft 216 rotatably mounted on the machine frame. The arm 214 is normally urged by a spring 217 to contact a stationary stop 218.

Furthermore, the slide 211 is provided with a projection 219 adapted to engage a pin 221 (FIG. 6) of a lever 222 fulcrumed on a pivot 223 and pin and slot connected with the lever 73. Finally, the slide 211 is provided with a projection 224 (FIG. 4) adapted to cooperate with a latch 226 (FIG. 7) pivoted at 227 on a transverse slide 228. This latter is provided with a pair of slots 229 entered by a pair of stationary pins 231, and is normally urged by a spring 232 to contact a portion 233 of the set up carriage 11. The slide 228 when released by the portion 233 is displaced leftwards by the spring 232 thus causing the latch 226 to engage the projection 224 of the slide 211.

A universal bar 234 (FIG. 4) is secured to the arm 214 and to a second arm 236 secured to the shaft 216 as well. The universal bar 234 is adapted to cooperate with a notch 237 of each one of a set of levers 238, only one of which is shown in FIG. 4. Each lever 238 is fulcrumed on a common shaft 239 and is provided with a pin 241 cooperating with a cam slot 242 of a stem 243 secured to a corresponding motor key, for example the addition key 244. The other levers 238 are connected to other motor keys, for example the subtraction key, the total taking key etc. Each lever 238 is also adapted to control specific machine functions.

At the depression of a motor key, for example the key 244, the cam slot 242 of the corresponding stem 243

rocks the lever 238 partially counterclockwise. The notch 237 of the lever 238 through the universal bar 234 causes the arms 214 and 236 to be rocked counterclockwise, whereby the slide 211 is partially displaced rearwards. The bail 154 is thus slightly rocked clockwise without releasing the projection 158 of the sleeve 153. Furthermore, the slide 211 displaces rearwards the slide 191, which on one hand causes the lug 195 of the lever 193 to contact the edge of the lever 186, on the other hand its projection 189 releases the lug 187 thereof. Then the spring 188 rocks the lever 186 till the shoulder 197 is arrested by the lug 195 of the lever 193. The pin 185 of the lever 186 rocks now the lever 181 clockwise, thus causing the clutch 176, 177 to be engaged, whereby the shaft 129 begins a one-revolution cycle.

At the beginning of the cycle of the shaft 129 its cam 199 rocks the lever 201 counterclockwise. Then the lug 203 of the lever 201 engages the arm 206 of the bail 154, which is now additionally rocked clockwise, thus fully displacing the slide 211 rearwards. The arm 156 of the bail 154 releases now the projection 158 of the sleeve 153, while the arm 159 through the lugs 160 causes the pawl 162 to engage the disk 164, whereby the sleeve 153 is angularly secured to the auxiliary shaft 53. The slide 211, through the arm 214 and the universal bar 234 additionally rocks the lever 238 counterclockwise to control specific machine functions, but it no more affects the key 244, due to the shape of the cam slot 242.

During the cycle of the shaft 129, some machine functions, for example the operation of the totalizer selecting mechanism and of the totalizer reversing mechanism, are effected under the control of the fully rocked lever 238. Furthermore the lug 203 of the lever 201 engages the projection 204 thus rocking the lever 186 clockwise. The lever 186 causes now its shoulder 196 to be latched by the lug 195 of the lever 193, whereby the clutch 176, 177 cannot be reengaged before restoring the slide 191 forwards.

The slide 211 when fully displaced rearwards, through the projection 219 engages the pin 221 of the lever 222, thus returning the lever 73 to the position of FIG. 6 in the case it is not in said position. Thereafter a cam of the shaft 129, not shown in the drawings, causes the sector 51 (FIG. 1) to be rocked in a known manner to its intermediate position. In turn the cam 198 of the shaft 129 (FIG. 6) rocks the lever 30 counterclockwise, thus engaging the clutch 26, 27. The lever 30 displaces also the link 66 forwards, thus predisposing its projection 65 in front of the lug 63 of the slide 62.

