May 17, 1938. W. E. MATHI 2,117,620

CALCULATING MACHINE

Original Filed Nov. 13, 1931 6 Sheets-Sheet 1

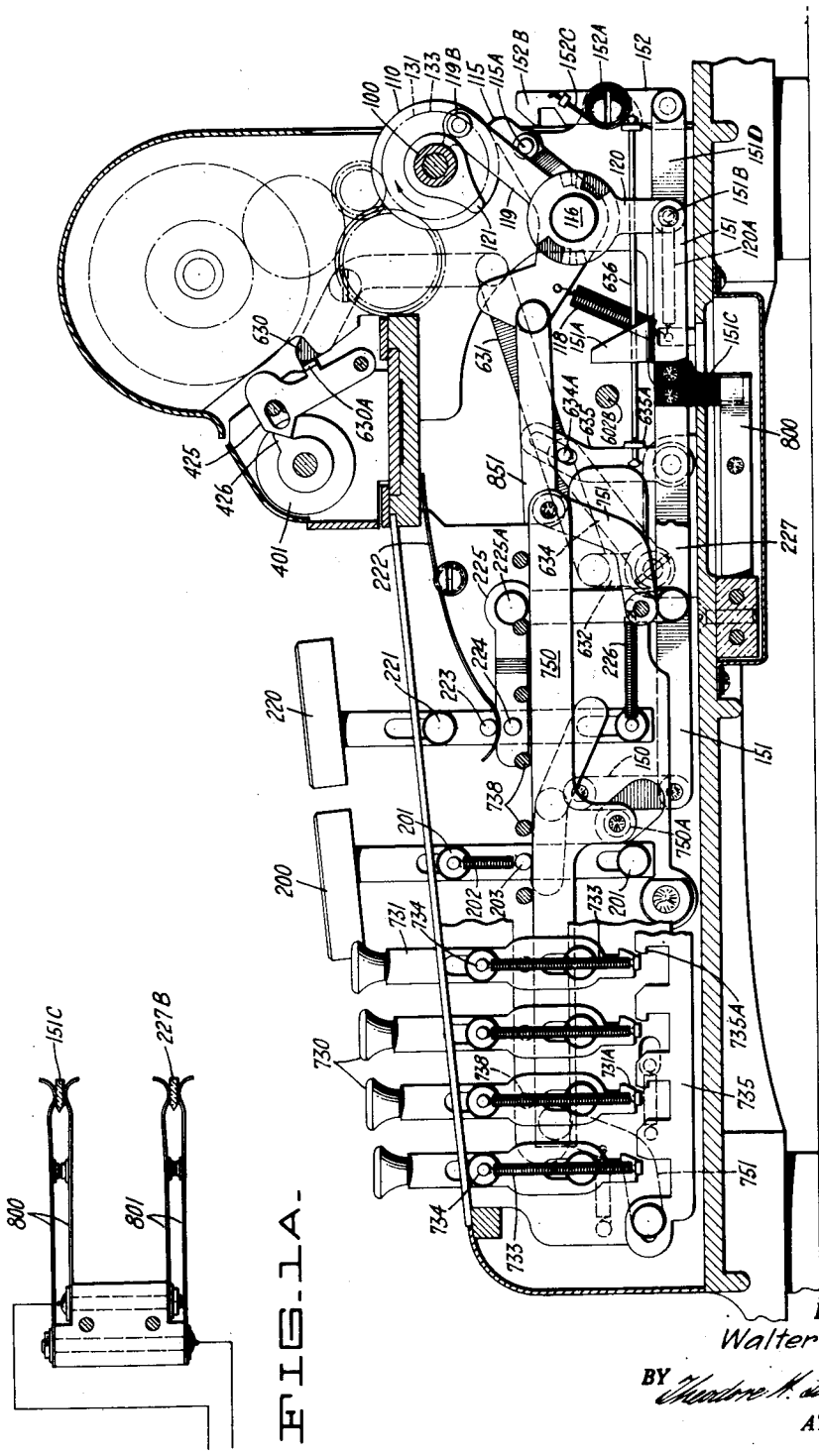


FIG. 1.

FIG. 1A.

INVENTOR.
Walter E. Mathi

BY Theodore K. Lassagne

ATTORNEY.

