

Nov. 21, 1933.

G. LERCH

1,935,851

CALCULATING MACHINE

Original Filed Oct. 26, 1927

4 Sheets-Sheet 1

FIG. 7-

FIG. 8-

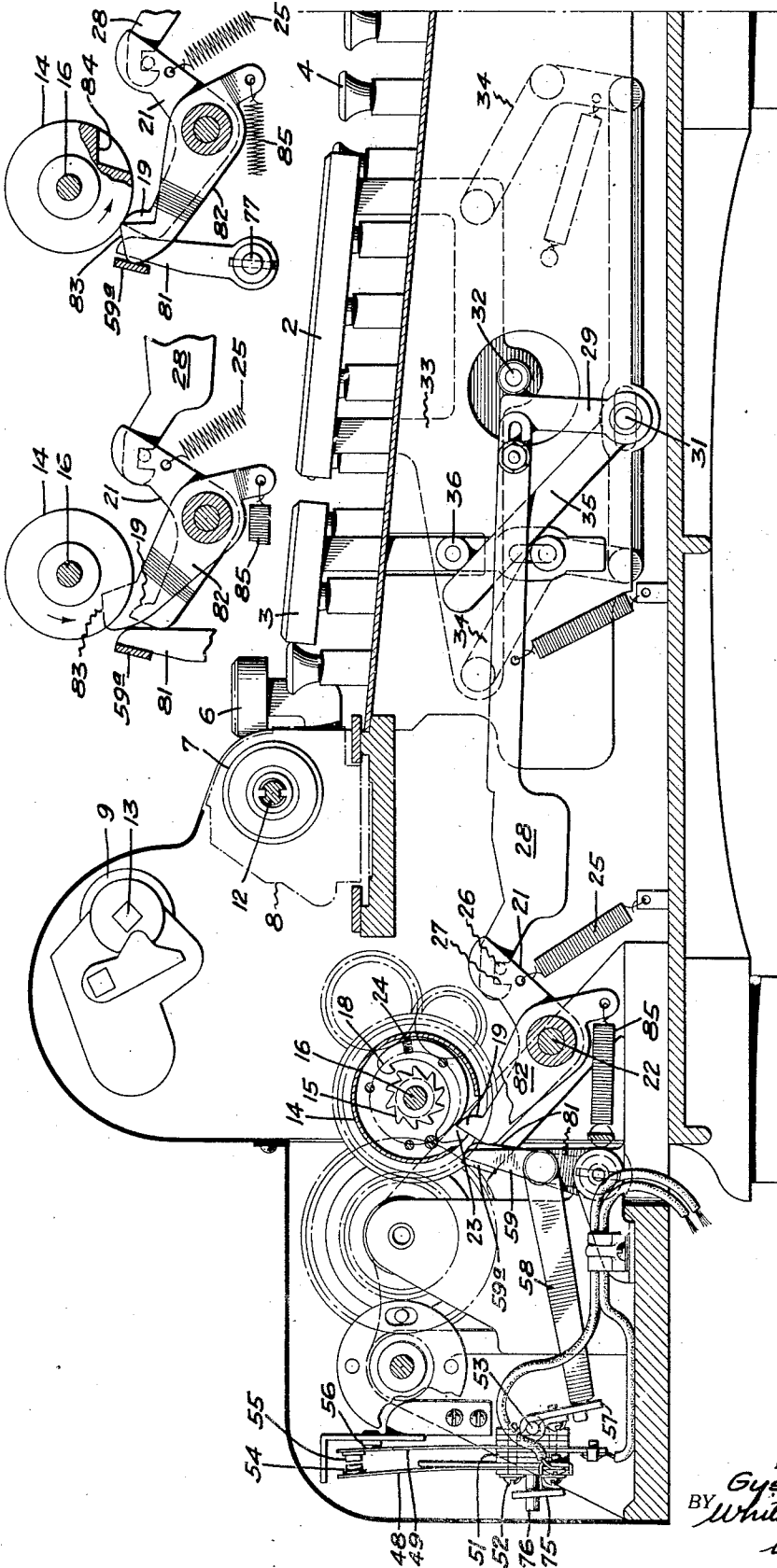


