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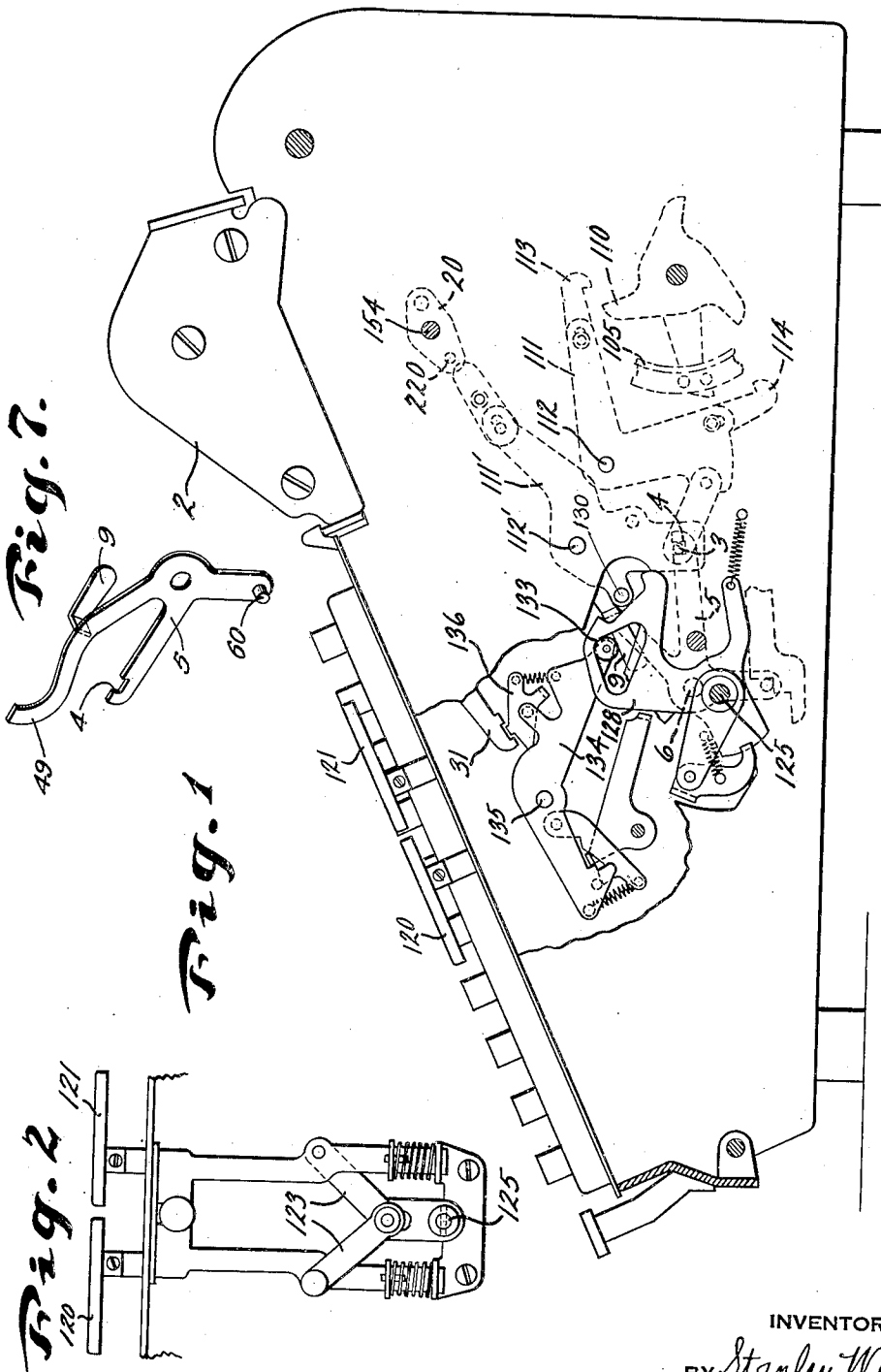
S. WICKS

