Sept. 19, 1933. G. LERCH 1,927,269

CALCULATING MACHINE

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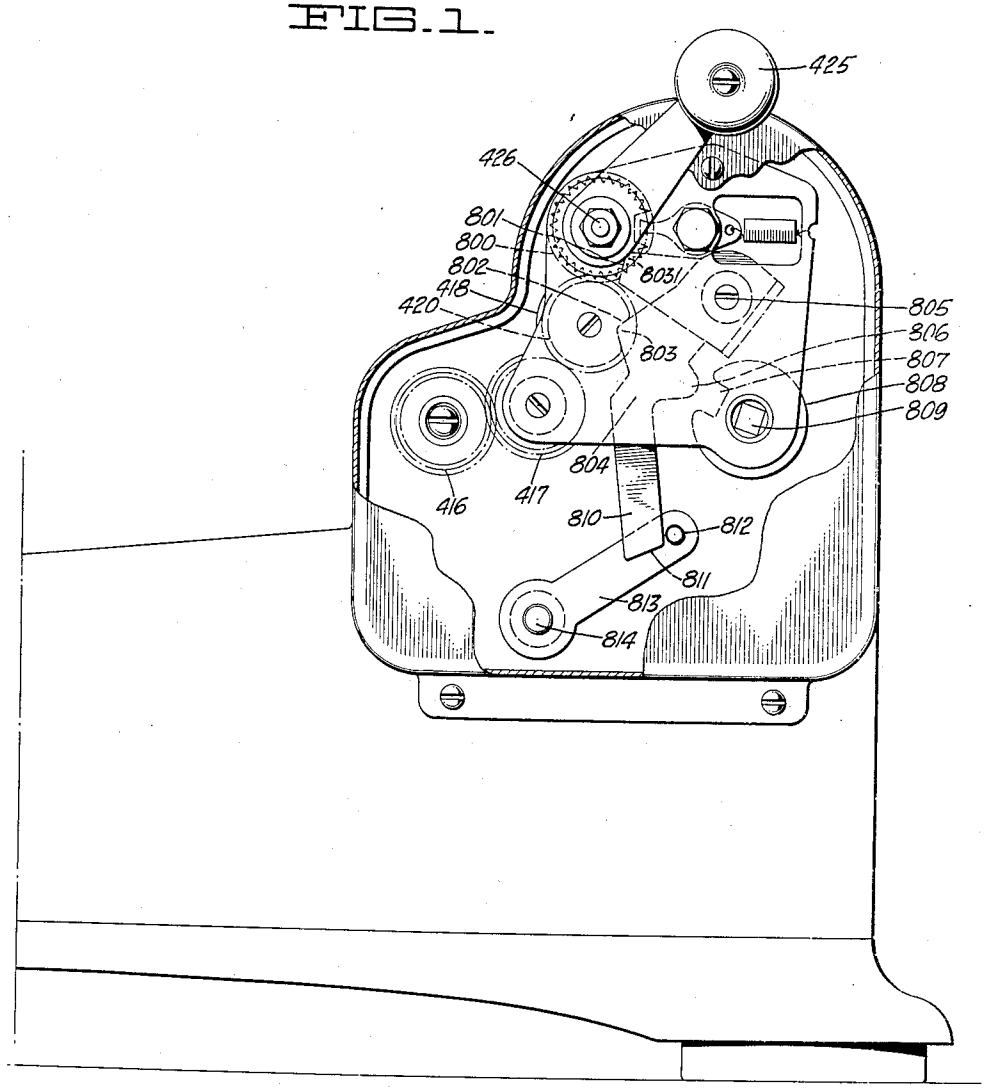
FIG. 1.



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CALCULATING MACHINE

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FIG. 2.