May 17, 1938. W. E. MATHI 2,117,620

CALCULATING MACHINE

Original Filed Nov. 13, 1931 6 Sheets-Sheet 2

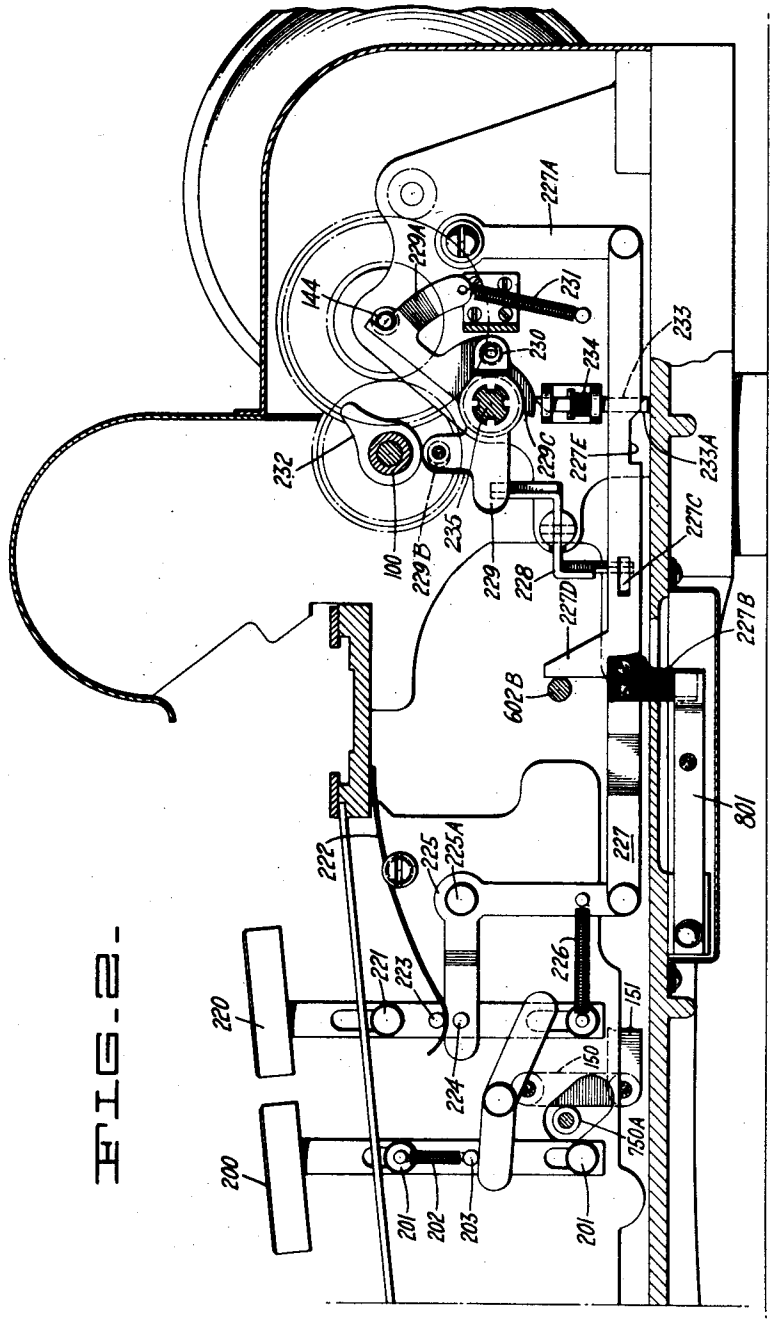


FIG-2-

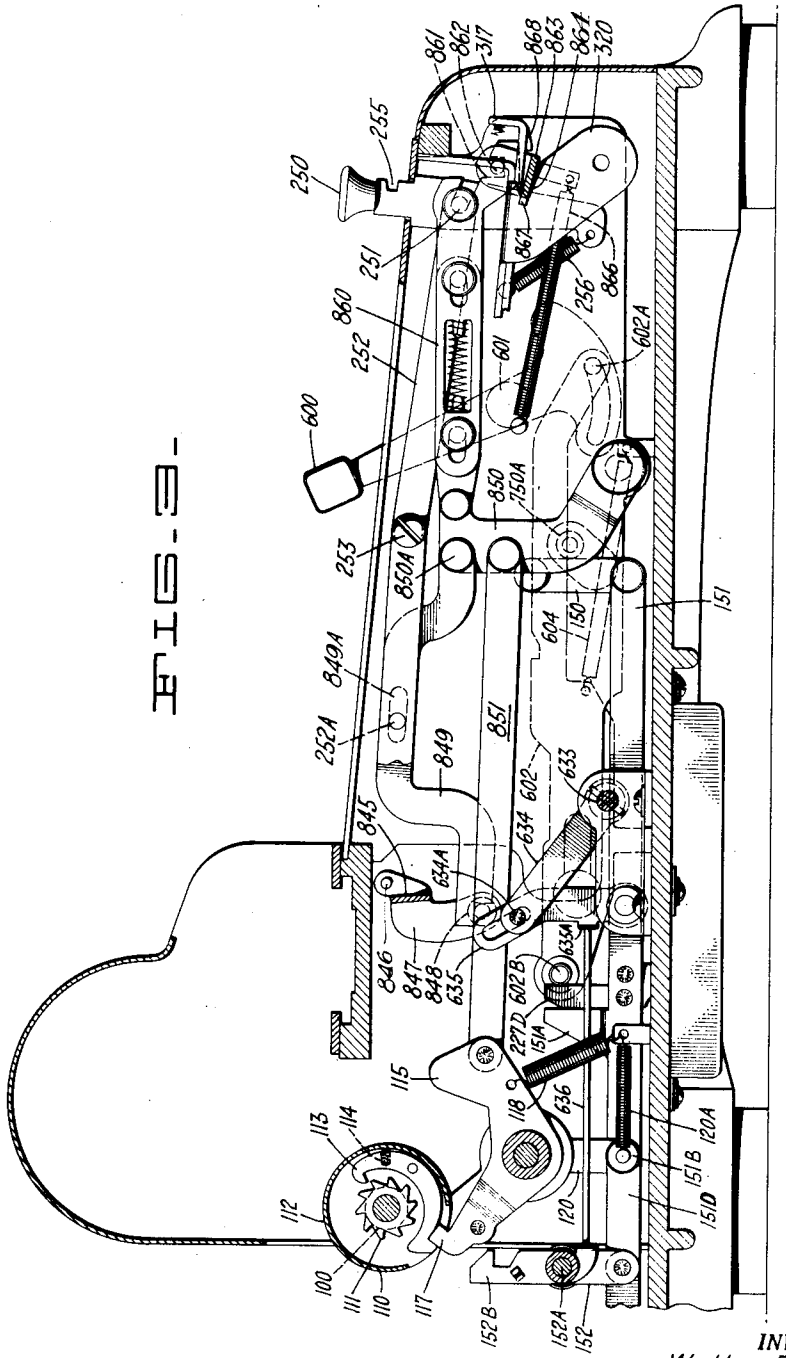
INVENTOR.
Walter E. Mathi
BY
ATTORNEY.

May 17, 1938. W. E. MATHI 2,117,620

CALCULATING MACHINE

Original Filed Nov. 13, 1931 6 Sheets-Sheet 3

FIG. 3.



INVENTOR.
Walter E. Mathi

BY

ATTORNEY.