FIG. 1-

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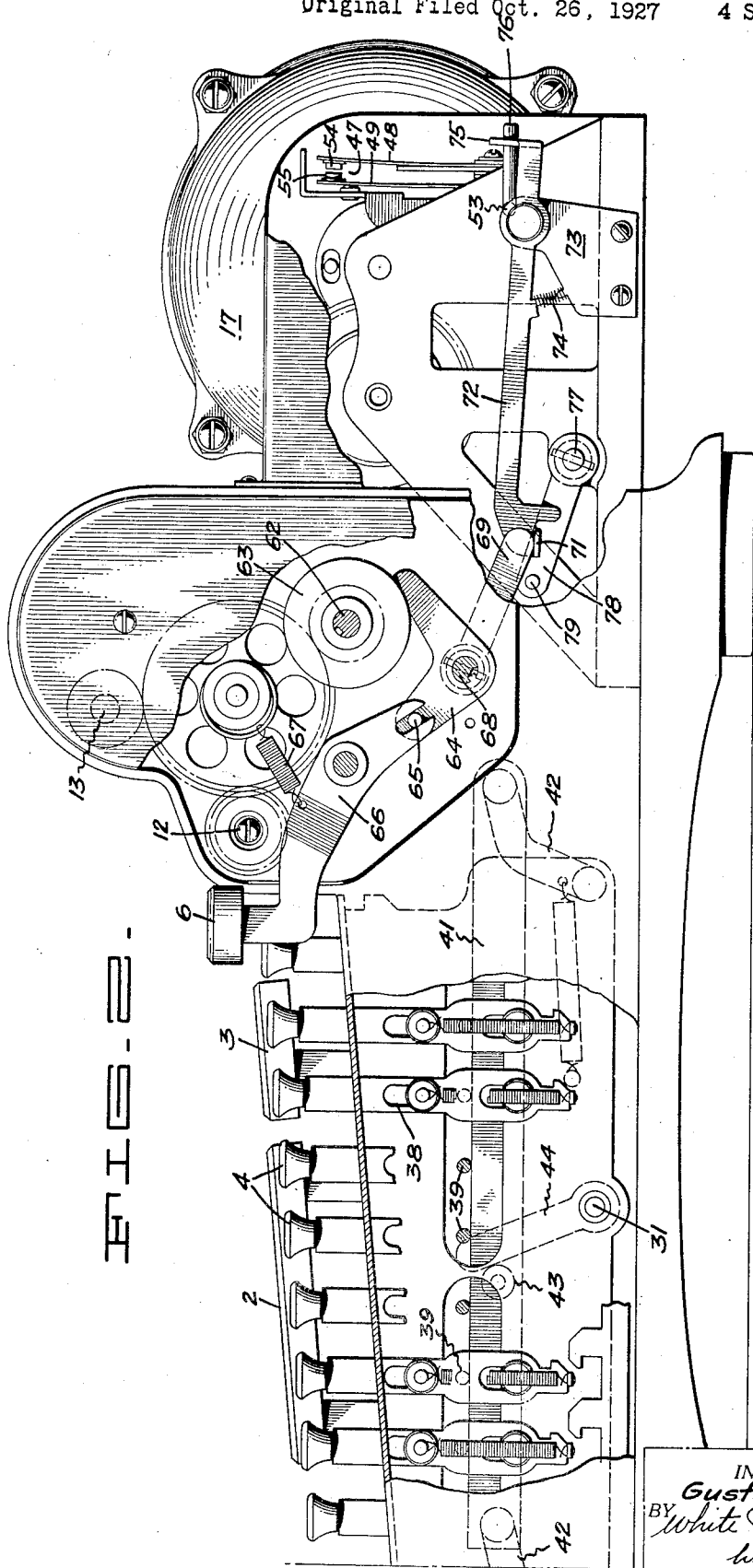
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4 Sheets-Sheet 2