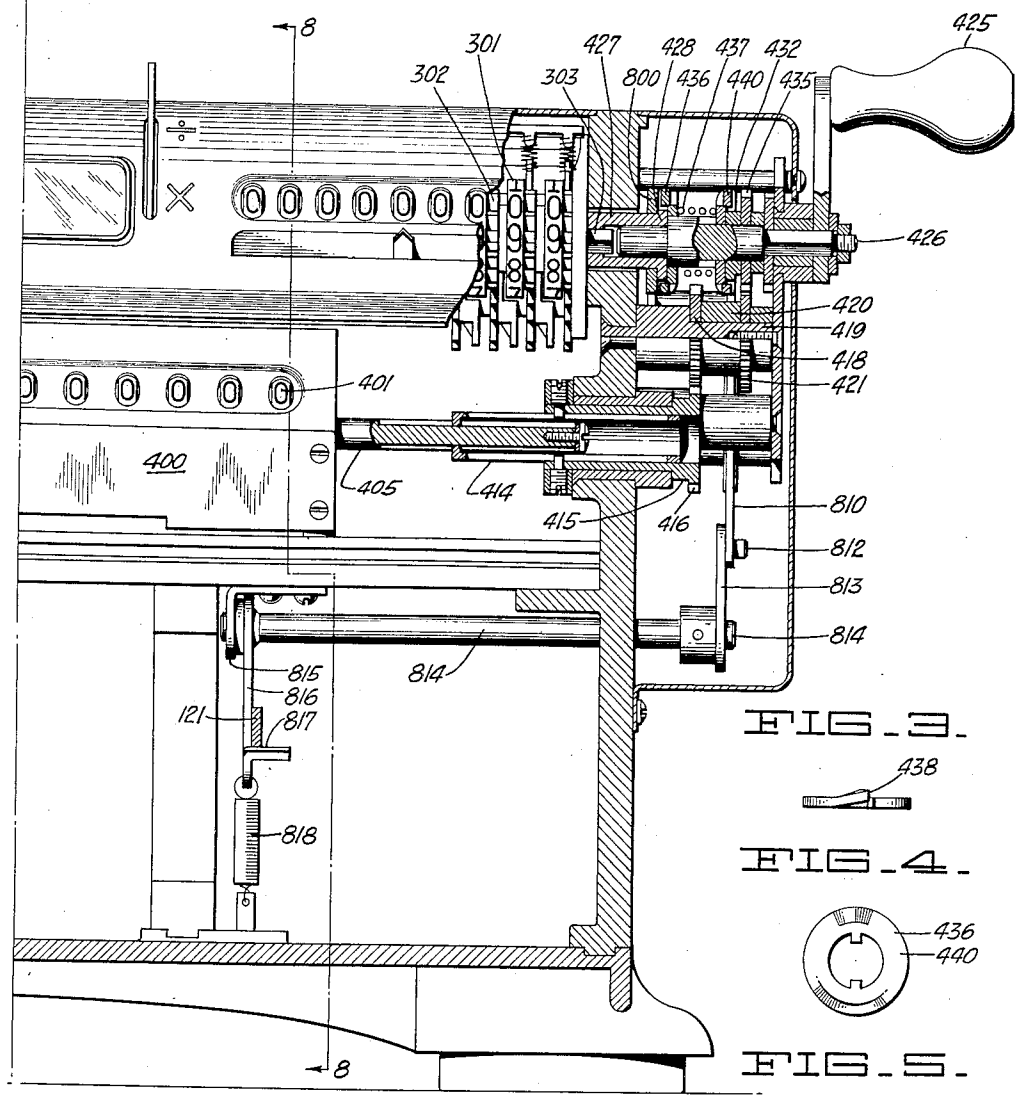
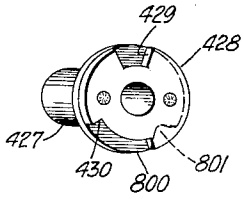


FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.



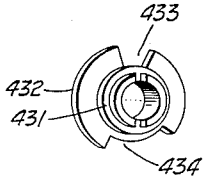


FIG. 7.

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FIG. 8.