2,221,686

CALCULATING MACHINE

Filed April 30, 1937

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

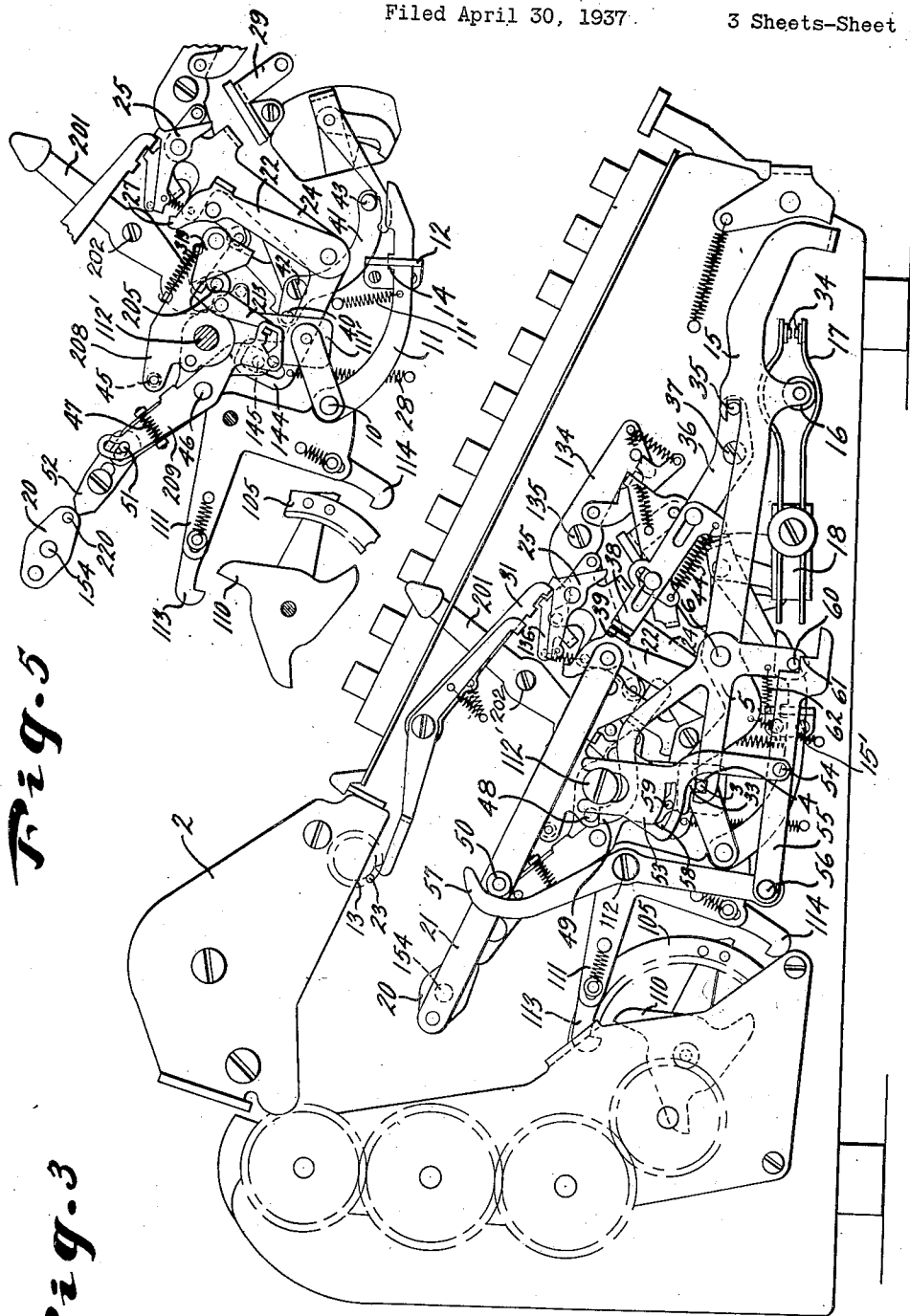


Fig. 5

Fig. 3

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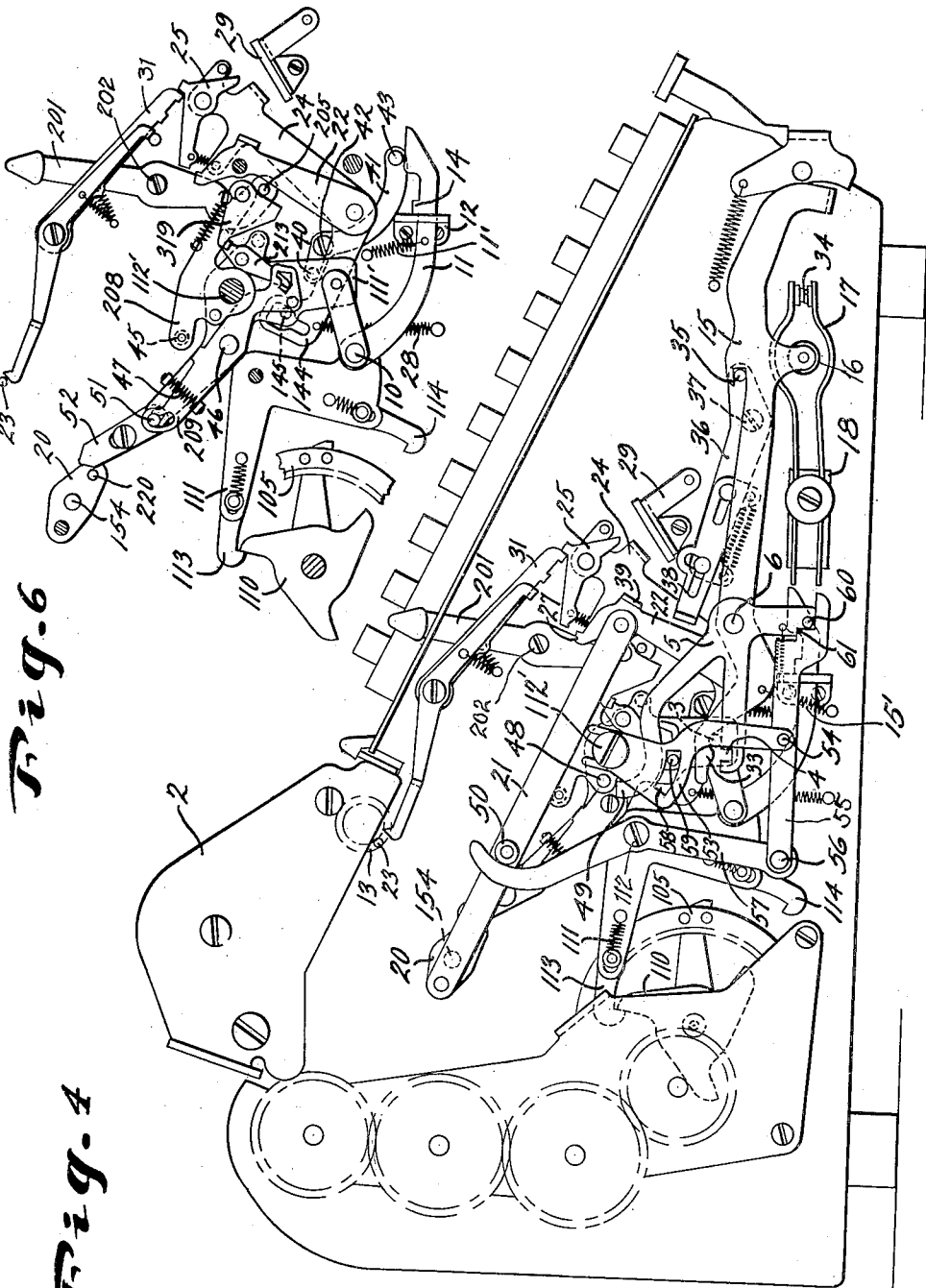
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,221,686

CALCULATING MACHINE

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Application April 30, 1937, Serial No. 140,015

2 Claims. (Cl. 235—62)

The invention relates to reversible cycle calculating machines, such as the well known "Monroe," wherein there is provided a three-position clutch member controlling the drive of the machine in one or the other direction, an object of the invention being to provide means for positively holding or locking said clutch member in its three positions to thus insure engagement of the driving means and centralization of the clutch member. Another object is to provide means for releasing and maintaining release of the normally engaged locking means for said clutch member during the plurality of cycles of movement of the machine required in accomplishing full automatic division. Other objects and advantages will appear hereinafter.

The invention consists in the novel construction and combination of parts as set forth in the appended claims.

In its preferred embodiment the invention is shown as applied to a Monroe calculating machine, constructed in accordance with the disclosure of the U. S. patents, Numbers 1,964,211 and 1,964,478, issued to Austin A. Overbury on June 26, 1934. Reference is also made to the Patents Numbers 1,566,650 and 1,888,161, issued to George C. Chase on December 22, 1925, and November 15, 1932.