May 17, 1938. W. E. MATHI 2,117,620

CALCULATING MACHINE

Original Filed Nov. 13, 1931 6 Sheets-Sheet 4

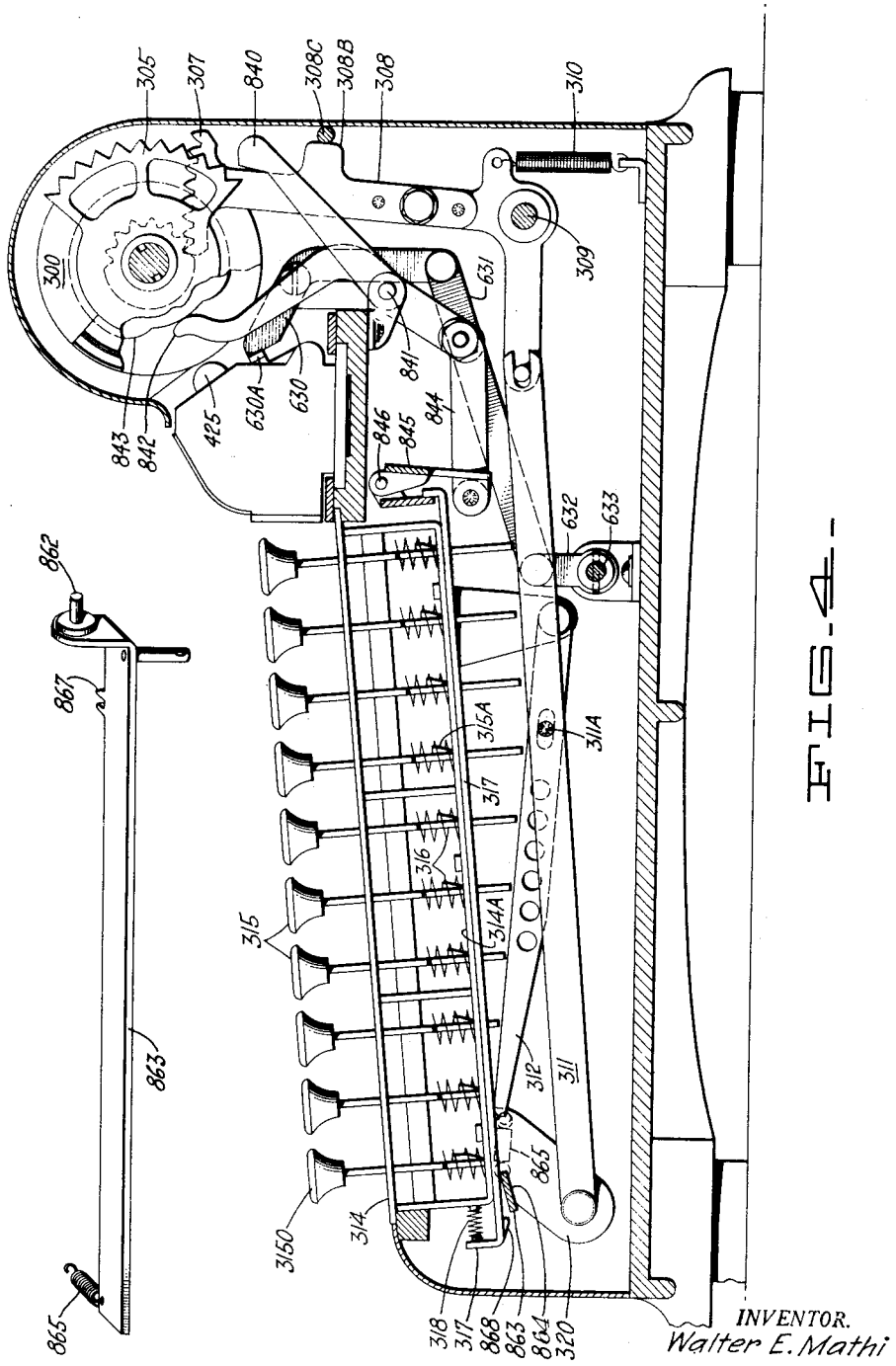


FIG. 4.

FIG. 5.

INVENTOR.
Walter E. Mathi

BY

ATTORNEY.

May 17, 1938. W. E. MATHI 2,117,620

CALCULATING MACHINE

Original Filed Nov. 13, 1931 6 Sheets-Sheet 5

FIG. 6.

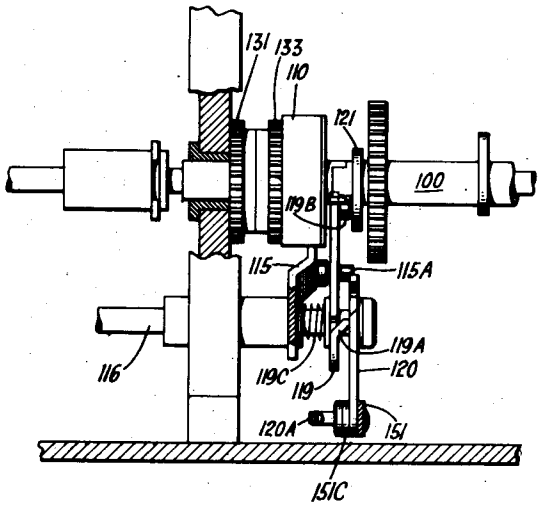
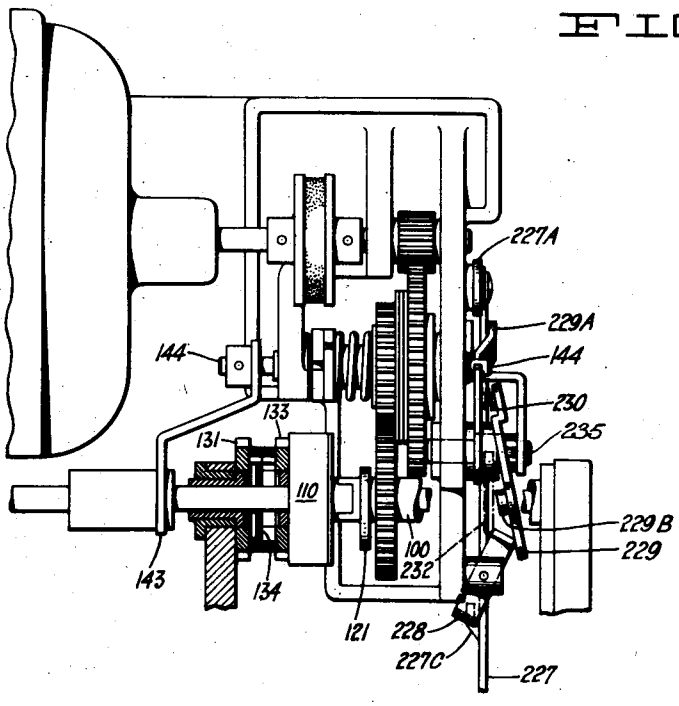


FIG. 7.



INVENTOR.
Walter E. Mathi
BY
ATTORNEY.