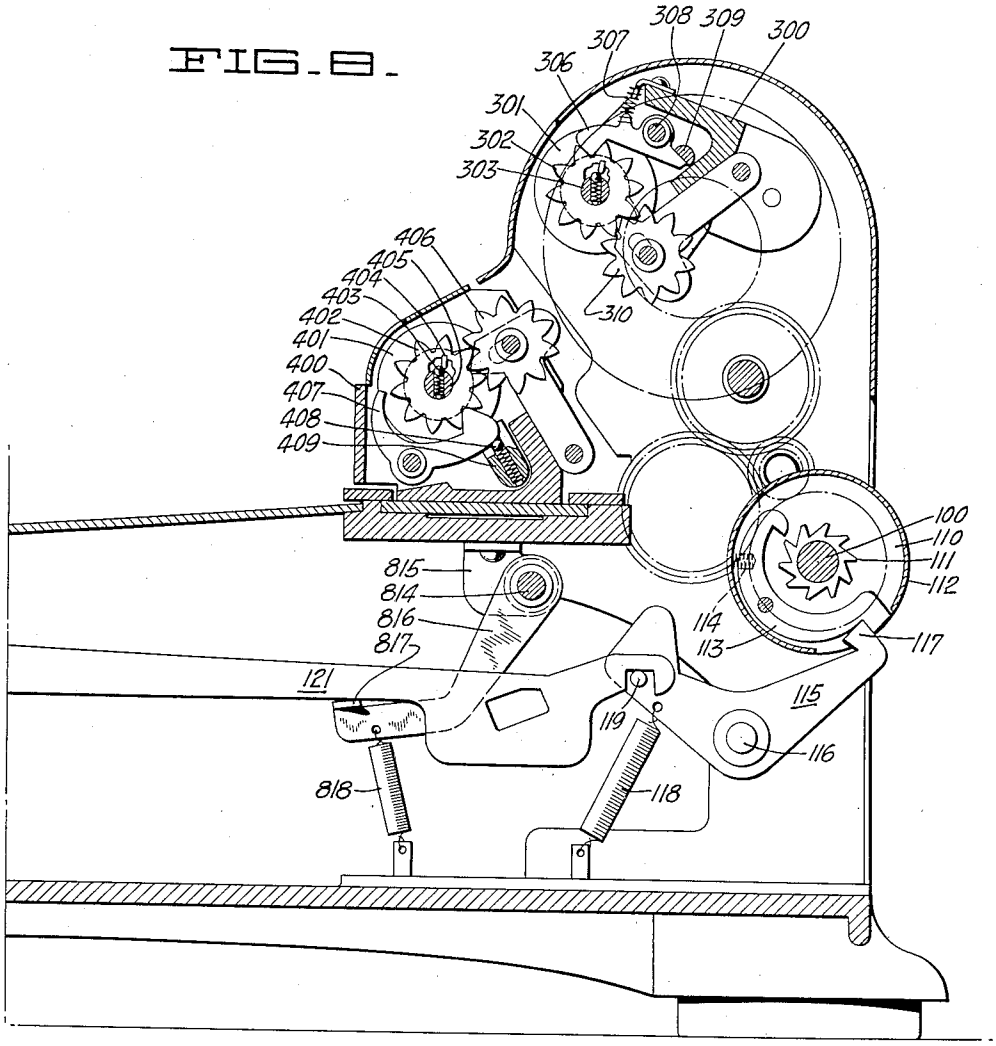


FIG. 9.

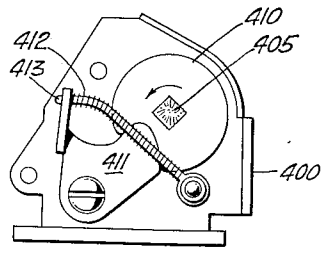
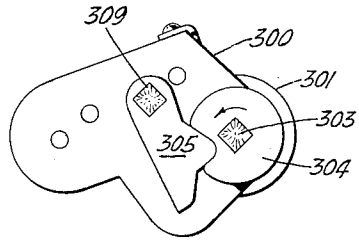


FIG. 10.