In the accompanying drawings illustrating the invention,

Figure 1 is a right hand side elevation showing certain parts mounted upon the left hand side frame of the machine and controlled by the plus and minus bars, the casing of the machine being shown as broken away, and certain other parts being shown in dotted lines.

Figure 2 is a detail side view of the plus and minus bar mechanism.

Figure 3 is a left hand side elevation of the machine, with the casing removed, the parts being shown in normal position.

Figure 4 is a view similar to Figure 3 with the division lever thrown to active position, the clutch lever engaged with one of the rotating clutch elements, the means for locking the clutch lever in neutral position released, the means for locking said clutch lever in engagement with one or the other of said rotating clutch elements in active position, the means for maintaining the release, in division operations, of the means for locking the clutch lever in neutral position, the contacts of the motor switch engaged, and the locking means for the machine in full cycle position released.

Figure 5 is a detail side view of certain parts

shown in and in the positions of Figure 3, parts being removed to show the clutch controlling means.

Figure 6 is a detail side view of certain parts shown in and in the positions of Figure 4, parts being removed as in Figure 5.

Figure 7 is a detail perspective view of the latch lever.

According to known construction, amounts set up on suitable differential actuating devices are registered upon the numeral wheels 13, upon rotation of the shaft of the actuating means and the shaft 154 upon which the tens carry members are mounted, said shafts being connected with an electric motor and a train of gearing adapted for forward or reverse rotation, to register additively or subtractively upon said wheels 13. These wheels 13, and the multiplier-quotient wheels (not shown) are mounted upon an endwise shiftable carriage 2, utilized in multiplication and division in the well known manner.

Single order operations

In single order operations, registration is controlled by plus bar 120 and minus bar 121 (Fig. 2), having link connections 123 with a rock shaft 125 extending across the machine and provided with a setting plate 128 having spaced shoulders adapted to engage a projection 130 of a compound reversing clutch lever 111, 111', fulcrumed upon the framing of the machine at 112, 112'. This clutch lever is normally positively held or locked in neutral or centralized position by means of the engagement of a pin 3 thereof with a notch 4 of a latch lever 5, fulcrumed upon the framing at 6. Depression of the plus bar 120 will rock the shaft 125 and setting plate 128 in clockwise direction as viewed in Figures 1 and 2, thereby moving said clutch lever from neutral into adding position, in which a hook arm 114 of said lever will engage with a lug upon the gear 105 forming one leg of the differential drive to said shaft 154. Normally the gearing comprising both working legs of said differential drive will rotate idly, as described in said Patent No. 1,566,650. Interruption of the movement of one leg causes the planet gears of said drive to move in their orbit in one direction and interruption of the movement of the other leg causes said planet gears to move in the opposite direction. Depression of the minus bar 121 will effect rocking movement of the parts 125, 128, and 111, 111' to bring hook arm 113 of said clutch lever into engagement with the member 110 of the other leg of the differential drive,

whereby the drive of the shaft 154 will be effected in the reverse direction.

During the above described movements of setting plate 128, suitable opposed cam surfaces of said plate having engagement with a roller 133 of a lever 134, fulcrumed at 135, will rock said lever downwardly. The roller 133 also engages an arm 9 of said latch lever 5, and during downward movement of lever 134 will rock said latch lever out of engagement with pin 3 of the clutch lever prior to movement of the latter.

Pivoted at 10 (Figs. 5 and 6), to lever element 111 is a spring tensioned latch arm 11, the forward end of which extends through a suitable aperture of a bracket 12, the latter being fast to the stationary framing. The latch arm 11 is provided with a projection 14, adapted, in centralized position of the clutch lever 111, 111', to be inactively positioned, as seen in Figure 5. The above described movement of clutch lever 111, 111', into engagement with either adding leg 105 or subtracting leg 110 of the differential drive, will move said latch arm in one or the other direction, whereby it will be drawn upwardly by its spring 11' and the projection 14 of said arm will be engaged with one side or the other of said bracket 12 to thereby positively hold or lock said clutch lever in engagement with one or the other of the clutch elements 105 or 110.