In the case the carriage 11 (FIG. 1) is in its rightmost rest position, the clutch 26, 27 displaces the rack 49 leftwards until the sector 51 encounters the lug 82, whereby the carriage 11 is tabulated to a position corresponding to the amount set up therein. Now the carriage portion 232 releases the slide 228 (FIG. 7), thus placing the latch 226 in front of the projection 224 of the slide 211. This latter is thus prevented from being restored as long as the carriage 11 will not be returned rightwards. In the case the carriage 11 has been displaced from its right position before starting the shaft 129, the latch 226 already contacts the upper edge of the projection 224, whereby when the slide 211 is fully displaced rearwards it is immediately latched by the latch 226 in the reached position.

Upon the leftward movement of the rack 49, when the sector 51 (FIG. 1) encounters the lug 82, the slide 44 through the bail 38 (FIG. 6) disengages the latch 34 from the lever 28, thus causing the spring 31 to rock the lever 30 clockwise. Now the link 66 is returned rearwards, whereby its projection 65 through the lug 63 displaces the slide 62 rearwards. The bail 59 is thus rocked counterclockwise and causes the clutch 56, 57 to be engaged, whereby an auxiliary one-revolution cycle of the shaft 53 together with the sleeve 153 is started.

It is to be noted that in the case the carriage 11 is already in the due transverse position, the clutch 56, 57 is engaged before the end of the cycle of the shaft 129 under the mere control of the cam 198. On the contrary, in the case the carriage 11 is to be tabulated through a long stroke, the engagement of the clutch 56, 57 may be delayed and may be effected even after the shaft 129 terminates its cycle.

During a first part of the auxiliary cycle of the shafts 53 and the sleeve 153, some machine functions are effected, for example the engagement of the sectors 14 (FIG. 1) with the racks 83. Thereafter the cam 166 (FIG. 6) rocks the bail 168 clockwise, whereby the lever 171 through the spring 172 yieldably rocks the lever 144. Then the lug 143 of the lever 144 releases the projection 146 of the bail 138, thus causing the pawl 141 to engage the wheel 142, whereby a one-revolution cycle of the main shaft 121 is started. Simultaneously the lever 144 locates its lug 152 on the path of the clutch pawl 56, whereby the shaft 53 and the sleeve 153 will be temporarily arrested upon being rocked 270 degrees, thus terminating the first part of the auxiliary cycle.

At the beginning of the cycle of the main shaft 121 (FIG. 1) the totalizer 86 is engaged with the racks 83. Thereafter the cams 131 and 132 rock the bail 88 counterclockwise, whereby through the rack 94 and the sector 96 (FIG. 2), the universal bar 100 (FIG. 1) is caused to engage the projections 101 and returns the sectors 14 to their zero position. Then the sectors 14 positively displace the engaged racks 83 rearwards, at the maximum permissible speed for correct accumulating the set up amount into the totalizer 86. Furthermore, the cam 133 of the main shaft 121, through the lever 134 rocks the universal bar 109 clockwise, whereby the springs 108 urge the levers 106 to follow the pins 103 of the racks 83. The typewheels 113 are thus predisposed for printing the accumulated amount on the paper in a known manner.

Thereafter the totalizer 86 is disengaged from the racks 83. Then the cams 131 and 132 return the bail 88 clockwise, whereby the universal bar 87 returns the racks 83 positively to their zero position, while the sectors 14 are returned to the angular position they occupied at the beginning of the cycle. Therefore, at the end of each cycle of the main shaft 121 the printed amount remains set up into the sectors 14 of the carriage 11. The tens transfer are effected in a manner known per se, during the return stroke of the racks 83.

Near the end of the cycle of the shaft 121, the cam 151 (FIG. 6) causes the spring 167 to restore counterclockwise the lever 168 together with the lever 144. Then the lug 143 of the lever 144 returns into the path of the projection 146 of the bail 138, whereby the main clutch 141, 142 will be disengaged upon having rotated the shaft 121 one revolution. In turn the lug 152 of the lever 144 releases the clutch pawl 56, thus causing the clutch 56, 57 to be reengaged for effecting a second part of the auxiliary cycle of the shaft 53 and the sleeve 153.