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Patented Sept. 19, 1933

1,927,269

UNITED STATES PATENT OFFICE

1,927,269

CALCULATING MACHINE

Gustav Lerch, Oakland, Calif., assignor to Marchant Calculating Machine Company, a corporation of California

Application May 10, 1930. Serial No. 451,422

10 Claims. (Cl. 235—130)

The present invention relates to calculating machines, and particularly to the type embodying two separate and distinct registering mechanisms comprising rotatable disks, either or both of which can be returned to zero position by turning a single crank shaft, rotation of the crank shaft in one direction serving to zeroize one register, and rotation of the crank shaft in the opposite direction serving to zeroize the other register. Registers of this type are shown in the application of Friden, Serial Number 182,627, filed April 11th, 1927, to which reference is hereby made for a disclosure of mechanisms as are not specifically described herein.

It is an object of the invention to provide a simple and dependable interlocking mechanism whereby the driving means of the calculating machine will be automatically disabled while either of the above mentioned registering mechanisms is being zeroized or is out of its full cycle position.

Other objects will appear as the description progresses.

The invention possesses a plurality of advantageous features, some of which will be set forth at length in the following description, where that form of the invention which has been selected for illustration in the drawings accompanying and forming part of the present specification shall be outlined in full. In said drawings, one form of apparatus embodying the invention has been shown, but it is to be understood that the invention has not been limited to such form, since the invention, as set forth in the claims, may be embodied in a plurality of other forms.

It is manifest that the invention may be embodied in a calculating machine having any suitable form of accumulator and counter registers. In the accompanying drawings, the invention is shown embodied in a calculating machine of the general type disclosed in the patent to Friden, Number 1,643,710, dated September 27th, 1927, to which reference is hereby made for a disclosure of a complete calculating machine. The machine comprises an actuator into which the values to be calculated are introduced by any suitable means, and from which the introduced values are transmitted to the accumulator register, upon rotation of the actuator. The machine also embodies a counting register which is operated in time with the rotation of the actuator. The accumulator register is arranged in displaceable relation with respect to the actuator for the purpose of making direct action of the selected values on the numeral wheels of highest value possible.

In the accompanying drawings forming a part of this specification:

Figure 1 is a side elevation of a portion of a calculating machine provided with a single crank for zeroizing both registers, a portion of the casing being broken away to more clearly disclose the mechanism associated with the crank, and part of the interlocking mechanism for automatically disconnecting the driving means. The remainder of this latter mechanism will be disclosed as this specification progresses.

Figure 2 is a lateral section showing the zeroizing crank, its associated mechanisms, and a front view of the mechanism composing the present invention herein specified.

Figures 3, 4, and 5 are views of the driving member of the clutch, Figure 3 being a top view of Figure 4, and Figure 5 being a bottom view of Figure 4.

Figure 6 is a perspective view of one of the clutch members forming part of the drive for the zeroizing mechanism and its integrally mounted co-member for operating the mechanism composing the present invention when one register is being zeroized.

Figure 7 is a perspective view of another clutch member forming part of the drive of the zeroizing mechanism, which also serves as the operating member for the mechanism composing the present invention when the other register is being zeroized.

Figure 8 is a longitudinal section taken on the line 8—8, Figure 2.

Figure 9 is an end elevation of the carriage on which the accumulator register is mounted.

Figure 10 is a left end view of the frame in which the counter register is mounted.

Drive control

In the present embodiment, the driving mechanism comprises an electric motor which is connected to the drive shaft 100 (Figure 8) by appropriate speed reducing gearing and is adapted to be intermittently connected to the calculating machine to drive the same.