Fulcrumed to the stationary framing at 6 is a rock lever 15, provided at its forward end with an insulating roller 16, normally having engagement with spring arm 17 of a motor switch 18. With clutch lever 111, 111', in normal centralized position, pin 3 thereof will be positioned beneath a projection 33 of the rearward arm of rock lever 15, to thus hold the contacts 34 of switch 18 disengaged. Operation of clutch lever 111, 111', upon depression of the plus bar 120 or the minus bar 121, will move said pin 3 of the clutch lever free of said projection 33, thereby releasing rock lever 15 from spring arm 17 of the switch, whereupon the retraction of the spring 17 will engage the contacts 34 of the switch and a machine cycle will be initiated. Rock lever 15 is at the same time retracted by its spring 15'.

Rock lever 15 has pin and slot engagement 35, with a lock lever 36, fulcrumed upon the framing at 37, and provided with a flexible mounted end 38, normally positioned in the path of movement of a projection 39 of rock arm 22, thereby locking the machine in full cycle position. Upon the release of rock lever 15 as above described, lock lever 36 will be rocked counter-clockwise beneath the projection 39, thereby unlocking the cyclic drive.

Upon manual release of plus bar 120 or minus bar 121, the parts will be brought to rest in full cycle position by cyclically operable means described as follows:

Setting plate 128, in depressing the rear end of lever 134, carries a pawl 136 (Figs. 1 and 3) mounted upon said lever, into position beneath a trigger 31, said trigger normally engaging a pawl 25 mounted upon rock arm 24, and serving to hold said pawl inactive. Upon release of the plus or the minus bar, suitable springs will return lever 134 to normal position, thereby causing pawl 136 to raise trigger 31 and release pawl 25, the latter then being spring urged into position behind a shoulder 27 of rock arm 22, said arm being connected to the operating shaft 154 by crank 20 and link 21. This connects the arms 22 and 24 to operate in unison, and therefore, after the eccentric connection of link 21 with shaft 154

passes through dead center (corresponding to full cycle) position, arm 22, moving forwardly, will carry arm 24 therewith, the latter arm being carried against a fixed stop 29, to prevent further rotation of the parts in the original direction.

In the movement of rock arm 24 against stop 29, a rearward extension 144 (Fig. 6) of said arm will first engage a pin 40, fast to lever 41, fulcrumed to the framing at 42, thereby rocking said lever clockwise. Upon clockwise movement of lever 41, a pin 43 fast to the forward end of said lever will depress the forward end of latch arm 11 and release the projection 14 thereof from the bracket 12, and as arm 24 continues in its movement to the stop 29, rearward extension 144 of said arm will continue to be raised and a suitable cam face of said extension, acting upon a pin 145 of compound clutch lever 111, 111', will move said lever to its centralized or neutral position, thereby releasing the motor drive.

The restoration of setting plate 128 to normal position upon release of the plus or the minus bar releases latch lever 5, which is then retracted by its spring 62 to reengage notch 4 with pin 3.

During this movement, pin 3 of said clutch lever will reengage projection 33 of rock lever 15 and rock said lever clockwise about its fulcrum 6 to disengage the motor switch 18. Clockwise movement of rock lever 15 will impart clockwise movement to the full cycle lock lever 36, during which the flexibly mounted end 38 of said lock lever will engage the under surface of projection 39 of rock arm 22, and as the latter is restored to full cycle position upon the rebound of the parts under influence of spring 28, from the stop 29, spring 44 will snap said flexibly mounted end 38 into position opposite said projection to again lock the machine in full cycle position.

During the rebound of the parts from the stop 29, a lug of pawl 25 will engage with the end of trigger 31, said pawl being thereby lifted out of engagement with said shoulder 27 of rock arm 22. A locator cam, such as that described in patent 1,566,650, and designated therein as 153, is attached to one of the driven shafts and serves to locate the parts accurately in their position of rest.

Plural order operations

Patent 1,888,161 above referred to, describes means, upon rearward setting of manipulable lever 201, for accomplishing full automatic division by setting the machine in operation subtractively, reversing the numeral wheel actuators upon over-subtraction in said wheels, and making a single corrective additive cycle, which effects a tens carry to the higher order wheels, the tens carry movement being utilized to determine disengagement of the clutch and shifting of the numeral wheel carriage.

Means for accomplishing automatic multiplication is fully set forth in Patent 1,964,211 hereinbefore referred to.

In the present invention, the latch arm 11, the projection 14 of which is adapted to engage one side or the other of the bracket 12, will insure positive engagement of the clutch lever with a rotating clutch element during the plurality of cycles of movement of the machine required in accomplishing automatic multiplication.