May 17, 1938. W. E. MATHI 2,117,620

CALCULATING MACHINE

Original Filed Nov. 13, 1931 6 Sheets-Sheet 6

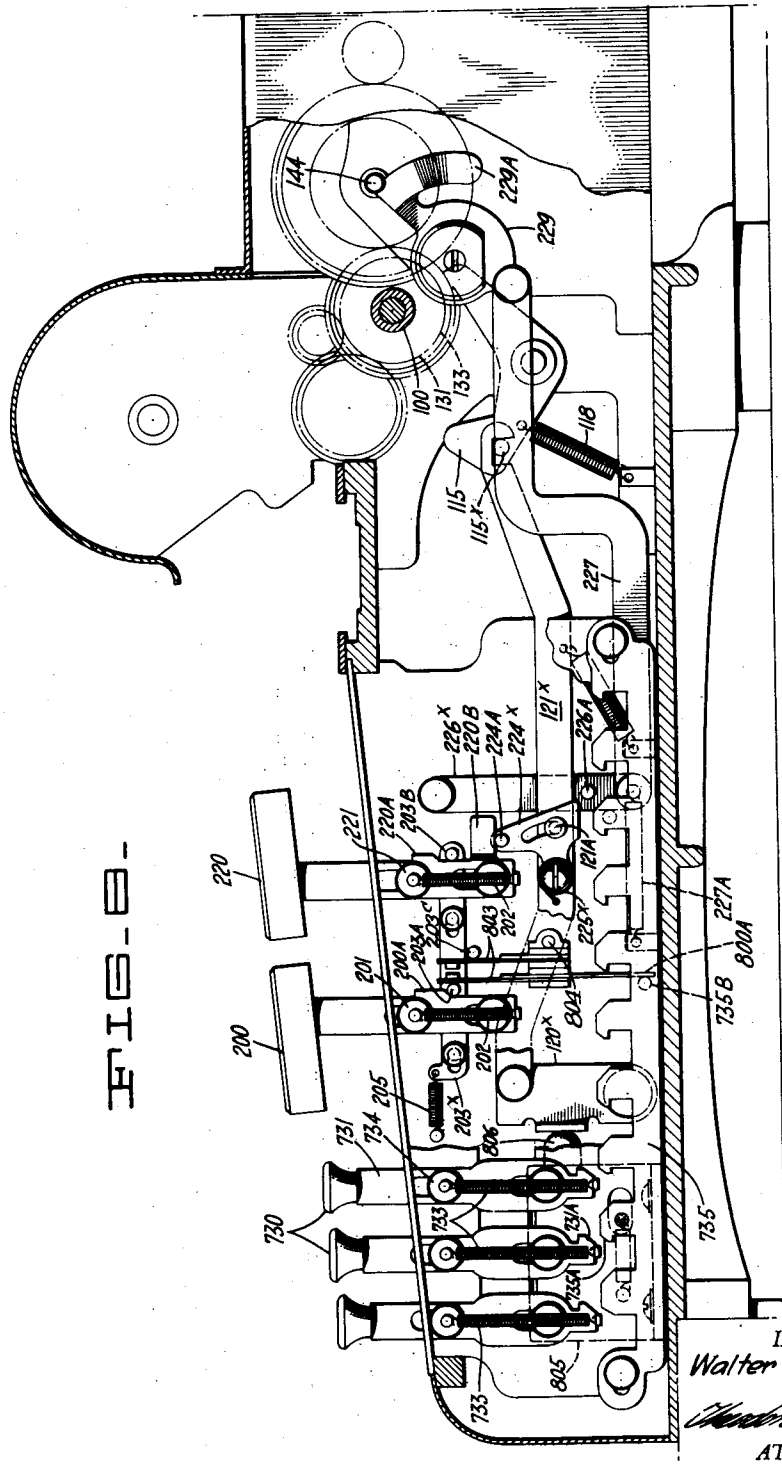


FIG-8-

Patented May 17, 1938 2,117,620

UNITED STATES PATENT OFFICE

2,117,620

CALCULATING MACHINE

Walter E. Mathi, Oakland, Calif., assignor to Marchant Calculating Machine Company, a corporation of California

Application November 13, 1931, Serial No. 574,840
Renewed December 26, 1935

17 Claims. (Cl. 235—62)

The present invention relates to calculating machines and the like adapted to perform the four cardinal calculations and combinations thereof, and particularly to the type in which a transmission mechanism is adapted to be controlled by a plurality of operation controlling devices to initiate a calculation of one or more cycles of operation. The invention is concerned more particularly with means for reducing the force or pressure required to operate any control key or lever by the provision of power operated means for engaging or setting the various control devices to their respective positions.

It is an object of the invention to provide operation control devices which require a comparatively light pressure for movement thereof to operative position.

Another object of the invention is the provision of operation controlling mechanism which is moved to operative position by power derived from the motor upon movement of the control devices or keys to operative position.

Another object of the invention is the provision of power operated means for engaging a clutch or transmission mechanism.

Another object of the invention is the provision of power operated means for positioning reversing mechanism to initiate a subtractive operation.

Another object of the invention is the provision of electromagnetic means for positioning the various operation controlling mechanisms.

Another object of the invention is the provision of means for latching the clutch engaging means in operative position during a plural cycle operation.

Another object of the invention is the provision of means for disabling the above-mentioned latching means at selected intervals during the plural cycle operation.

Other objects will appear as this description progresses.

The machine embodying the present invention is of the general type shown in the patent to Friden No. 1,643,710, dated September 27, 1927, to which reference is hereby made for a disclosure of a complete calculating machine including mechanisms not specifically described herein. It is to be understood, however, that although the invention is shown applied to a machine of the general type disclosed in said patent, it is manifest that the invention is applicable in any machine which is power driven and in which various controlling mechanisms must be set at the beginning of a particular operation.

The invention possesses a plurality of advantageous features, some of which will be set forth in full in the following description, and while the preferred construction thereof is shown in the drawings accompanying the description, it is understood that the invention is capable of modification within the scope of the claims.

In the accompanying drawings:

Figure 1 is a right side elevation of the machine, partly in section, showing the multiplier keys, the plus and minus keys and the clutching mechanism controlled thereby.

Figure 1A is a detail view showing the circuit closing means controlled by the various operation initiating devices.

Figure 2 is a partial right side elevation partly in section, showing the plus and minus keys and the means whereby the minus key controls the setting of the reversing mechanism to initiate a subtractive operation.

Figure 3 is a left side elevation partly in section, showing the automatic division lever and the devices settable thereby, as well as the add key and the control exercised thereby on various locking mechanisms in the machine.

Figure 4 is a right side elevation partly in section, showing the numeral keys and the differential selecting mechanism associated therewith.

Figure 5 is a detail view of the locking means for the numeral keys.

Figure 6 is a fragmentary front elevation partly in section, showing the main actuator clutch and the power operated means for engaging said clutch.

Figure 7 is a fragmentary plan view partly in section, showing the driving mechanism for the main clutch, the reversible transmission mechanism, and the power operated means for shifting said reversing mechanism to subtractive position.

Figure 8 is a right side elevation partly in section, showing the electromagnetic means for setting the various operation control devices.

Calculating machines heretofore have been provided with power driven means for controlling the various operations thereof including devices which were settable by movement of various control keys against the tension of springs sufficiently strong to restore the mechanism to normal position upon completion of the operation. Calculating machines of this type are disclosed in the application of Avery and Lerch No. 405,127, filed November 6, 1929 and matured into Patent No. 2,022,103, issued November 26, 1935. In the type of machine where the operation initiating devices

positively move the various controlling mechanisms to set position against the tension of springs or such, considerable pressure sometimes amounting to several pounds is required to move said operation initiating devices, which is undesirable in a machine and tiring to the operator.

The present invention provides power operated means for setting the various controlling mechanisms to operative position upon manipulation of the respective controlling keys so that the heretofore necessary strong springs to provide for restoration of said mechanisms are eliminated, the controlling keys being provided with very light springs so that the pressure required to operate the same is materially reduced.

Differential mechanism

The machine is provided with a plurality of banks of numeral keys, one of which is shown in Figure 4, the said numeral keys **315** being mounted in a top plate **314** and a strap **314A** attached thereto. The keys are normally held in raised position by springs **316** bearing against the strap **314A** and suitable shoulders formed on the key stems. Disposed below and in contact with the strap **314A** is a slide **317** normally held in its forward position by a spring **318**. The slide is provided with a plurality of apertures through which the key stems extend, and each key stem is provided with a lug **315A** which, when the key is depressed, causes longitudinal movement of the slide **317**, and which engages under said slide to hold the key in depressed position. The clearance key **3150** is provided on its face with a camming projection which operates upon depression of the clearance key to move the slide rearwardly to release any depressed key.