The means whereby the drive is connected to the calculating mechanism includes a clutch 110, the driving member of which is a toothed wheel 111, fixed on one end of the drive shaft 100. Enclosing the toothed wheel 111 is a circular housing 112, which constitutes the driven member of the clutch, and pivoted within this housing in a position to engage the toothed wheel 111 is a

driving pawl 113. This pawl is normally pressed into engagement with the toothed wheel by means of the inset compression spring 114, but is adapted to be maintained in its non-engaging position by means of the clutch control mechanism.

The clutch control mechanism comprises a bell crank member 115 journaled on a stub-shaft 116 on the machine frame and carrying on one end a projection 117 adapted, when the actuator is in full cycle position, to project through an appropriately positioned aperture in the clutch housing 112 to engage the tail of the pawl 113 and urge it to clutch disengaging position.

A spring 118 tensioned between a stud on the machine base and the opposite end of the bell crank 115, tends to urge the projection 117 into clutch disengaging position, so that in the absence of intervention by other instrumentalities, the actuator will be brought to rest with the clutch in disengaged position when it reaches full cycle position after a rotation. Means are provided for operating the bell crank 115 to engage the actuator for the number of rotations requisite to perform a desired calculation, and pin 119 is provided on the forward end of the bell crank 115 for this purpose. Pin 119 is engaged by the notched rear end of the control link 121 which is pivoted at its forward end to a control plate, and normally held in position overlying the pin 119 by a suitably tensioned spring as is disclosed in the above mentioned patent. A plurality of operating means provided in a calculating machine are adapted to impart to control link 121 an oscillation to the right as viewed in Figure 8. This imparts a corresponding clockwise oscillation to the clutch operating bell crank 115 permitting engagement of the driving pawl 113 for the period that such adjustment is maintained. An object of the present invention is to provide means whereby the notched end of control link 121 is lifted out of operable engagement with pin 119 on bell crank 115. The means whereby this end is accomplished will be described hereinafter.

The accumulator register

The calculating machine embodies a rotary actuator, such as is disclosed in the above mentioned patent and application, and into which values may be introduced by any suitable means. On rotation of the actuator, the introduced values are transmitted to the numeral wheels 401 mounted on the transversely movable carriage 400. The machine is also provided with a counting register, comprising a plurality of numeral wheels, which is operated in time with the revolutions of the actuator. Integral with each numeral wheel 401 of the accumulator register 400 is a ten-tooth gear 402 which is engaged by an escapement pawl 407 to provide step by step movement of the numeral wheel 401. It also places the numeral wheel in proper relative position with the actuator and prevents its overthrow. The pawls 407 are normally held in spring pressed engagement with the gears 402 by the spring pressed balls 408 which are mounted in an oscillatory comb 409, said comb being journaled at its ends so that it may be rotated to move the balls 408 out of contact with the pawls 407, thereby permitting free rotation of the gears 402 and their integral numeral wheels 401. This accumulator register is provided with a zero resetting shaft 405 which extends axially through a plurality of the numeral wheels 401 and which is provided with a plurality of spring pressed balls 403 respectively engaging a tooth 404 secured to the internal periphery of each numeral wheel. The spring compressing the ball 403 is of sufficient strength to cause the numeral wheel 401 to be carried with the shaft 405 upon rotation thereof when the spring pressure on the pawl 407 has been released, and means are provided for releasing this pressure upon initial movement of the zero resetting shaft 405 from neutral position. Secured to the zero resetting shaft 405 (Figure 9) is a disk having a depression in its periphery in which an arm of the lever 411 seats when the shaft 405 is in neutral position. The arm of 411 is held in the depression by a spring 412 surrounding the pivoted rod 413. The lever 411 is secured to the end of the comb 409 (Figure 8), so that as the lever 411 is rocked, upon initial rotation of the zero resetting shaft 405, the comb 409 is rocked to move the balls 408 out of contact with the pawls 407, thereby releasing the pawls, and removing the resistance to rotation from numeral wheel 401. Therefore, further rotation of the zero resetting shaft 405 moves the numeral wheels to zero position, and upon completion of a rotation of the zero resetting shaft 405, the lever 411 springs back into the depression in the periphery of the disc 410, and thereby rocks comb 409 back to normal position as shown (Figure 8), and causes the reapplication of spring pressure to the pawls 407.