In accomplishing full automatic division however, the following means are provided for releasing and maintaining release of the normally

effective locking means for said lever during the plurality of cycles of movement of the machine required, namely during the calculation of the first figure of the quotient including automatic reversal of the clutch lever from subtractive to additive position and the corrective additive cycle; during the calculation of the second figure and any following figures of the quotient including the automatic reversal of the clutch lever from additive to subtractive position, from subtractive to additive position and the final corrective additive cycle; the normally ineffective locking means for said lever having the operation previously described for single order operations and being rendered effective or enabled during the calculation of the first figure of the quotient, rendered ineffective or disabled and enabled again on automatic reversal of the clutch lever from subtractive to additive position and remaining enabled during the corrective additive cycle, and being disabled and enabled again on automatic reversal of said lever from additive to subtractive position and remaining enabled during the calculation of the second figure of the quotient, etc.

Manipulable division lever 201, fulcrumed upon the framing at 202, being moved to rearward position, will bring a pin 205 thereof (Fig. 5) into engagement with a click pawl 319, mounted upon the forward end of an arm 208, which arm is pivoted upon the fulcrum 112' of clutch lever element 111'. In this movement, pin 205 will rock arm 208, a pin 45 on the rearward end of said arm acting upon a lever 209, fulcrumed at 46 to clutch lever element 111' and having flexible spring connection 47 therewith, to bring the hook arm 113 of the clutch lever into engagement with subtraction member 110 of the differential gear train, thus setting the machine into operation subtractively, upon engagement of the motor switch 18, in the manner previously described.

During the above mentioned movement of arm 208, a pin 48 fast to said arm will engage an arm 49 of latch lever 5, thereby rocking said latch lever out of engagement with pin 3 of the clutch lever. Pin 205 passes entirely beyond the pawl 319 in this movement, leaving the clutch lever in that respect free to be adjusted to any one of its three positions. However, projection 14 of latch arm 11 will have been moved to the position shown in Figure 6, thereby positively holding or locking the clutch lever 111, 111' in its subtractive position.

The machine will continue in subtractive operation, until an over subtraction occurs, thereby causing a pin 23 of the numeral wheels 13 in engaging the rear end of trigger 31, to trip the pawl 25. Rock arm 24 will now be carried against stop 29, as previously described, the clutch lever 111, 111' released from the aforesaid positive holding means and brought to unclutching position and pawl 25 re-engaged with the end of trigger 31. In addition to this however, the setting of manipulable lever 201 has adjusted certain control devices into position to effect the reclutching of lever 111, 111', in its reverse operation position, that is to say, in this case hook arm 114 of said lever 111, 111' will be engaged with addition clutch member 105 of the differential gear train the positive holding means for said lever reengaged and the machine will be started in additive operation. For this purpose, counter-clockwise movement of lever 209 in said unclutch-

ing of lever 111, 111', through suitable pin and slot engagement 51 of lever 209 with tooth 52, will advance said tooth, which is mounted upon the framing of the machine, into the position shown in Figure 6, the lever 209 and tooth 52 being latched in this position by means of latch 213. In this position, tooth 52 is so adjusted that whenever lever 111, 111' is brought into its neutral position, the rearward end of said tooth will lie in the path of movement of a pin 220 carried by the crank arm 20 of shaft 154, said pin 220 thus acting to throw the clutch lever 111, 111' into additive or into subtractive position, according to the direction of rotation of shaft 154, all as fully described in the aforementioned Patent No. 1,888,161.

During the above described automatic operation of clutch lever 111, 111', the latch lever 5 will be maintained in position released from engagement with pin 3 of the clutch lever, by means described as follows:

Pivotal and slidably engaging at the upper end thereof with fulcrum stud 112' of clutch lever element 111', is a plate 53, the lower end of which is pivoted at 54 to an arm 55, the latter being pivoted at 56 to the lower arm of a rock lever 57 fulcrumed upon fulcrum stud 112 of clutch lever element 111, said rock lever 57 having an upper arm adapted to cooperate with roller 50 carried by link 21 as hereinafter described. Plate 53 is provided with a slot 58, arched about fulcrum 112' as a center and through which extends a pin 59 fast to lever 209. During rocking movement of clutch lever 111, 111', the pin 59 will move idly along said slot 58 of plate 53. As lever 209 is rocked about its fulcrum 46 however, the pin 59 will be moved upwardly, thereby lifting the plate 53 therewith. Centralizing latch lever 5 is provided with a pin 60 normally positioned above shoulder 61 of arm 55, as shown in Figure 3. During counter-clockwise movement of lever 209 however, pin 48, in rocking said latch lever 5 counter-clockwise out of engagement with pin 3 of the clutch lever, will carry pin 60 free of the shoulder 61 of arm 55.

