July 23, 1935. C. M. F. FRIDEN 2,009,010

CALCULATING MACHINE

Original Filed March 30, 1927 5 Sheets-Sheet 1

FIG. 1.

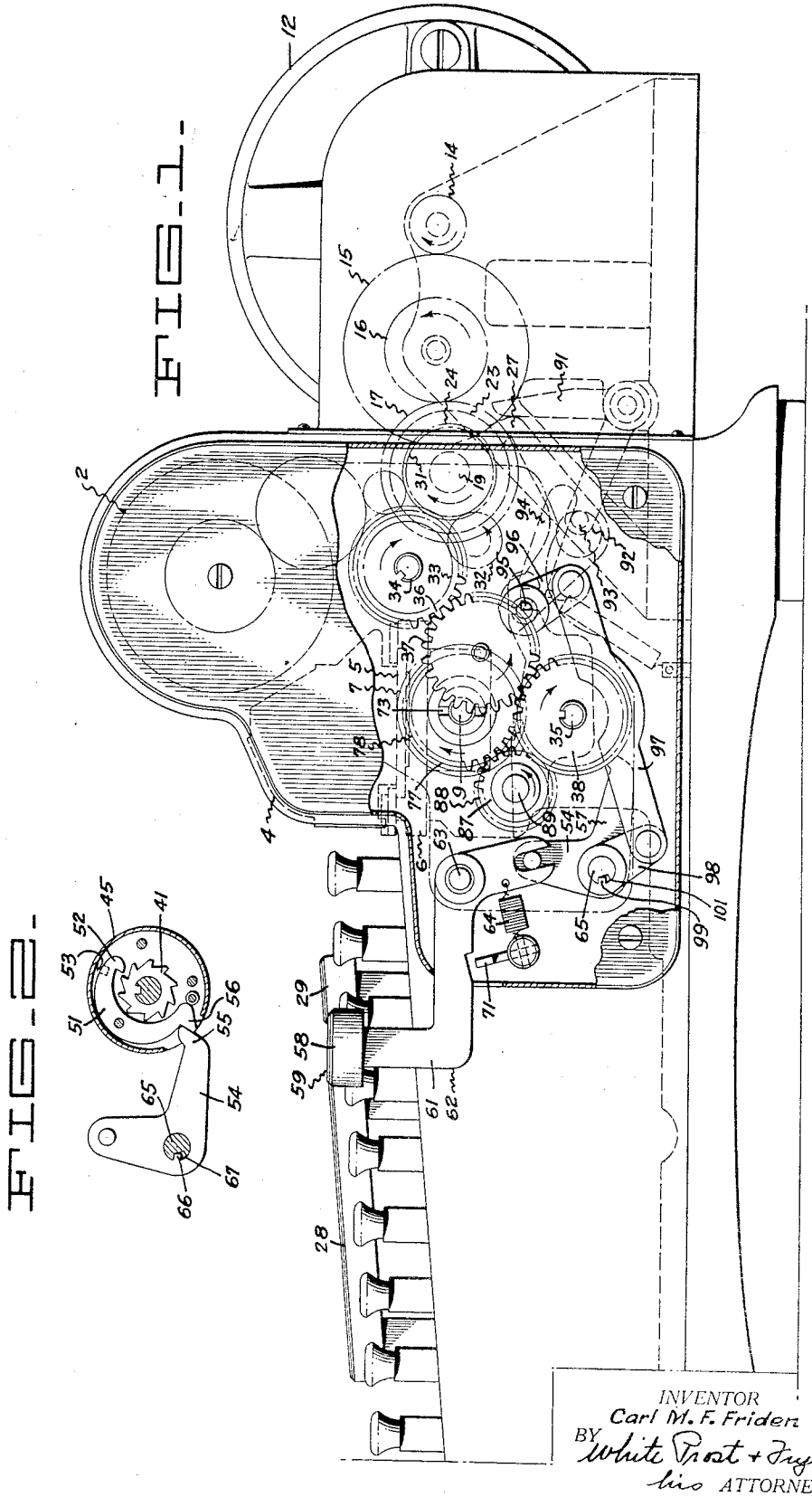

FIG. 2.