The selecting bar or lever which is variably depressed by the depression of the different keys is positioned below the key stems and comprises a duplex lever. The main lever **311** is pivoted at its forward end to a tongue **320** depending from the frame and is connected at its free or movable end with a bellcrank **308** pivoted at **309** and provided on its upper end with a rack **307** meshing with a gear of the actuator selecting element.

Fulcrumed on a depending bracket near the end of the key section is the secondary lever **312**, said lever being pivoted to the main lever **311** at **311A** (Figure 4). The arrangement of the duplex lever system is such that the selecting element is variably positioned from one to nine increments upon depression of the corresponding numeral key **315**. The bellcrank **308** is shown in Figure 4 in its zero position, in which the lug **308B** engages a zero stop **308C** under the tension of spring **310**. Reference is hereby made to the above noted patent to Friden and application of Avery and Lerch for a more detailed description of the differential selecting mechanism. The values entered into the actuator **300** are transferred to the numeral wheels **401** (Figure 1) upon rotation of said actuator by means to be described hereinafter.

Means are provided for locking the settable selecting element **305** in set position upon rotation of the actuator **300**. Said means comprises a locking dog **840** (Figure 4) pivoted at **841** and adapted to be rocked into engagement with a notched flange of selecting element **305** by a cam **843** integral with the actuator, moving an arm **842** in a counter-clockwise direction to rock said dog into engagement with the flange.

Driving mechanism

The machine is provided with a motor which drives through suitable speed reducing gearing the drive shaft **100** of the machine (Figures 3 and 7). Mounted on said drive shaft is a ratchet wheel **111** (Figure 3) which constitutes the driving member of the clutch **110**. Secured within the clutch housing **112** is a pawl **113** which is constantly urged into engagement with the ratchet wheel **111** by a compression spring **114**, being held normally from engagement therewith by the nose **117** of the clutch bellcrank lever **115**. As fully disclosed in the above-mentioned patent, upon counter-clockwise movement of said bellcrank, the pawl **113** engages with ratchet wheel **111** to drive the actuator **300** through one or more cycles of movement, depending upon the release of bellcrank lever **115** so that the nose **117** thereof engages the tail of pawl **113** and disengages the same from the ratchet wheel **111**. The means for rocking the bellcrank **115** will be described hereinafter.

Suitable reversing gearing is interposed between the clutch **110** and the actuator **300** (Figures 1 and 7). Such reversing gearing is fully described in the above-mentioned patent, and it will only be necessary to mention such parts as cooperate with the instant invention. Gears **131** and **133** (Figures 6 and 7) serve to transmit rotation from the clutch housing to the actuator, depending upon the desired direction of rotation. The gear **131** drives through a train of gearing to drive said actuator in an additive direction, while the gear **133** drives through a train of gearing serving to drive said actuator in a subtractive direction. The drive from the clutch housing to the respective gear is transmitted by the pin **134** (Figure 7) splined to said shaft and being shiftable into a seat in either of the respective gears **131** and **133**. A suitable shifting fork **143** is provided for shifting said pin from the seat in one gear to the seat in the other, said pin being normally disposed within the seat in the gear **131** in the position to drive said actuator in an additive direction.

Power operated clutch engaging means

The plus key **200** is mounted for vertical sliding movement by means of slots therein engaging a pair of studs **201**, said key being normally maintained in its elevated position by a spring **202** tensioned between the upper stud **201** and a pin **203** on said key stem. Said pin **203** overlies a bar **750** (Figure 1) which is mounted on parallel links **751** so that depression of key **200** through the pin **203** results in a downward and rearward movement of the bar **750**. Secured to a depending ear of said bar is a roller **750A** which is disposed in front of a link **150**, and secured to the lower end of link **150** is a rearwardly extending link **151**. Rearward movement of link **151** serves to close the circuit to the motor and cause engagement of said clutch, as is hereinafter described.

The minus key **220** is mounted for vertical sliding movement on studs **221**, being normally held in raised position by leaf spring **222** bearing beneath a pin **223** secured to said key. Pin **223** also overlies the horizontal arm of a bellcrank **225** which is adapted to be rocked in a counter-clockwise direction on depression of the key **220**. Secured to the horizontal arm of said bellcrank **225** is a pin **224** which overlies the parallel link **750** and is adapted to depress the same during the latter part of the downward movement of the

minus key 220, the purpose of such delayed action being explained hereinafter in connection with the control of the reversing mechanism.

A series of multiplier keys 730 of differing numerical values are provided, said keys being mounted for vertical sliding movement on pins 734, being normally maintained in their raised position by spring 733 tensioned between the upper pin 734 and a lateral extension on the lower end of the key stem. The lower end of the key stem is provided with a nose 731A which is adapted, on depression of the key, to cam a latching slide 735 to the right, and thereafter to be positioned beneath a nose 735A on said slide to maintain said key in depressed position during the operation determined thereby. The mechanism controlled by said keys whereby the clutch is maintained in engagement for a plurality of cycles of operation, is fully disclosed in the above-mentioned patent. Secured to the key stem 731 is a pin 738 overlying the parallel bar 750 and being adapted to depress the same upon depression of the multiplier keys. Depression of the multiplier key through the pin 738 depresses the parallel bar 750, causing the roller 750A to rock the links 751 rearwardly to cause engagement of the clutch.

Means are provided for operating the clutch engaging mechanism upon movement of the division lever to operative position. The division lever 600 (Figure 3) is pivoted at 601 and is connected at the bottom end thereof by a pin 602A with a division slide 602, said divison slide being normally held in its forward position by a spring 604 tensioned between said slide and a suitable stud on the base plate. At its rearward end, the slide 602 is provided with a laterally extending pin 602B which is disposed in front of an upwardly extending ear 151A of slide 151. When the division lever 600 is moved toward the front of the machine, the lower end and slide 602 are moved rearwardly, pin 602B serving to cause rearward movement of link 151 to cause engagement of the clutch.

Means are provided for enabling the clutch engaging means upon rearward movement of the link 151. Secured to the link 151 at 151B near the rearward end thereof is a depending arm of a cam disk 120 (Figures 1 and 6) on shaft 116. The cam disk 120 is normally maintained in the position shown in Figure 1 by a spring 120A tensioned between the depending arm thereof and a suitable stud on the machine base. The disk 120 is provided with a pair of oppositely disposed cam slots which are adapted when said disk is in operative position, to receive the lateral cam lugs 119A of a lever 119 loosely mounted on the shaft 116. A compression spring 119C (Figure 6) tends to move said lever 119 to the right on the shaft 116 as viewed in Figure 6. Movement of said lever 119 to the right positions a roller 119B carried on the upper end thereof in the path of a cam 121 secured to the main drive shaft 100 (Figures 1 and 6).