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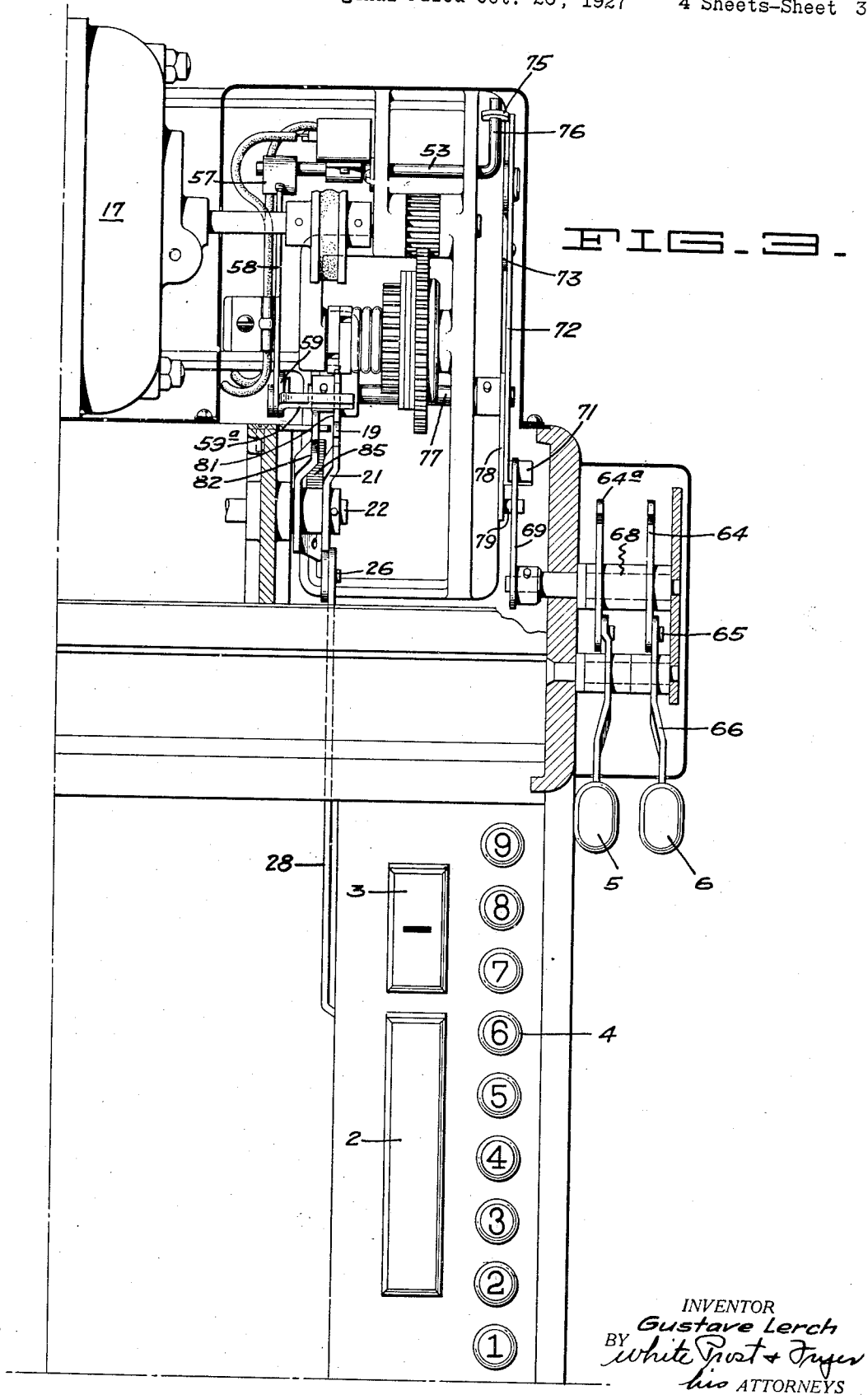
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CALCULATING MACHINE

Original Filed Oct. 26, 1927 4 Sheets-Sheet 4

FIG. 4.