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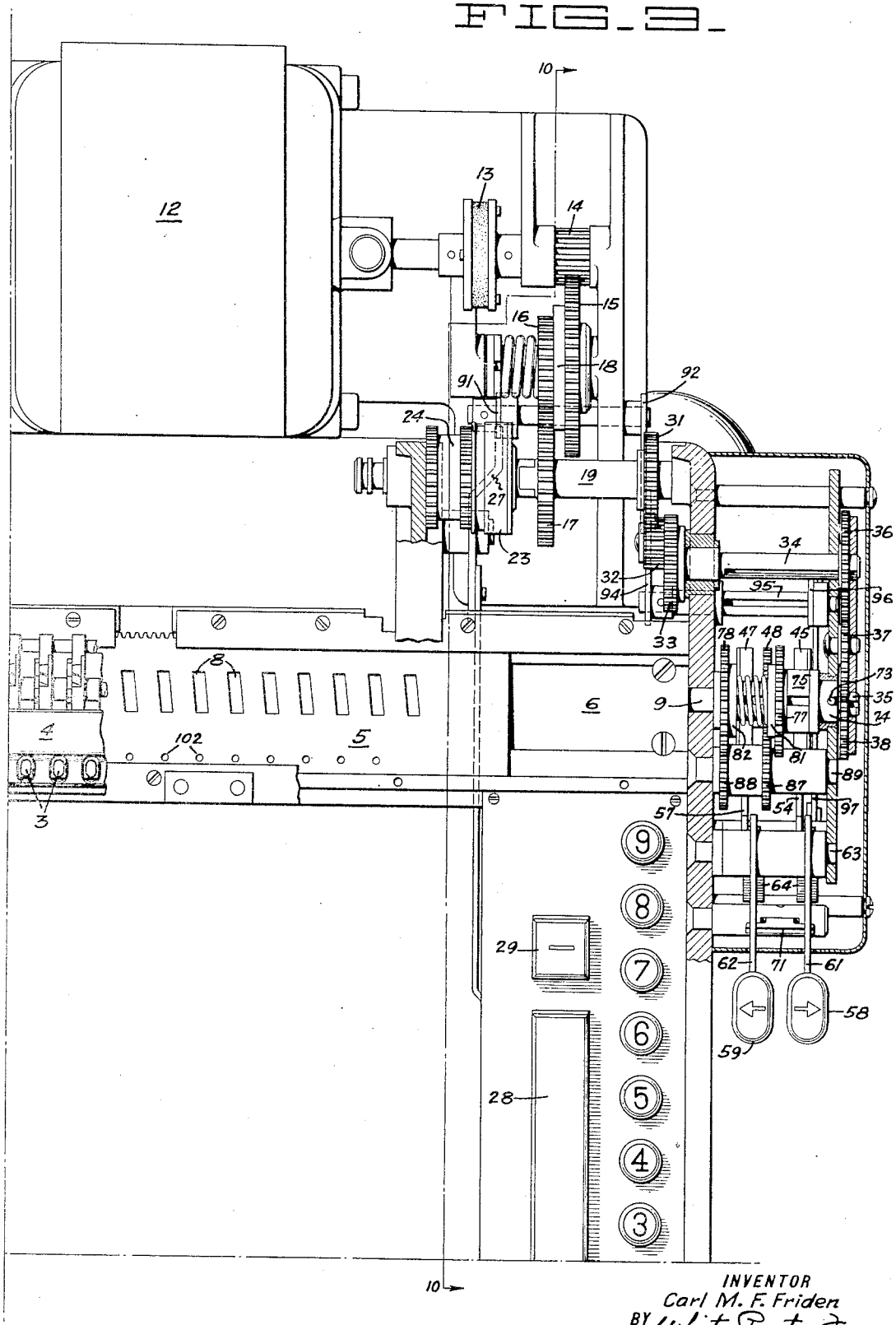
FIG. 3.