As the plate 53 is moved upwardly, arm 55 will be rocked upwardly about its pivot 56 to bring the shoulder 61 thereof rearwardly of the pin 60 of latch lever 5 to the position shown in Figure 4.

As the pin 3 of the clutch lever 111, 111', during centralization of said lever, is moved opposite the related notch 4 of latch lever 5, the roller 50 of link 21, will be positioned against the upper arm of lever 57, whereby pin 60 of latch lever 5 engaging rearwardly of said shoulder 61 of arm 55 will hold said latch lever free of said pin 3 during automatic reversal of said clutch lever. This will continue during each automatic reversing action of said clutch lever, until the completion of the final corrective additive cycle following the restoration of the manipulable division lever 201, when cyclically operable means will restore the parts to normal position as previously described for single order operations with respect to the means for holding the clutch lever engaged with a rotating clutch element, and by means to be described with respect to the means for holding the clutch lever in its neutral position.

Restoration of the division lever 201 restores pin 205 thereof to its normal position. The machine will continue to run until an over-carry causes the parts to be carried to the stop or bumper 29 and centralizes the clutch lever 111, 75

111', and upon rebound of the parts from said bumper, said clutch lever will be rocked into additive position as previously described. The machine will now make its final corrective additive cycle and come to rest in full cycle position as follows:

As the pin 220 of crank 20 rocks the clutch lever 111, 111', into add position, latch 213 mounted on said clutch lever will be carried downwardly and in contacting the restored pin 205 of the division lever 201, will release lever 209. Release of lever 209 will cause said lever to be rocked clockwise about its fulcrum 46, under influence of its spring 47, thereby withdrawing tooth 52 forwardly out of the path of movement of the pin 220 of crank 20. The above named movement of lever 209 will carry slide plate 53 downwardly, thereby bringing the shoulder 61 of arm 55 below the path of movement of pin 60 of latch lever 5. The parts are then again tripped by the numeral wheel 13, and as clutch lever 111, 111' is caused to be centralized upon the subsequent movement of the parts towards the bumper 29, shoulder 61 of arm 55 being now out of the path of movement of pin 60 of latch lever 5, said latch lever, under influence of its spring 62 will reengage notch 4 thereof with pin 3 of the clutch lever to positively hold or lock said clutch lever in centralized position.

Upon rebound of the parts from the bumper 29, the pawl 25 of rock arm 24 will be disengaged from shoulder 27 of rock arm 22, and tooth 52 having been withdrawn as previously described, the parts will remain in normal position.

During centralizing of the clutch lever 111, 111', the contacts of the motor switch 18 will be disengaged, and as the parts are brought into normal position the lock lever 36 will be moved opposite projection 39 of rock arm 22, thereby locking the machine drive as previously described.

I claim:

1. In a calculating machine, the combination

with motor driven reversible actuating means including a driving train having oppositely rotating clutch elements, and control means including a clutch member and a plus key and a minus key for controlling said clutch member; of normally effective means for locking said clutch member in neutral position, normally ineffective means for locking said clutch member in engagement with one or the other of said clutch elements, and means for rendering ineffective said first named locking means and for rendering effective said last named locking means upon manipulation of the plus key or the minus key and for restoring the parts to normal position upon retraction of the plus key or the minus key.

2. In a calculating machine, the combination with motor driven reversible actuating means including a driving train having oppositely rotating clutch elements, control means including a clutch member engageable with first one and then the other of said clutch elements to accomplish a plurality of successive cycles of movement of the machine in opposite directions in division operations and a division key for controlling the engagement of said clutch member with one of said clutch elements, and means for automatically releasing said clutch member from the one clutch element and engaging the same with the other clutch element; of normally effective means for locking said clutch member in neutral position, normally ineffective means for locking said clutch member in engagement with one or the other of said clutch elements, and means for rendering ineffective and maintaining ineffectiveness of said first named locking means during said plurality of cycles of movement of the machine in opposite directions and for rendering effective said last named locking means upon manipulation of the division key and for restoring the parts to normal position upon retraction of the division key.

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