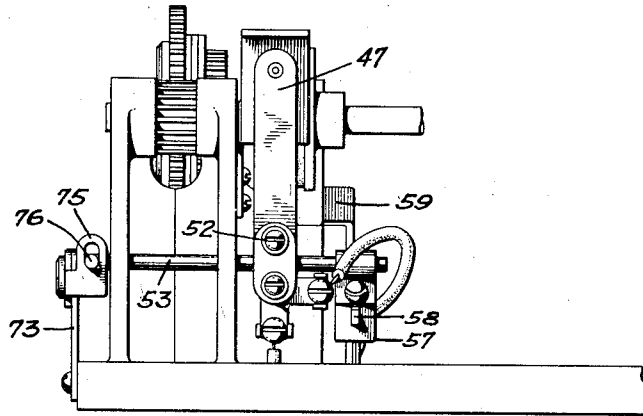
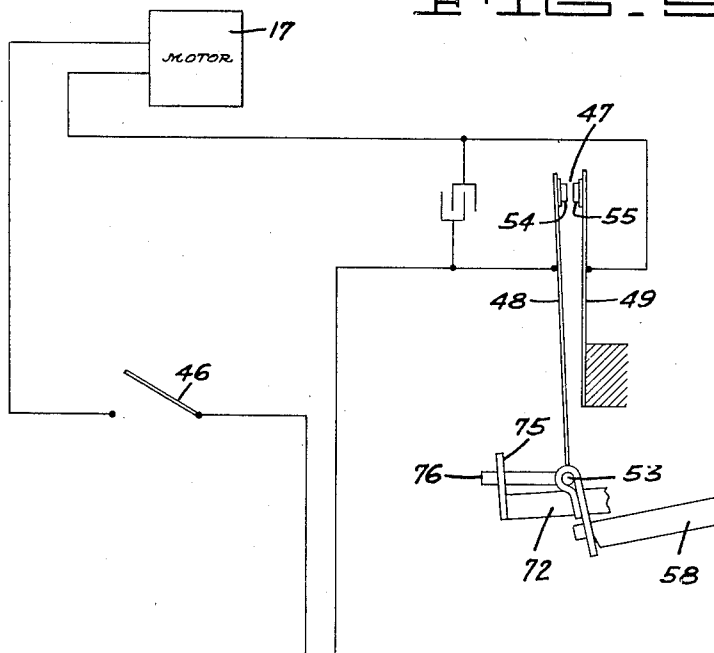


FIG. 5.



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UNITED STATES PATENT OFFICE

1,935,851

CALCULATING MACHINE

Gustave Lerch, Oakland, Calif., assignor to
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Application October 26, 1927, Serial No. 228,762
Renewed July 26, 1932

14 Claims. (Cl. 172-239)

The invention relates to electrically driven calculating machines and particularly to means for controlling the circuit of the electric motor and the connections between the motor and the operating mechanisms of the calculating machine.

An object of the invention is to provide a calculating machine having a normally silent electric motor which is normally disconnected from the operating mechanism of the calculating machine, with control mechanism, which when operated energizes the motor and establishes a driving connection between the motor and the operating mechanism.

Another object of the invention is to provide a calculating machine having a normally silent driving motor and a normally open switch in the motor circuit, with control means, which when depressed closes the switch and prevents the switch from opening as long as the control means is held depressed.

Another object of the invention is to provide a switch control mechanism whereby the switch after it is closed by the depression of a key, is held in closed position during the time that the actuator is out of full cycle position, thereby preventing the quick release of the key from causing the opening of the switch.

Another object of the invention is to provide, in a calculating machine having a plurality of mechanisms adapted to be independently driven by an electric motor, a normally open switch in the motor circuit which is closed by the operation of any of the respective control means associated with the drive of the respective operating mechanisms.

Another object of the invention is to associate the electric switch with the mechanical means employed for connecting the motor to the respective operating mechanisms, so that the switch remains closed as long as the mechanical driving connection is closed and is opened when the mechanical driving connection is opened.

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

The present invention relates particularly to the control of electrically driven calculating machines and, I have shown such control embodied in a calculating machine such as is shown in the Friden Patent No. 1,643,710 of September 27, 1927, to which reference is hereby made for a complete disclosure of an electrically driven calculating machine. In the machine disclosed in said Friden patent, the electric motor is in operation continuously, during the operation of the calculating machine. In accordance with the present invention, the circuit of the electric motor is normally open and is closed only during such time that the mechanism of the calculating machine is in operation to perform a calculation or to reset the registers of the calculating machine to zero.

Referring to said drawings, Figure 1 is a vertical section through a calculating machine, parts thereof being broken away to reduce the size of the figure, showing the control mechanism of my invention in association with one set of control keys.

Figure 2 is a vertical section through the calculating machine showing the control mechanism of my invention in association with other control keys.

Figure 3 is a top or plan view of a portion of a calculating machine embodying my invention, showing the various control keys which are operative to control the excitation of the electric motor, a portion of the machine being shown in sections to better disclose the construction.