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CALCULATING MACHINE

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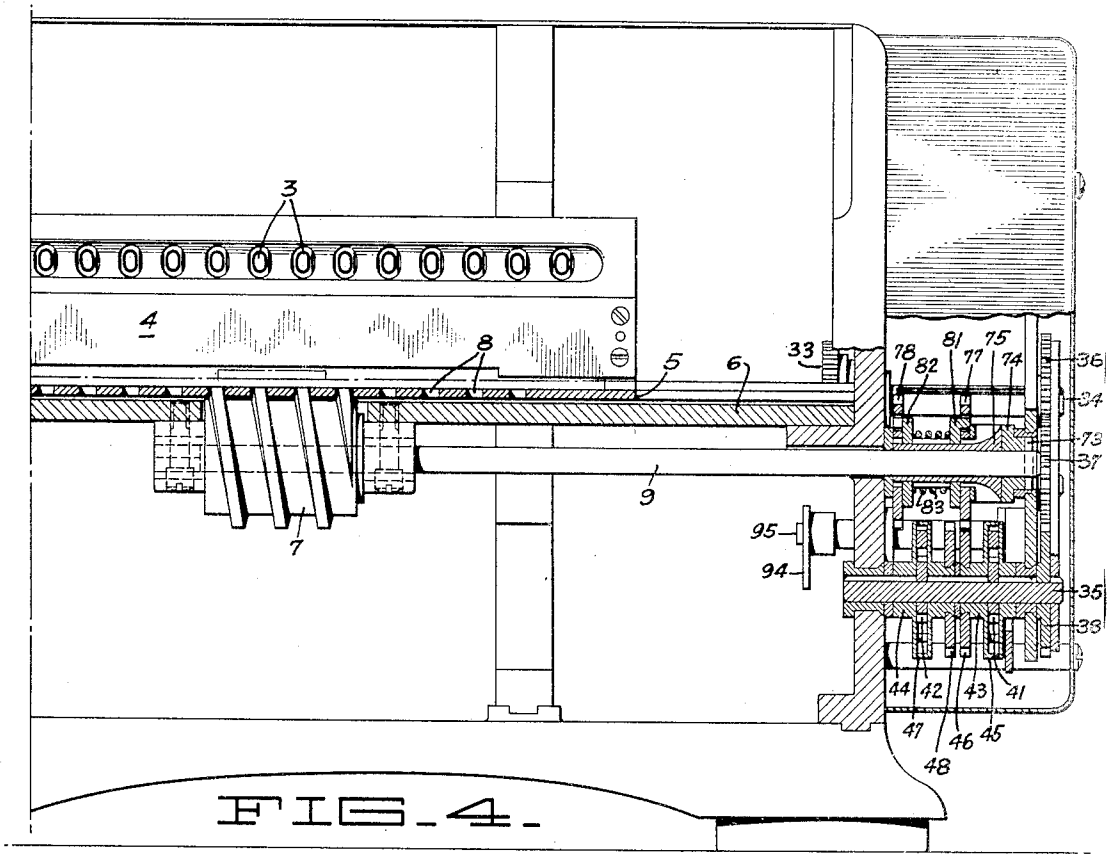


FIG. 4.

FIG. 5.

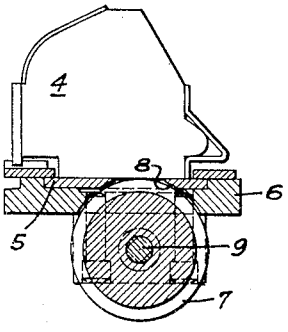


FIG. 6.

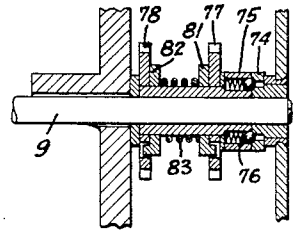
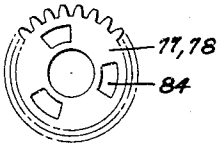
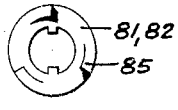


FIG. 7.

FIG. 9.





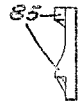


FIG. 8.