Means are provided for closing the circuit through the motor upon rearward movement of the link 151. The link 151 is provided with a depending lug 151C of insulating material, which, in the forward position of said slide, serves to separate the pair of spring contacts 800 (Figures 1 and 1A). Upon rearward movement of the slide 151, the interponent 151C is moved from between said contacts, which thereupon close a circuit through the motor which rotates shaft 100 and cam 121. The rearward movement of slide 151 has also rocked the cam disk 120 to permit the cam lug 119A to move in alignment with the slot formed therein, permitting the spring 119C to move the lever 119 to position the roller 119B in the path of the cam 121. During the subsequent rotation of the cam 121, the lever 119 is rocked in a clockwise direction, rocking the clutch release bell crank 115 by contacting a laterally extending pin 115A secured thereto. Thus rearward movement of link 151 serves to enable the mechanism to cause engagement of the clutch 110 by rocking the clutch release bell crank 115 from engagement with the clutch housing against the tension of the spring 118.

Means are provided for latching the clutch release bell crank in clutch engaging position. An arm 151D is pivoted to link 151 at 151B and secured to the rearward end thereof is a two-part lever 152 (Figure 1) which is pivoted at 152A. The nose 152B of said lever is maintained in longitudinal alignment with the lower part by means of the spring 152C which holds a laterally extending lug on said nose in contact with said lower part. Upon rearward movement of the slide 151, the lever 152 is rocked in a counter-clockwise direction as viewed in Fig. 1, so that the pin 115A is positioned in the notch in nose 152B upon clockwise movement of the bellcrank lever 115, and said bellcrank is latched thereby in clutch engaging position. Thus as long as an operation control key is in operative position the clutch release bellcrank 115A is latched out of engagement with the clutch housing, permitting the clutch to remain engaged until release of the depressed key.

Means are provided for disabling the latch for the clutch controlling member during plural order operations in which it is desired to stop the actuating mechanism without restoring the controlling device therefor to normal position. This is disclosed in the instant case in connection with the automatic division lever, but is equally applicable to mechanism which includes means for setting up a plural order multiplier where such latch is disabled during a shifting operation.

As fully described in the above mentioned patent and application, upon movement of the next to highest order numeral wheel 401 from zero to nine, or nine to zero, cam lug 426 (Figures 1 and 4) rocks the transfer lever 425, which through lateral extension 630A rocks a lever 630 which is connected by a link 631 with an upwardly extending arm 632 secured to shaft 633. To the other end of shaft 633 (Figure 3) is secured a lever 634 having a pin 634A disposed within a slot in an upwardly extending arm 635. The arm 635 is provided with a lateral lug 635A which has an aperture to receive a rod 636. The rearward end of said rod is connected to the tail of the latching pawl 152. The rod 636 is allowed a certain amount of lost motion to allow a rocking of pawl 152B without moving the lever 635.

Counterclockwise rocking of lever 635 (Figure 1) is sufficient to pull the rod 636 and rock the latching pawl 152B in a clockwise direction against the bias of spring 152C to disengage the latch from the bellcrank 115, allowing the same to engage the clutch housing and disengage the clutch at the end of the cycle of operation then in progress in a well known manner.

Thus the latch for the clutch controlling bellcrank 115 is disabled whenever an overdraft occurs during a division operation, whether it be a positive or a negative overdraft, so that the bellcrank is allowed to engage the clutch housing and

stop the operation of the machine. The latch 152B is maintained in operative position by spring 152C, however, so that upon subsequent rocking of the bellcrank 115 to again engage the clutch, it is again latched in its locked position to permit succeeding cycles of rotation of said clutch to complete the operation.

Means are provided for latching the selecting mechanism in set position and for locking the keyboard upon movement of the clutch bellcrank 115 to clutch engaging position. As previously described, the locking dogs 840 (Figure 4) are secured to a shaft 841. One of said dogs is provided with an extension to the end of which is secured a link 844, the other end of said link being secured to an ear on gate 845 pivoted at 846, so that a rocking of the gate 845 to the rear of the machine will cause a counter-clockwise oscillation of the dog 840 to engage the selecting element 305 and lock the same in adjusted position. The gate 845 (Figure 3) is provided with a downwardly extending arm 847 to which is secured a roller 848. Adapted to engage the roller 848 is the notched rearward end of a link 849 which is pivotally secured at its forward end to a pivoted supporting member 850 at 850A. The member 850 is connected to the clutch release bellcrank 115 by a link 851 (Figures 1 and 3) so that counter-clockwise oscillation of the bellcrank 115 (Figure 3), to cause engagement of the clutch, causes a rearward oscillation of the member 850 and rearward movement of the link 849, so that if the notch on the forward end of said link is in engagement with the roller 848, the arm 847, and gate 845 will be rocked to move the locking dogs 840 to locking position, as above described.

Means are provided for enabling the lock engaging function of gate 845 only during plural cycle operations. The link 849 is provided intermediate its end with a slot 849A (Figure 3) in which engages the pin 252A on a lever 252 pivoted at 253. The forward end of said lever 252 is secured to the add key 250 at 251, as shown in Figure 3. Upon depression of the add key 250, the notch 255 therein engages in the cover plate under the influence of spring 256, rocking the lever 252 and raising the rearward end of link 849 out of engagement with the pin 848, so that rearward movement of the link 849 is ineffective. The locking of the selecting elements is controlled in the usual manner during a single rotation by the cam 843 and a finger 842 cooperating therewith (Figure 4). During plural cycle operations the clutch release bellcrank 115 is maintained rocked in counter-clockwise direction, maintaining the link 849 in its rearward position in which it engages roller 848, and holding the locking dog 840 in engagement with the selecting element 305 continuously during the entire operation.

Means are provided for locking the keyboard upon movement of the clutch release bellcrank to clutch engaging position. As previously described, counter-clockwise movement of bellcrank 115 (Figure 3) through link 851, rocks the supporting member 850 towards the rear of the machine. Pivoted to the upper forward edge of member 850 is a spring link 860, the forward end of which is provided with a notch engaging pin 251 on the add key 250. A second notch 861 is provided in the forward end of said spring link 860 which engages a pin 862 on lock bar 863 (Figures 3 and 5). This lock bar is rockably supported adjacent the key latching slide 317 in notches 864 and depending supporting ears 320, in which notches it is retained by springs 865 and 866 secured thereto and to the frame. Lugs 867 (Figure 5) embrace one of the ears 320 to prevent lateral movement of the lock bar. Rocking of the supporting member 850 exerts a pull on link 860, rocking the lock bar 863 to bring its forward end directly behind the struck down lug 868 on the latching slide 317 (Figures 3 and 4), thus preventing the rearward movement of these slides necessary to permit depression or release of any numeral key.