During this second part of the auxiliary cycle, at first the sectors 14 (FIG. 1) are disengaged from the racks 83, and the sector 51 is returned to the angular position of FIG. 1. Then the lever 24 is caused to disengage the pinion 23, whereby the spring 16 (FIG. 3) returns the carriage 11 rightwards together with the rack 49 (FIG. 1) and the sector 51. Furthermore, the carriage 11 through the slide 228 (FIG. 7) returns the latch 226 rightwards, thus releasing the projection 224 of the slide 211.

At the end of the second part of the auxiliary cycle, the cam 70 returns the slide 62 upwards thus placing the lug 63 above the projection 65 of the link 66. In turn the cam 54 causes the spring 64 to restore the slide 62 forwards while the bail 59 is restored clockwise, whereby the lug 58 will arrest the pawl 56, thus arresting the auxiliary shaft 53. The projection 158 (FIG. 4) of the sleeve 153 returns now in front of the notch 157 of the arm 156, whereby the spring 217 restores now the arm

214 together with the bar 234, the slide 211, the bail 154 and the slide 191. In turn the projection 189 of the slide 191 returns into the path of the lug 187 of the lever 186. Simultaneously, the projection 189 engages the pin 192 of the lever 193 to disengage the lug 195 from the shoulder 196, whereby the lever 186 is restored to the position of FIG. 4. In turn the universal bar 234 releases the lever 238, which is finally restored by its spring together with the key 244.

It is thus clear that the bail 168 and the lever 144 cause the shaft 121 and 53 to be sequentially operated.

Specific machine operations, for example and correction of the amount set up on the carriage 11, do not require the movement of the racks 83 (FIG. 1), whereby the cycle of the main shaft 121 may be excluded. In this order a correction key not shown in the drawings is adapted to rock a lever similar to the lever 238 (FIG. 4), which is connected through a link 246 (FIG. 6) to a latch 247 fulcrumed on a stationary pivot 248. The latch 247 is adapted to cooperate with a lug 249 of the lever 144.

At the depression of the correction key, on one hand the universal bar 234 (FIG. 4) is rocked counterclockwise thus causing the clutch 176, 177 of the shaft 129 to be engaged, on the other hand the link 246 (FIG. 6) locates the latch 247 on the path of the lug 249. Then the shaft 129 causes the clutch 56, 57 to be engaged, whereby the cam 166 of the sleeve 153 rocks the bail 168 clockwise. However the lever 144 is prevented from being rocked, because its lug 249 is arrested by the latch 247. Therefore, the clutch 141, 142 is not engaged and the shaft 121 is not cycled. Furthermore, the clutch 56, 57 is not disengaged by the lug 152, whereby the two parts of the auxiliary cycle are effected sequentially without being discontinued. During the second part of this cycle the lever 24 (FIG. 1) is operated for causing the carriage 11 to be restored in a similar manner as in an accumulating operation.

Higher speed cycles

In predetermined operations, for example in the repeated adding or subtracting operations, some machine functions are not effected. Particularly the engagement and disengagement of the sectors 14 with the racks 83, the tabulation stroke of the set up carriage 11, its transverse restoration, and the printing, are to be effected during a single operation and are to be prevented during the other operations. Since the engagement and disengagement of the sector 14, as well as the return stroke of the carriage 11 are effected by the auxiliary shaft 53, whereas the tabulation stroke of the carriage is effected by the shaft 129, the cycles of said two shafts may be excluded between the various cycles of the main shaft 121.

Furthermore, since the printing requires a predetermined time between the end of the forward stroke of the racks 83 and their return stroke, when the printing is excluded the main shaft 121 may be operated at a higher speed. Therefore, the cycles wherein the printing is effected will be called lower speed cycles, because the shaft 121 is operated at a predetermined low speed; the cycles wherein the printing is excluded will be called higher speed cycles because the shaft 121 is operated at a speed higher than said predetermined speed.