Figure 4 is a rear elevation of a detail of the calculating machine, showing the switch which is employed to control the excitation of the motor.

Figure 5 is a diagrammatic representation of the motor circuit.

Figure 6 is a detail of the clutch housing, the clutch control lever and the lever for stopping the clutch and the actuator in full cycle position.

Figure 7 is a detail showing the position of the same parts when the clutch is out of full cycle position.

In the drawings I have shown my invention embodied in a calculating machine having a plurality of control keys. These control keys comprise the addition bar 2, depression of which causes the motor to rotate the actuator in a forward direction; the minus bar 3, depression of which causes the motor to rotate the actuator in a reverse direction; the automatic multiplier keys 4, depression of which causes the motor to rotate the actuator a number of times equal to the numerical value appearing on the key

and two zero resetting keys 5 and 6, the respective depression of which causes the electric motor to reset to zero, the product register and the multiplier register. The product register 7 is arranged in a longitudinally movable carriage 8 and the multiplier register 9 is mounted in the frame of the calculating machine. As shown in the Friden patent above referred to, the calculating machine is provided with a reversible rotary actuator, into which values are introduced by the depression of keys, and which, upon rotation, transfers the values to the figure discs of the product register 7. Connected to the actuator or to the drive therefor, so that it rotates synchronously with the actuator, is an operating member which actuates the multiplier register 9 to indicate the number of effective rotations of the actuator. The two registers 7 and 9 are thus associated and display two of the factors of the calculation. The product register 7 is provided with a zero resetting shaft 12 and the multiplier register 9 is provided with a zero resetting shaft 13. As shown in the Friden patent above referred to, the actuator is connected to the clutch housing 14 so that it rotates synchronously therewith, the clutch housing constituting the driving member, and reversing gearing, controlled by the keys or bars 2 and 3 determines the forward or reverse direction of rotation of the actuator.

The clutch which is interposed between the motor and the rotary, reversible actuator, comprises the clutch housing 14 and the enclosed ratchet wheel 15, secured to the shaft 16 which is permanently connected to the electric motor 17 through suitable gearing. The shaft 16 is therefore in rotation whenever the motor is energized. Pivoted within the clutch housing 14 is a pawl 18 which is normally held from engagement with the ratchet wheel 16 by the toe 19 on the end of the clutch control lever 21 which is mounted on the shaft 22. The toe 19 of the lever 21 extends through an aperture in the peripheral wall of the clutch housing and into engagement with a foot 23 on the end of the pawl 18, normally holding the pawl 18 in clutch disengaging position, against the pressure of the spring 24. The toe 19 of the clutch control lever 21 also serves to stop the clutch housing and consequently the actuator in full cycle position. The clutch control lever 21 is normally held in clutch disengaging position by the spring 25. The clutch housing is released and the clutch pawl is moved into engagement with the ratchet wheel 15, upon rotation of the clutch control lever 21 in a counterclockwise direction as shown in Figure 1. This clutch engaging movement of the clutch control lever 21 is effected by depression of either of the keys 2, 3 or 4. The clutch control lever 21 is provided at its forward end with a laterally extending pin 26 which is normally engaged by the seat or notch 27 on the rear end of the clutch bar 28, which bar is pivoted at its forward end to the lever arm 29 which is secured to the shaft 31. The lever arm 29 extends substantially vertically and disposed in front of said arm is a roller 32 carried by the frame 33 on which the plus bar 2 is mounted. The frame 33 is supported on levers 34 so that when the bar 2 is depressed, the roller 32 is moved backward, moving the lever arm 29 in a counterclockwise direction and similarly moving the clutch control lever 21 to cause engagement of the clutch. Secured to the shaft 31 is a second lever 35 above which is disposed a roller 36 carried by the stem of the minus key 3,

so that depression of the minus key also causes backward movement of the lever arm 29 and counterclockwise movement of the clutch control lever 21, resulting in the engagement of the clutch.