The counter register

The counter register carried on frame 300, the majority of which is an exact replica of the accumulator register, will be specified only in part to show wherein the two are differentiated.

The numeral wheels 301 are likewise provided with the ten-tooth gears 302 which are engaged by the spring-pressed pawls 306 to perform a similar function to that specified in the accumulator register. The pawls 306 are individually pivoted on a shaft 308 and are normally held in contact with the gears 302 by the springs 307. Means are provided whereby the pawls 306 are lifted out of engagement with the gears 302, to permit free rotation of the numeral wheels 301 during the zero resetting operation. For this purpose, an oscillating half-round shaft 309 engages a projection of the pawls 306 beyond the shaft 308, and, normally, the flat surface of the half-round shaft is in engagement with the pawls. Rotation of the shaft 309, however, through a limited arc, rocks the pawls 306 sufficiently to move them out of engagement with the gears 302 to permit free rotation of the numeral wheels 301. The zero resetting shaft 303 which extends axially through a plurality of the numeral wheels 301 is provided on its end with a disk 304 (Figure 10) having a depression in its periphery which is engaged by a projection of the lever 305 secured to the end of the half-round shaft 309, which in its neutral position, allows the projection of lever 305 to be seated in the depression on the periphery of disk 304. The initial rotation of this disk from this neutral position causes lever 305 to swing back and revolve shaft 309 sufficiently to disengage pawls 306 from gears 302, thereby permitting their free rotation for the zero resetting operation. The depression in the peripheries of disks 304 and 410 and the shape of the projections on levers 305 and 411 are such that the disks 410 and 304 may be rotated only in a counter-clockwise direction as is shown in Figures 9 and 10.

Calculating machines have heretofore been provided with a lock which caused a positive jam to occur if an attempt were made to revolve the

actuator while either one of these zero resetting shafts was out of its full cycle position. This positive jam was allowed for by the provision of a safety friction clutch which had to be of sufficient strength to drive the machine, therefore was also of sufficient strength to cause undue stresses and strains on the machine parts upon the occurrence of a jam. It can readily be seen that without any lock a more serious jam could occur if either of the zero resetting shafts were out of its full cycle position, causing the pawls to be out of engagement with the gears and, therefore permitting free rotation of the intermediate gears 406 or 310. This free rotation could so place the intermediate gear that the end of a tooth would jam against the end of its driving member on the actuator.

The aforementioned object of the present invention is to so temporarily disable the operating means of the calculating machine so that rotation of the actuator, or starting of the motor is impossible during the period that either of the zero resetting shafts is out of its full cycle position, thus preventing the possibility of either type of jam set forth above. While the specific embodiment of the invention chosen for purposes of illustration is one in which the operating means for controlling the drive of the actuator is disabled during operation of the resetting mechanism, the scope of the invention is not limited to such embodiment, being equally applicable to a structure in which the operating means for controlling a power driven resetting mechanism is disabled during operation of the actuator.

The particular zero resetting mechanism chosen to be described in connection with the present invention, is one whereby a crank 425 (Figures 1 and 2) secured to crank shaft 426, journaled in the frame of the machine, is normally held in neutral position by means provided therefor. The crank 425 is rotatable in either direction, rotation in one direction serving to zeroize one register and rotation in the opposite direction serving to zeroize the other register. Full-stroke means are provided for necessitating the complete zeroizing revolution of one register before the crank can be rotated in the opposite direction to zeroize the other register.