In this order fulcrumed on the shaft 239 (FIG. 5) is a function control member formed of a lever 250 adapted to cooperate with the universal bar 234 in a similar manner as the lever 238 (FIG. 4). The lever 250 may be rocked counterclockwise through a partial stroke by manually or automatically operable means. The lever 250 is connected through a link 251 to a lever 252 fulcrumed on the shaft 148. The link 251 is provided with a pin 253 normally contacted by a latch 255 under the urge of a spring 254. The latch 255 is fulcrumed on a pivot 256 and is adapted to cooperate with the lug 249 of the lever 144.

The lever 252 is pin and slot connected with a shifting member formed of a lever 257 provided with a pair of shoulders 158 and 259 adapted to alternately cooperate with a pair of elements or lugs 260 and 261 of a lever 262. This lever is fulcrumed on the shaft 148 and cooperates with a pair of cams 263 and 264 secured to the sleeve 153. Normally the shoulder 258 of the lever 257 lies into the path of the lug 260, while the shoulder 259 is out of the path of the lug 261.

The lever 257 is linked with a lug 266 of a horizontal lever 267 (FIG. 3) fulcrumed on a pivot 268 and engaged by two flanges 269 secured to the main shaft 121. This shaft is so mounted on the machine frame as to be shiftable rightwards together with its cams and the crank lever 137, whereas the pinions 119 and 126 cannot be axially displaced therewith. A second main clutch is provided for causing the higher speed pinion 119 to operate the main shaft 121. Said clutch comprises a second clutch pawl 271 (FIG. 5) formed on the bail 138 and a clutch wheel 272 secured to the pinion 119 (FIG. 3) the pawl 271 being normally located at left of the wheel 272.

The shaft 121 is provided with a group of normally ineffective cams adapted to cooperate with the various cam followers of the machine when the shaft 121 is shifted rightwards. This second set of cams comprise a pair of cams 273 and 274 (FIG. 3) for the bail 88 to operate the universal bars 87 and 100 (FIG. 1) substantially at the maximum permissible speed for causing the racks 83 to correctly accumulate the set up amount into the totalizer 86 when the shaft 121 is rotated at said higher speed. The second group of cams comprises also a circular disk 276 (FIG. 3) for the lever 134 to prevent the universal bar 109 (FIG. 1) from being moved during the cycle of the shaft 121.

Upon rocking manually or automatically the lever 250 (FIG. 5) partially counterclockwise, the universal bar 234 causes the shaft 129 to effect one cycle in a manner similar to the lever 238 (FIG. 4). Then the link 251 (FIG. 5) is partially displaced rearwards, whereby its pin 253 causes the latch 255 to contact the lug 249 of the lever 144. During the cycle of the shaft 129 the lever 250 is fully rocked counterclockwise and through the link 251 and the lever 252 displaces the lever 257 in a vertical direction. The shoulder 259 is thus located into the path of the lug 261 of the lever 262, while the shoulder 258 is located out of the path of the lug 260.

At the end of the cycle of the shaft 129, the clutch 56, 57 (FIG. 6) is engaged to cause an auxiliary cycle of the shaft 53 and the sleeve 153. During the first part of this auxiliary cycle, the cams 263 and 264 (FIG. 5) rock the lever 262 clockwise. Now the lug 261 engages the shoulder 259 and shifts the lever 257 forwards in a horizontal direction. The lever 267 (FIG. 3) is rocked counterclockwise and shifts the main shaft 121 rightwards. Now, when the cam 166 (FIG. 6) rocks the bail 168 clockwise together with the lever 144, on one hand the lug 152 of the lever 144 is placed into the path of the clutch pawl 56, whereby the auxiliary shaft 53 is arrested at its intermediate position, on the other hand the lug 143 of the lever 144 releases the bail 138, whereby the clutch pawl 271 (FIG. 5) engages the wheel 272.