Depression of any of the automatic multiplier keys 4, also results in counter-clockwise movement of the clutch control lever 21 to cause the release of the clutch housing and the engagement of the clutch. Projecting laterally from the side of each key stem 38 of the keys 4 is a pin 39 (Fig. 2) which overlies a bar 41 which is mounted on links 42, so that depression of the bar 41 results in forward movement of such bar. Carried by the bar 41 which is moved backward by the depression of any of the keys 4, is a roller 43 which lies in front of the lever arm 44 which is secured to the shaft 31. Upon backward movement of the bar 41, the lever arm 44 is moved in a clock-wise direction, as shown in Figure 2, causing partial rotation of the shaft 31. The lever arm 29 (Fig. 1) is secured to the shaft 31, and when such shaft is rotated due to the depression of a key 4, the lever arm 29 is moved backward, causing release of the clutch housing and engagement of the clutch.

The driving shaft 16 is rotated by the electric motor 17, the circuit of which is normally open. This circuit is provided with a switch 46 which is closed by hand by the operator when he desires to use the calculating machine. This switch, however, does not close the motor circuit, because such circuit is provided with another switch which must be closed before the circuit through the motor is closed. The second switch is arranged to be closed upon depression of any of the control keys 2, 3 and 4, and, since all of these keys are associated with the clutch control lever 21, the operating mechanism for the second switch is preferably associated with said lever 21 so that upon depression of any of said keys, the control switch is closed. In the present construction, the control switch 47 comprises two resilient metallic elements 48 and 49 spaced apart at their lower ends by suitable insulating material 51 and suitably bound together by screws 52 which do not however contact with the metallic elements 48 and 49. The block of insulating material 51 in which the elements 48 and 49 are held, is mounted on a shaft 53 which is suitably journaled in the frame of the machine, so that the insulating block 51 and the resilient metallic elements may be slightly rotated. The metallic elements 48 and 49 are provided on their upper ends with normally spaced contacts 54 and 55 and the element 49 is in contact with an insulating stud 56. A slight rotation of the shaft 53 in a clockwise direction (Fig. 1) causes a flexing of the metallic element 49, due to its contact with the stud 56, bringing the two contact members 54 and 55 together and closing the circuit through the motor. The member 49 possesses sufficient resiliency to return the insulating block 51 to the position shown in Figure 1 upon the release of pressure tending to rotate the shaft 53 so that a torsional strain is required to rotate the shaft 53 to bring the contacts 54 and 55 together, and when such torsional pressure is released, the switch opens. Secured to the shaft 53 is an arm 57 having a slot therein in which is disposed the shouldered end of the link 58 which, at its forward end is pivoted to the lever 59. The lever 59 is provided at its upper end with a lateral extension 59a which lies behind the clutch control lever 21. Interposed between the clutch control lever and the extension 59a is a lever 81, 150

which is normally in close contact at its upper end, with the extension 59a and the rear end of the lever 21. Therefore, movement of the clutch control lever 21 in a direction to release the clutch housing and cause engagement of the clutch, rocks the lever 59 backward, thus rocking the shaft 53 and bringing the contacts 54 and 55 into engagement, closing the circuit through the motor. As long as pressure is maintained on the control key (i. e. either key 2, 3 or 4) the clutch lever 21 is held in the position shown in Fig. 6, holding the extension 59a pressed backward and holding the switch closed. In the operation of the machine however, either key 2 or 3 is frequently given an abrupt tap and is not held depressed and means are provided for preventing the immediate re-opening of the switch, when this practice is employed. It will be noted in Fig. 6 that there is a material clearance between the end of the foot 19 on the clutch lever 21 and the periphery of the clutch housing 14, and when pressure on the key is released the foot 19 moves forward and rides on the periphery of the clutch housing as shown in Fig. 7. This forward movement of the foot 19 and the consequent forward movement of the lever 81 would permit, if not prevented, a forward movement of the lever 59, which might be sufficient, either due to wear or the lack of close adjustment, to permit the switch to open, thus stopping the calculating mechanism in mid-cycle position. To overcome this possibility, I have associated the lever 59 with the full cycle stop means, so that the switch is always held closed during the time that the calculating mechanism is out of full cycle position. Associated with the clutch housing 14 is a centralizing lever 82 which is provided on its end with a cam projection 83 which normally seats in a cam notch 84 in the side wall of the clutch housing to position and hold the housing and consequently the actuator in full cycle position. The cam projection 83 is pressed into the notch 84 or against the periphery of the housing, by the strong spring 85, which is of sufficient strength to position the housing in full cycle position. Upon the initial movement of the clutch housing from full cycle position, the centralizing lever is moved counter-clockwise, bringing the upper end thereof into contact with the backwardly pressed arm 59a of the lever 59 as shown in Fig. 7, and holding such lever in switch closing position until the clutch housing again reaches full cycle position. The arrangement of the switch operating parts is preferably such that the contacts 54 and 55 are brought together, starting the motor, before the pawl 18 engages the ratchet 15, thereby permitting the motor to gain speed before the load is applied thereto.