The keyboard lock, as well as the selection lock, is disabled during addition to permit faster operation in setting up items on the keyboard. The forward end of link 860 having a slot engaging stud 251 on the add key 250, is lowered upon depression of the add key, so that notch 861 does not engage the pin 862 and rearward movement of the link 860 has no effect upon the lock bar 863.

Power setting of the reversing means, and control therefor

Means are provided for enabling power operated means for setting the reversing gears to subtractive position upon depression of the minus key 220. As previously described, depression of key 220 through pin 223 rocks the bellcrank 225, said bellcrank being maintained in its normal position as shown in Figure 2 by spring 226. Secured to the lower end of the arm of bellcrank 225 is a link 227 (Figures 1 and 2), said link being supported at its rearward end by an arm 227A (Figure 2). The link 227 is provided with a downwardly extending lug 227B of insulating material which is normally disposed between the two spring contacts 801 (Figures 1A and 2). Upon rearward movement of the link 227, the interponent 227B is removed from between the contacts 801 which thereby energize the motor and start the rotation of shaft 100.

The link 227 is provided with a cam lug 227C (Figures 2 and 7) which normally holds the downwardly extending arm of lever 228 to the left, as viewed in Figure 7. The upper arm of said lever 228 contacts the forwardly extending arm 229 of a two part member 229, 229A, holding the same rocked in a counter-clockwise position, as shown in Figure 7, against the compression spring 230. Two part member 229, 229A is carried on shaft 235, being splined on said shaft so that movement of one part of member 229, 229A is effective to rock the other part. The rearward and upwardly extending arm 229A is provided with a cam (Figures 2 and 7) which is adapted to engage in a slot of shaft 144 and shift the same to shift fork 143 (Figure 7) and thereby position the reversing pin 134. Lever 229, 229A is normally held in the position to perform additive rotation of the actuator by spring 231, as shown in Figure 2.

As shown in Figure 7, member 229, 229A is held in its normal inoperative position with the link 227 in its forward position. Upon rearward movement of link 227, compression spring 230 becomes effective to rock the lever 229 in a clockwise direction to position a roller 229B on an upward extension of said lever in the path of a cam 232 (Figure 2) on the driving shaft 100. As the motor has been energized and is rotating the shaft 100 and cam 232 are rotating in a clockwise direction. Cam 232 contacts roller 229B, rocking lever 229, 229A in a counter-clockwise direction, whereby the cam flange formed thereon becomes effective to shift shaft 144, fork 143, and cam 134

to their right hand positions, as viewed in Figure 7, thereby determining a subtractive drive of the actuating mechanism.

The setting of the reversing pin 134 is accomplished before the release of the clutch by bellcrank 115, due to the lost motion between pin 224 and link 750, as shown in Figure 1. Thus the reversing gearing is fully positioned before the clutch is engaged to start actuation.

Means are provided for setting the reversing gearing to subtractive position upon movement of the division lever to operative position. As previously described, movement of the division lever 600 to operative position causes rearward movement of a slide 602 and a pin 602B secured thereto. The pin 602B is disposed immediately in front of an upward extension 227D on link 227 (Figures 2 and 3). Rearward movement of slide 602 is thereby imparted through link 227 to enable the means for setting the reversing gears to subtractive position in the manner described above.

It is to be noted that upon movement of the division lever to operative position, the reversing gears are set before the clutch is engaged for actuation. This is due to the relative spacing of lugs 227D and 151A with respect to the pin 602B as shown in Figure 3. The lug 227D is in contact therewith and the lug 151A is spaced to the rear thereof, so that rearward movement of slide 602 causes first a positioning of the reversing gear to subtractive position, and thereafter an engagement of the clutch.

Means are provided for latching the reversing mechanism in subtractive position upon movement of the same thereto, until the end of the subtracting operation and the disengagement of the clutch. The slide 227 engages a lateral extension 233A on a spring pressed plunger 233 (Figure 2), normally holding the same in depressed position. Upon rearward movement of link 227, a notch 227E permits the plunger 233 to move upwardly under the influence of compression spring 234, the nose of said plunger impinging against a cam 229C formed on member 229A. When member 229 is rocked in counterclockwise direction by cam 232, the cam surface 229C moves from over the plunger 233, allowing the same to move upwardly under the influence of spring 234 to a position in front of the forward edge of said cam, thereby holding member 229, shaft 144 and pin 134 in the position to cause subtractive rotation. When the operation control device is released, that is, either the minus key or the division lever, the slide or link 227 moves forwardly under the influence of spring 226, and again depresses the plunger 233 permitting member 229 to be restored to its normal position, as shown in Figure 2, by the spring 231.

In the modification shown in Figure 8, means are disclosed whereby the clutch is engaged upon depression of the plus or minus keys or multiplier keys by electro-magnetic means. Upon depression of the minus key, the reversing gears are also set by said means.

The plus key 200 is provided on its stem with a cam lug 200A which is adapted to contact with a pin 203A to cam a slide 203× rearwardly against the tension of a spring 205. The pin 203A lies immediately in front of a pair of contacts 803 mounted in a block of suitable insulating material which is mounted for rocking movement on shaft 804. Rearward movement of said pin closes aid contacts, pin 203A engaging one of said pair of contacts while the other contact is pressed against pin 203C, thereby making a circuit through the solenoid 805. The right hand end of the core 806 of said solenoid is made of non-magnetic material, the relative positioning of the magnetic material with respect to the solenoid being such that upon energization of the solenoid the core 806 will be moved to the right from the position shown in Figure 8. Said core 806 lies immediately in front of and in contact with a lateral extension of a pivoted member 120×. Pivoted to the upper end of member 120× is a link 121× which extends rearwardly and by a notch in the rearward end thereof engages a pin 115× on the clutch release bellcrank 115. Consequently, upon energization of the solenoid the rearward movement of its core 806, lever 120×, and link 121× serve to rock the clutch release bellcrank to clutch engaging position.

The minus key 220 is provided on the stem thereof with a cam lug 220A which is adapted, upon depression of the minus key, to contact a pin 203B on slide 203×, moving said slide to the right and closing the contacts 803, whereupon the clutch is engaged in the manner described above. It will be noted that the cam lug 220A is slightly spaced from the pin 203B so that the minus key may move downwardly appreciably before contacting the pin 203B and closing the contacts 803. The purpose of said spacing is to permit positioning of the means for setting the reversing gearing before rearward movement of link 121×.