The main shaft 121 is now rotated at a speed twice than in the case of the lower speed cycle, thus effecting a higher speed cycle. The lever 144 is latched in the rocked position by the latch 255, whereby at the end of the cycle of the shaft 121 the clutch 271, 272 is not disengaged and clutch 56, 57 (FIG. 6) is not reengaged as long as the latch 255 (FIG. 5) engages the lug 249. The main shaft 121 effects thus a set of repeated cycles, whereas the shaft 53 and the sleeve 153, as well as the shaft 129, are prevented from being cycled sequentially with the repeated cycles of the shaft 121. The latch 255 is caused to release the lug 249 of the lever 144 by means operated manually or automatically. Then the lever 144 may be restored counterclockwise and on one hand its lug 143

(FIG. 6) arrests the main shaft 121, on the other hand its lug 152 causes the clutch 56, 57 to be reengaged, whereby the shaft 53 and the sleeve 153 may finally effect the second part of the auxiliary cycle.

The main shaft 121 may be returned leftwards to the position of the lower speed cycles, during an auxiliary cycle of the shaft 53 and the sleeve 153, when the lever 250 has not been rocked counterclockwise. Then the lug 260 engages the shoulder 258 of the lever 257, which is returned rearwards, and through the lever 267 (FIG. 3) returns the shaft 121 leftwards to the position of the lower speed cycles.

It is thus evident that the first cyclically operating mechanism 121 is normally adapted to be operated at a predetermined speed sequentially with the second power operating mechanism 53, 153, and that the means 257 are operable by the second mechanism 53, 153 under the control of a function control member 250 for causing the first mechanism 121 to be operated at a higher speed than said predetermined speed.

It will be understood that many changes, improvements and additions of parts may be made to the described storing device without departing from the scope of the invention as defined in the appended claims thereof.

What I claim is:

1. In a printing calculating machine comprising a set of differentially reciprocable actuators, a power driving device having a main shaft cyclically power operable through a one-revolution main clutch for operating said actuators, an auxiliary shaft cyclically power operable through a one-revolution auxiliary clutch for effecting predetermined machine functions, and a member operated by said auxiliary shaft for causing said main shaft to be operated and for temporarily arresting said auxiliary shaft in an intermediate position, the combination comprising:

- (a) a normally effective first main clutch for driving said main shaft at a predetermined angular speed,
- (b) a normally ineffective second main clutch for driving said main shaft at an angular speed higher than said predetermined angular speed,
- (c) a first group of cams on said main shaft,
- (d) a group of cam followers normally cooperating with said first group of cams for controlling said machine functions in a predeterminate relationship with respect to the angular position of said main shaft,
- (e) means operable for displacing said main shaft in an axial direction for rendering said first main clutch and said first group of cams ineffective and for rendering said second main clutch effective,
- (f) a function control member,
- (g) a shifting member controlled by said control member and operated by said auxiliary shaft for operating said displacing means,
- (h) and a second group of cams on said main shaft adapted to cooperate with said cam followers when said main shaft is so displaced for controlling said machine function in a different timing relationship with respect to said angular position.

2. In a printing calculating machine comprising a set of differentially reciprocable actuators, and a register adapted to cooperate with said actuators for amount accumulating operations and total taking operations, a power driving device having a cyclically power operable main shaft, normally effective first cam means on said main shaft for controlling the reciprocation of said actuators, a cyclically power operable auxiliary shaft for effecting predetermined machine functions, means for causing said auxiliary shaft and said main shaft to be sequentially cycled, and comprising in combination:

- (a) a first clutch normally effective for operating said main shaft at a predetermined angular speed for enabling said normally effective cam means to control the reciprocation of said actuators at the maximum