Power from the electric motor is also employed to reset the product register and the multiplier register to zero and the control keys for these zero resetting devices are also associated with the electric switch 47, so that the motor circuit is closed only during such time that the elements of the calculating machine are in operation.

The means disclosed herein for resetting the registers to zero by power derived from the electric motor and the control of the connections between the motor and the two zero resetting shafts of the respective registers is fully disclosed in the application of Carl M. F. Friden, Serial Number 112,757, filed June 1, 1926. In view of the disclosure in said application, it is believed

not necessary to fully describe the structure of the zero resetting devices and their control elements. The zero resetting mechanism as disclosed in said Friden application embodies a driving shaft 62 which is connected to the motor so that it is rotated synchronously therewith. Associated with the driving shaft 62 are two clutches substantially identical with the clutch shown in Figure 1 and interposed between the motor and the actuator. These two clutches are arranged on the same shaft 62 and each clutch comprises a ratchet wheel secured to the shaft and a clutch housing rotatably mounted on the shaft and a pawl mounted in the housing for engagement with the ratchet. One of the clutch housings is connected through a suitable train of gearing with the zero resetting shaft 12 and the other clutch housing is connected through a suitable train of gearing with the zero resetting shaft 13. Each clutch housing 63 is provided with a clutch control lever 64 which is identical in mode of operation with the clutch control lever 21. Each clutch control lever 64 is provided with a laterally extending pin 65 which is engaged by the forked end of the lever 66 which forms the stem of the zero resetting control key, these keys being shown at 5 and 6 in Figure 3. The keys 5 and 6 are normally held in elevated position by springs 67 and, depression of either of the keys, rocks the clutch control lever 64 to free the associated clutch housing and cause engagement of the associated clutch.

The two clutch control levers 64 and 64a are keyed to a supporting shaft 68, the keyway being wider than the key, so that the shaft may be partially rotated by the rotation of one clutch control lever 64 without causing rotation of the other clutch control lever 64a. The shaft 68, however, is rotated in a clockwise direction (Fig. 2) upon depression of either of the keys 5 or 6. Secured to the shaft 68 is an arm 69 which bears at its rear end on a laterally extending foot 71 formed on the front end of the lever 72 which is pivoted on the bracket 73, the lever 72 being normally held with its front end elevated, by the spring 74. The rear end of the lever 72 is provided with a lateral extension 75 having an eye therein into which the bent end 76 of the shaft 53 extends. The shaft 53 carries the insulating block 51 of the switch 47 so that by rocking the shaft 53, the switch contacts are brought into engagement. When either of the keys 5 or 6 is depressed, the forward end of the lever 72 is depressed, raising the rear end of the lever and consequently raising the bent end 76 of the shaft 53, partially rotating the shaft and bringing the switch contacts 54 and 55 into engagement, closing the circuit through the motor. The motor therefore is normally silent and is in operation only during such time that the clutch control lever 64 or the clutch control lever 64a is out of engagement with the aperture in the clutch housing 63. Depression of either key 5 or 6 therefore closes the motor circuit, energizing the motor and closes the clutch between the motor driven shaft 62 and the selected zero resetting shafts 12 or 13. Upon release of either key 5 or 6, the clutch control levers 64—64a will stop the clutch housing 63 in full cycle position, stopping the zero resetting shaft in zero position and at the same time opening the motor circuit. I have therefore provided a calculating machine having a normally silent motor, and having a single switch in the motor circuit, which is closed by the depression of any of the operation controlling

keys of the machine and which is opened when the operation is completed, so that the motor is in operation only during such time as it is serving a useful purpose in driving the operative mechanism of the machine.