Means are also provided for connecting the crank shaft 426 to the zero resetting shaft 303 upon movement of the crank in one direction, and for connecting the crank shaft 426 to the zero resetting shaft 405 upon rotation of the crank 425 in the opposite direction. Mounted on the crank shaft 426 and rotatable with respect thereto, is a sleeve 427 connected to the zero resetting shaft 303 so that it rotates therewith. The sleeve is provided on its end with a flange 428 having two depressions 429 and 430 of different lengths, the depression 429 being shorter than 430. Rotatably mounted on the crank shaft 426 and spaced from the sleeve 427 is a collar 431 with a flange 432 which is similarly provided with short and long depressions 433 and 434. Secured to the collar 431 is a gear 435. Splined to the chank shaft 426, and associated with the flange 428 is a clutch washer 436, and similarly splined to the shaft 426, and associated with flange 432, is a like clutch washer 440. Surrounding the shaft and interposed between these two clutch washers and holding these washers in contact with the respective flanges 428 and 432 is a coiled spring 437. Each washer is provided with a tooth 438 (Figure 3) which normally engages in the short depression of its associated flange, and is also provided with a cam portion 439 (Figure 5) which is normally in engagement with the long depression of its associated flange. The tooth 438 on washer 436 faces in one direction, and the tooth 438 on washer 440 faces in the opposite direction, so that when the crank shaft 426 is rotated in one direction, the washer 436 drives the flange 428 in that direction, and when the crank shaft is rotated in the opposite direction, the washer 440 drives the flange 432 in the opposite direction. During the time that one clutch washer is operating its associated flange, the other clutch washer is held out of engagement with its associated flange by virtue of the cam portion 439 on the washer, which slides on the full face of the flange, and does not permit the tooth 438 to drop into engagement until a full revolution has been completed.

Since the flange 428 is integral with the sleeve 427, and the sleeve 427 is secured to the zero resetting shaft 303 of the counting register, rotation of the crank 425 in one direction causes synchronous rotation of the zero resetting shaft 303. The accumulator carriage 400 is movable transversely of the machine and the zero resetting shaft associated therewith is provided with a telescoping portion 414 which connects the shaft 405 with the hub 415 which hub is journaled in the frame of the machine, and is transversely stationary with respect thereto. Integral with the hub is a gear 416 which meshes with gear 417 which in turn meshes with gear 418 which is rotatable on the shaft 419. Secured to gear 418 by the sleeve 420 is a gear 421 which is in mesh with gear 435, which is secured to sleeve 431 rotatably mounted on the crank shaft 426. Therefore, rotation of the crank 425 in the opposite direction, due to the operation of the clutch washer 440, causes synchronous rotation of the gear 435 which rotation is transferred through the train of gears 421, 418, and 416 to cause one rotation of the zero resetting shaft 405 for each rotation of the crank 425 in the proper direction. It is therefore apparent that the rotation of the crank shaft 426 in one direction serves to zeroize the counter register and rotation of the crank shaft in the opposite direction serves to zeroize the accumulator register.

Clearance interlock

Means have been provided for an interlocking safety mechanism which will not permit the machine to be actuated while either of the register zero-resetting shafts is out of its full cycle position. Secured to flange 428 of sleeve 427 is a collar 800 which has in its periphery a depression 801 (Figure 1) into which an extension 8031 of lever 804 is normally held by a suitably provided spring tension which will hereinafter be disclosed. A similar depression 802 is provided on the periphery of sleeve 420 into which a second extension 803 of lever 804 is normally held. It is apparent that the initial rotation of collar 800 by revolving crank shaft 426 in a direction to zeroize the numeral wheels 301 of the counting register, or the initial rotation of sleeve 420 by revolving crank shaft 426 in the opposite direction to zeroize the accumulator register, will, in either case, throw the extensions 8031 and 803 out of the depressions 801 and 802 and tend to rotate the lever 804 in a counter-clockwise direction about the axis 805. This rotation, in addition to locking the actuator through shaft 809