- permissible speed for a correct cooperation with said register,
- (b) a normally ineffective second clutch adapted to operate said main shaft at an angular speed higher than said predetermined angular speed,
- (c) normally ineffective second cam means on said main shaft, said second cam means being so shaped as to control the reciprocation of said actuators substantially at said maximum permissible speed upon operating said main shaft at said higher angular speed,
- (d) a function control member,
- (e) and means controlled by said member and operated by said auxiliary shaft for rendering ineffective said first clutch and said first cam means and for rendering effective said second clutch and said second cam means.
3. A power driving device according to claim 2, comprising in combination:
- (f) a cyclically power operating mechanism adapted to be operated upon a partial operation of said member for causing the operation of said auxiliary shaft,
- (g) and means controlled by said mechanism for terminating the operation of said member.
4. A power driving device according to claim 2, comprising in combination:
- (f) a starting member adapted to be moved by said function control member a predetermined extent,
- (g) a cyclically power operating mechanism adapted to be operated by said starting member upon being so partially operated, said mechanism being adapted to cause said auxiliary shaft to be operated,
- (h) means controlled by said mechanism for additionally moving said starting member and said control member,
- (i) and means controlled by said control member when additionally moved and operated by said auxiliary shaft for rendering ineffective said first clutch and said first cam means and for rendering effective said second clutch and said second cam means.
5. In a printing calculating machine comprising a set of differentially reciprocable actuators, a register adapted to cooperate with said actuators for amount accumulating operations and total taking operations, and a printing device conditionable for printing amounts according to the differential reciprocation of said actuators, a power driving device having a cyclically power operable main shaft, a first group of cams secured to said main shaft, cam following means normally effective for cooperation with said first group of cams to control the reciprocation of said actuators and to so condition said printing device, an auxiliary shaft cyclically power operable through a one-revolution auxiliary clutch for effecting predetermined machine functions, a member operated by said auxiliary shaft for causing said main shaft to be operated and for temporarily disengaging said auxiliary clutch to arrest said auxiliary shaft in an intermediate position, and comprising in combination:
- (a) a first one-revolution main clutch normally effective for operating said main shaft at a predetermined angular speed for enabling said first group of cams to control the reciprocation of said actuators at the maximum permissible speed for a correct cooperation with said register,
- (b) a normally ineffective second clutch adapted to operate said main shaft at an angular speed higher than said predetermined angular speed,
- (c) a second group of cams normally axially distanced from said cam following means, said second group of cams when engaging said cam following means being adapted to prevent the operation of said printing device and to control the reciprocation of said actuators substantially at said maximum permissible speed upon operating said main shaft at said higher angular speed,

- (d) a function control member for causing a machine operation wherein no print is to be effected,
- (e) means shiftably mounting said main shaft in axial direction,
- (f) and a shifting member controlled by said function control member and operated by said auxiliary shaft for axially shifting said main shaft to disable said first main clutch and to engage said second main clutch, said first group of cams being then removed from said cam following means, said second group of cams being caused to engage said cam following means.
6. In a ten key calculating machine comprising a set up mechanism, a set of actuators differentially reciprocable under the control of said mechanism, a register adapted to cooperate with said actuators for amount accumulating operations and total taking operations, and a printing device conditionable for printing amounts according to the differential reciprocation of said actuators, a power driving device having a cyclically power operable main shaft, a first group of cams secured to said main shaft, cam following means normally effective for cooperation with said first group of cams to control the reciprocation of said actuators and to so condition said printing device, an auxiliary shaft cyclically power operable through a one-revolution auxiliary clutch, a set up control member operable by said keys for engaging said auxiliary clutch to set up a figure on said mechanism, and comprising in combination:
- (a) starting means for causing said auxiliary shaft to be operated for effecting predetermined machine functions irrespective of said set up control member,
- (b) a member controlled by said starting means and operated by said auxiliary shaft for causing said main shaft to be operated and for temporarily disengaging said auxiliary clutch to arrest said auxiliary shaft in an intermediate position,
- (c) a first one-revolution main clutch normally effective for operating said main shaft at a predetermined angular speed for enabling said first group of cams to control the reciprocation of said actuators at the maximum permissible speed for a correct cooperation with said register,
- (d) a normally ineffective second clutch adapted to operate said main shaft at an angular speed higher than said predetermined angular speed,
- (e) a second group of cams normally axially distanced from said cam following means, said second group of cams when engaging said cam following means being adapted to prevent the operation of said printing device and to control the reciprocation of said actuators substantially at said maximum permissible speed upon operating said main shaft at said higher angular speed,
- (f) a function control member for causing a machine operation wherein no print is to be effected,
- (g) means shiftably mounting said main shaft in axial direction,
- (h) and a shifting member controlled by said function control member and operated by said auxiliary shaft for axially shifting said main shaft to disable said first main clutch and to engage said second main clutch, said first group of cams being then removed from said cam following means, said second group of cams being caused to engage said cam following means.
7. In a printing calculating machine comprising a set of differentially reciprocable actuators, a register adapted to cooperate with said actuators for amount accumulating operations and total taking operations, and a printing device conditionable for printing amounts according to the differential reciprocation of said actuators, a power driving device having a cyclically power operable main shaft, a first group of cams secured to said main shaft,