Means are also provided for preventing the operation of the keys 5 and 6 while any one of the keys 2, 3, and 4 is depressed and vice versa. The lever 81 is secured to the shaft 77, to the other end of which is secured the lever 78 provided with a stud 79 which underlies the lever 69. When either of the keys 2 or 3 is depressed, the lever 59 is rocked, rocking the lever 78 and bringing the stud 79 into contact with the lever 69, preventing depression of either key 5 or 6. Conversely, when either key 5 or 6 is depressed, the lever 69 is secured into contact with the stud 79, preventing lever 81 from rocking and consequently preventing depression of either key 2 or 3.

I claim:

1. The combination with two associated elements, of a motor for driving the same, a circuit for said motor, a normally open switch in said circuit, a normally open clutch between said motor and one of said elements, a normally open clutch between the motor and the second of said elements, independent means for controlling the several clutches and means common to the two clutch controlling means for controlling said switch.

2. The combination with two associated elements, of a motor for driving the same, a circuit for said motor, a normally open switch in said circuit, a normally open clutch between the motor and one of said elements, a normally open clutch between the motor and the other of said elements and two control members, operation of one member serving to close the switch and close one clutch and operation of the other member serving to close the switch and close the second clutch.

3. The combination with two associated elements, of a motor for driving the same, a circuit for said motor, a normally open switch in said circuit, normally open clutches between the motor and the respective elements, keys for independently controlling said clutches and means common to said keys for controlling said switch.

4. The combination with two associated elements, of a normally silent motor for driving said elements, normally open clutches between the motor and the respective elements, independent control means for said clutches and a switch common to said several control means for controlling the motor.

5. The combination with two associated elements, of an electric motor for driving said elements, a circuit for said motor, a normally open switch in said circuit, normally open clutches between the motor and the respective elements, a control key associated with each clutch, and means correlating the keys with the switch whereby pressure on either key moves the switch to closed position.

6. The combination of the machine proper, a motor for driving the same, a circuit for said motor, a normally open switch in the motor circuit, a normally open clutch between the motor and the machine proper, a lever for controlling said clutch and stopping the clutch driven member in full cycle position and means moved by said lever for closing said switch.

7. The combination with two associated elements, of a normally silent motor for driving said elements, normally open clutches between the motor and the respective elements, means for independently engaging the respective clutches, and a single switch correlated with both said clutch engaging means for energizing the motor.

8. The combination with two associated elements, of a normally silent motor for driving said elements, normally open clutches between the motor and the respective elements, a control key associated with each clutch, depression of a key serving to cause engagement of a clutch and circuit controlling means comprising a single train of mechanism operated by the depression of either key for energizing the motor.

9. The combination with two associated elements, of an electric motor for driving said elements, a circuit for said motor, a normally open switch in said circuit, normally open clutches between the motor and the respective elements, a control key associated with each clutch, and means comprising a lever correlating the keys with the switch whereby pressure on either key moves the switch to closed position.

10. The combination with two associated shafts, of a motor for driving said shafts, a circuit for said motor, a single switch in said circuit, clutches between the motor and the respective shafts, a control key associated with each clutch, and unitary means operated upon depression of either key for closing said switch.

11. The combination with two associated shafts, of a motor for driving said shafts, a circuit for said motor, a single switch in said circuit, clutches between the motor and the respective shafts, a control key associated with each clutch, and unitary means comprising a linkage operated upon depression of either key for closing said switch.

12. The combination with a plurality of associated elements, of a motor for driving said elements, a normally open power circuit for said motor, normally open clutches between the motor and the respective elements, control mechanism associated with each clutch, and means comprising a member operable by either of said control mechanisms for closing said power circuit.

13. The combination with a rotary element of a motor for driving the same, a circuit for said motor, a normally open switch in said circuit, a normally open clutch between the motor and the rotary element, manually operable means for closing said switch and said clutch, and a centralizing lever operating to return the rotary element to full cycle position after a retrograde rebound thereof and arranged to be moved by movement of the rotary element from full cycle position to hold said switch closed.

14. The combination with a plurality of associated elements, of a normally silent motor for driving said elements, individual power transmission mechanisms connecting each of said elements with said motor, a switch for controlling operation of said motor, and means associated with each of said mechanisms for controlling said switch to maintain said motor in operation so long as any of said mechanisms is operating to transmit power from said motor to one of said elements.

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