Means are provided whereby the reversing mechanism is set to subtractive position upon depression of the minus key. The stem of the minus key 220 is provided with a lateral extension 220B which overlies a pin 224A on member 224× pivoted on link 121×. Member 224× is slotted to engage a pin 121A on said link 121× and is normally held with the bottom edge of said slot engaging said pin by a spring 225×, thus maintaining the pin 224A immediately beneath extension 220B. Upon depression of the minus key, member 224× is rocked downwardly, positioning the rearward edge thereof in front of a pin 226A on a depending link 226×. Secured to the bottom of said link 226× is a rearwardly extending link 227 which is pivoted at its rearward end to the reversing member 229A. When member 224× is positioned in front of pin 226A and the solenoid 805 is energized, rearward movement of the core 806 of said solenoid imparts rearward movement to link 121×, link 227, rocking member 229 in a counterclockwise direction, the cam extension 229A thereof becoming effective to shift shaft 144, part 143 and reversing pin 134 to subtractive position. Link 227 and member 229 are normally held in position to determine additive registration by spring 227A tensioned to the forward end of link 227. Link 121× is permitted a sufficient amount of lost motion with respect to clutch release bellcrank 115 so that the reversing pin is fully positioned before engagement of the clutch.

Means are provided whereby the clutch will be engaged by the electro-magnetic means upon depression of a multiplier key. As previously described, upon depression of a multiplier key 730 the nose 731A formed on the bottom of the stem thereof to contact the lug 735A on slide 735 moves said slide rearwardly. The slide 735 is provided with a pin 735B which is disposed immediately forward of a downward extension 800A from the spring contact assembly 803. Rearward movement of slide 735 acts to close said contacts 803, pin 735B engaging extension 800A and rocking

spring contact assembly **803** about shaft **804** so that one of the contact arms is pressed against pin **203A** and is thereby flexed into contact with the other arm thereby energizing the solenoid **805**, causing rearward movement of its core **806** member **120**, link **121** rocking the clutch release bellcrank **115** to clutch engaging position.

I claim:

1. In a calculating machine having a motor, actuating mechanism, a clutch between said motor and said actuating mechanism, power operated means for causing engagement of said clutch, normally disabled means for latching said means in clutch engaging position, motor operation control means, and manually operable means for enabling said engaging means, said latching means and said motor control means.

2. In a calculating machine having a motor, actuating mechanism, a clutch between said motor and said actuating mechanism, power operated means for causing engagement of said clutch, normally disabled means for latching said means in clutch engaging position, manually settable means for controlling said engaging means and initiating operation of the machine including operation of said motor, means for latching said engaging means in operative position, and automatically operated means for disabling said latching means upon completion of an ordinal registration during plural order operations.

3. In a calculating machine having a motor, actuating mechanism, a clutch between said motor and said actuating mechanism, power operated means for causing engagement of said clutch, normally disabled means for latching said means in clutch engaging position, manually settable means for controlling said engaging means and initiating operation of the machine, means for latching said engaging means in operative position, and means controlled by an overdraft registration for disabling said latching means with said settable means in operative position.

4. In a calculating machine having a motor, actuating mechanism, transmission mechanism including a clutch and reversing means, motor operated means for causing engagement of said clutch and positioning said reversing means, and manually operable means for determining operation of said motor operated means.

5. In a calculating machine having a motor, actuating mechanism, transmission mechanism including a clutch and reversing means, motor operated means for causing engagement of said clutch and positioning said reversing means, a switch for controlling operation of said motor, and manually operable means for determining operation of said motor operated means including means for closing said switch.

6. In a calculating machine having a motor, an actuator, a reversible transmission mechanism between said motor and said actuator, normally disabled power operated means for reversing the setting of said mechanism, a normally disabled latch for maintaining said mechanism in adjusted position, and manually operable means for enabling said power operated means and the latch therefor.

7. In a calculating machine having a motor, an actuator, a reversible transmission mechanism between said motor and said actuator including a clutch and reversing means, power operated means for setting said reversing means and causing engagement of said clutch, and manually operable means for enabling said power operated means seriatim.

8. In a motor driven calculating machine, a cyclically operable actuator, a train of driving mechanism therefor including a portion operable in time with said actuator and a separable portion operable synchronously with said motor, a clutch for connecting said portions, means for causing engagement of said clutch, normally disabled means comprising an element of said separable portion of said driving mechanism for operating said clutch engaging means, and a manually operable member for concurrently enabling said last named means and initiating operation of said motor.

9. In a motor driven calculating machine, a cyclically operable actuator, a train of driving mechanism therefor including a portion operable in time with said actuator and a separable portion operable synchronously with said motor, reversing means interposed in the timed portion of said train, means for positioning said reversing means, and means comprising an element of the separable portion of said train for operating said positioning means.

10. In a motor driven calculating machine, an actuator, a clutch element operable in timed relation therewith, an untimed clutch element driven by said motor, circuit closing means for said motor, means for causing engagement of said elements comprising a shiftable member operable by said untimed element, said shiftable member being permanently in cooperation with said engaging means, and a common member for shifting said shiftable member into the plane of said untimed element and operating said circuit closing means.

11. In a calculating machine, a motor, actuating mechanism, a clutch between said motor and said mechanism, means operable by said motor for causing engagement of said clutch, means for controlling starting operation of said motor, and manually operable means for initiating operation of said motor control means to start said motor and to initiate operation of said motor operated means.

12. In a calculating machine having a motor, actuating mechanism, a transmission mechanism including a clutch and reversing means, means operable by said motor for causing engagement of said clutch and positioning said reversing means, and manually operable means for determining operation of said motor operated means and said motor.

13. In a calculating machine, a motor, actuating mechanism, a selecting mechanism, a driving means for said actuating mechanism including a clutch, a power operated means for locking said selecting mechanism and for causing engagement of said clutch seriatim, means for controlling operation of said motor, and manually operable means for initiating operation of said power operated means and said motor controlling means.

14. In a calculating machine, a motor, actuating mechanism, a selecting mechanism, driving means for said actuating mechanism including a clutch and reversing mechanism, power operated means for locking said selecting mechanism, for setting said reversing mechanism, and for subsequently causing engagement of said clutch, means for controlling operation of said motor, and manually operable means for initiating operation of said power operated means and said motor controlling means.

15. In a calculating machine having a motor, a reversible actuator, a transmission mechanism

between said motor and said actuator and operable to drive said actuator in a selected direction, means driven by said motor for causing operation of said transmission mechanism selectively, and manually operable means for selectively initiating operation of said motor operated means.

16. In a motor driven calculating machine, an actuator, clutching and reversing mechanisms between the motor and the actuator, power operated means for causing engagement of the clutch, a manual control for said means, and a second manual control therefor acting to couple said reversing mechanism to said power operated means for concurrent operation thereby.

17. In a motor driven calculating machine, an actuator, clutching and reversing mechanisms between the motor and the actuator, electromagnetic means for causing engagement of the clutch, a manual control for said means, and a second manual control therefor acting to couple said reversing mechanism to said electromagnetic means for concurrent operation thereby.

WALTER E. MATHI.