cam following means normally effective for cooperation with said first group of cams to control the reciprocation of said actuators and to so condition said printing device, an auxiliary shaft cyclically power operable through a one-revolution auxiliary clutch for effecting predetermined machine functions, an arresting member operated by said auxiliary shaft for causing said main shaft to be operated and for temporarily disengaging said auxiliary clutch to arrest said auxiliary shaft in an intermediate position, and comprising in combination:

- (a) a first one-revolution main clutch normally effective for operating said main shaft at a predetermined angular speed for enabling said first group of cams to control the reciprocation of said actuators at the maximum permissible speed for a correct cooperation with said register,
- (b) a normally ineffective second clutch adapted to operate said main shaft at an angular speed higher than said predetermined angular speed,
- (c) a second group of cams normally axially distanced from said cam following means, said second group of cams when engaging said cam following means being adapted to prevent the operation of said printing device and to control the reciprocation of said actuators substantially at said maximum permissible speed upon operating said main shaft at said higher angular speed,
- (d) means shiftably mounting said main shaft in axial direction,
- (e) a normally ineffective latch for causing said arresting member to condition said main shaft to effect repeated cycles,
- (f) a displaceable control member,
- (g) a shifting member controlled by said control member when so displaced for shifting said main shaft to disable said first main clutch and to engage said second main clutch, said first group of cams being then removed from said cam following means, said second group of cams being caused to engage said cam following means,
- (h) and an element on said control member for rendering said latch effective when said control member is so displaced, said element disabling said latch upon restoration of said control member, whereby said arresting member causes said auxiliary clutch to terminate the cycle of said auxiliary shaft.

8. In a ten key calculating machine comprising a set up mechanism, a set of actuators differentially reciprocable under the control of said mechanism, a register adapted to cooperate with said actuators for amount accumulating operations and total taking operations, and a printing device conditionable for printing amounts according to the differential reciprocation of said actuators, a power driving device having a cyclically power operable main shaft, a first group of cams secured to said main shaft, cam following means normally effective for cooperating with said first group of cams to control the reciprocation of said actuators and to so condition said printing device, an auxiliary shaft cyclically power oper-

able through a one-revolution auxiliary clutch, a set up control member operable by said keys for engaging said auxiliary clutch to set up a figure on said mechanism, and comprising in combination:

- (a) starting means for causing said auxiliary shaft to be operated for effecting predetermined machine functions irrespective of said set up control member,
- (b) a member controlled by said starting means and operated by said auxiliary shaft for causing said main shaft to be operated and for temporarily disengaging said auxiliary clutch to arrest said auxiliary shaft in an intermediate position,
- (c) a first one-revolution main clutch normally effective for operating said main shaft at a predetermined angular speed for enabling said first group of cams to control the reciprocation of said actuators at the maximum permissible speed for a correct cooperation with said register,
- (d) a normally ineffective second clutch adapted to operate said main shaft at an angular speed higher than said predetermined angular speed,
- (e) a second group of cams normally axially distanced from said cam following means, said second group of cams when engaging said cam following means being adapted to prevent the operation of said printing device and to control the reciprocation of said actuators substantially at said maximum permissible speed upon operating said main shaft at said higher angular speed,
- (f) a function control member for causing a machine operation wherein no print is to be effected,
- (g) means shiftably mounting said main shaft in axial direction,
- (h) a pair of elements cyclically operable by said auxiliary shaft,
- (i) and a shifting member adapted to be moved by said control member in a first direction for being selectively engaged by one of said pair of elements, said shifting member being shifted by said elements in a second direction substantially perpendicular to said first direction for shifting said shaft to disable said first main clutch and to render effective said second main clutch, said first group of cams being then removed from said cam following means, said second group of cams being caused to engage said cam following means.

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