by throwing extension 806 into depression 807 of flange 808 secured to the shaft 809, performs the function of entirely disabling the starting control of the machine. The lever 804 is provided with an extension 810 which, during the counter-clockwise rotation of lever 804, engages the pin 812 of lever 813, secured to shaft 814, serving to rotate the lever 813 in a clockwise direction (Figure 1). This clockwise rotation is transferred through the shaft 814 journaled through the side frame of the machine and into bracket 815 (Figures 2 and 8), to lever 816 secured to the opposite end of shaft 814, and normally held down by spring 818. By means of an ear 817 on lever 816, which underlies the operating control link 121, said control link is lifted out of operating engagement with pin 119 on clutch bell crank 115, thereby permitting control link 121 to be oscillated by operating means provided therefor without the possibility of releasing the clutch mechanism to start the machine. It will be noted that the end of the arm 810 (Figure 1) of lever 804 is so constructed that the initial rotation of the arm 810 serves to impart very rapid movement to the lever 813 until it is rotated amply far to permit angle 811 of arm 810 to over-ride it, after which the remaining rotation is very slow. This is so constructed that the lever 816 will be rotated through an arc just sufficient to lift the control link 121 out of engagement by the very slightest movement of the handle 425, after which the overthrow of arm 810 moves the lever 813 only very slightly. Means have been provided whereby the lever 804 will be returned to and held in its normal position by the spring 818 (Figure 8). This is accomplished by the angle of the end 811 on the arm 810 which is just sufficient to permit the spring tension of spring 818, transferred through lever 816, shaft 814 and lever 813, to restore lever 804 to, and hold it in its normal position of engagement after a full cycle of the crank 425 has been completed.

I claim:

1. In a calculating machine, registering mechanism, an actuator, driving means therefor including a normally disengaged clutch connection, manipulable means for enabling said clutch connection, means for resetting said mechanism, and means controlled thereby for disabling said enabling means.

2. In a calculating machine, registering mechanism, an actuator, driving means therefor including a normally disengaged clutch connection, manipulable means for enabling said clutch connection, means for resetting said mechanism, and means operated as an incident to the operation of said resetting means for rendering said enabling means ineffective.

3. In a motor driven calculating machine, registering mechanism, an actuator therefor, clutching means and a manipulable control therefor, means for resetting said mechanism to zero, and means controlled by said resetting means for disabling said clutch control.

4. In a motor driven calculating machine, registering mechanism, an actuator therefor, clutching means and a manipulable control therefor, means for resetting said mechanism to zero, and means controlled by said resetting means for disconnecting said clutch control.

5. In a motor driven calculating machine, registering mechanism, actuating means therefor, driving means and a control for said driving means comprising a pair of relatively movable members, means for resetting said mechanism comprising a reversely rotatable element, and means controlled by movement of said element in either direction from neutral position for moving said members into inoperative relation with respect to each other.

6. In a motor driven calculating machine, registering mechanism, actuating means therefor, driving means and a control for said driving means comprising a pair of relatively movable members, means for resetting said mechanism comprising a reversely rotatable element, and means controlled by movement of said element in either direction from neutral position for disconnecting said members.

7. In a calculating machine, registering mechanism, actuating means therefor, a manipulable control for said actuating means, means for resetting said mechanism comprising a reversely rotatable element, means controlled by said actuating means for preventing operation of said resetting means, and means controlled by movement of said element in either direction from neutral position for disabling said control.

8. In a calculating machine, registering mechanism, actuating means and controls therefor, means for resetting said mechanism, means operated by said actuating means for preventing operation of said resetting means, and means controlled by said resetting means for causing disconnection of said actuating means and said controls.

9. In a calculating machine, registering mechanism, actuating means therefor, means for resetting said mechanism comprising a reversely rotatable element, means controlled thereby upon movement thereof for disabling said actuating means, and means controlled by said actuating means for preventing operation of said disabling means.

10. In a calculating machine, registering mechanism, actuating means and controls therefor, means for resetting said mechanism comprising a reversely rotatable element, means controlled thereby upon movement thereof in either direction for disconnecting said actuating means and said controls, and means controlled by said actuating means for preventing operation of said disconnecting means.

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