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CALCULATING MACHINE

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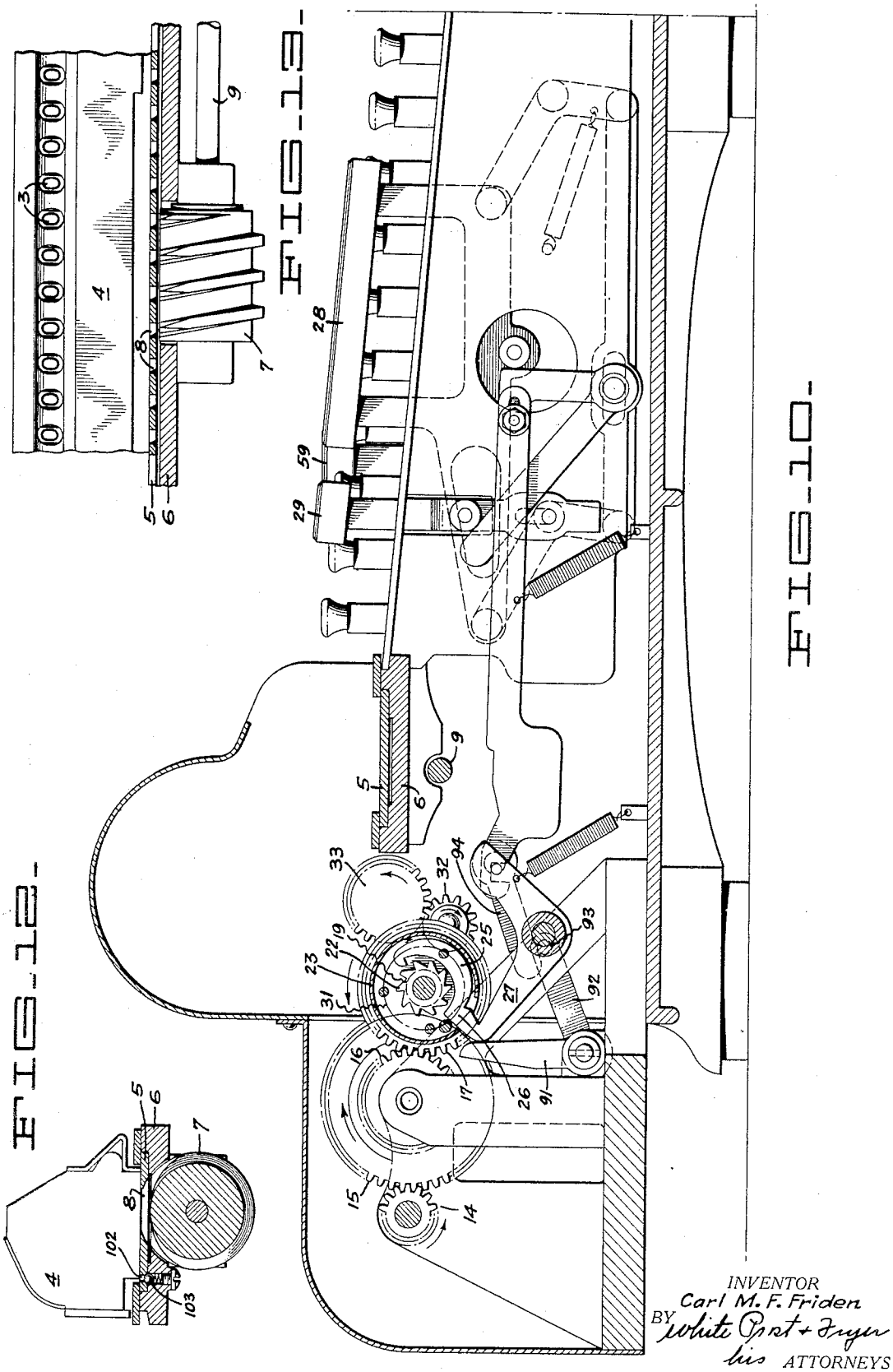

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CALCULATING MACHINE

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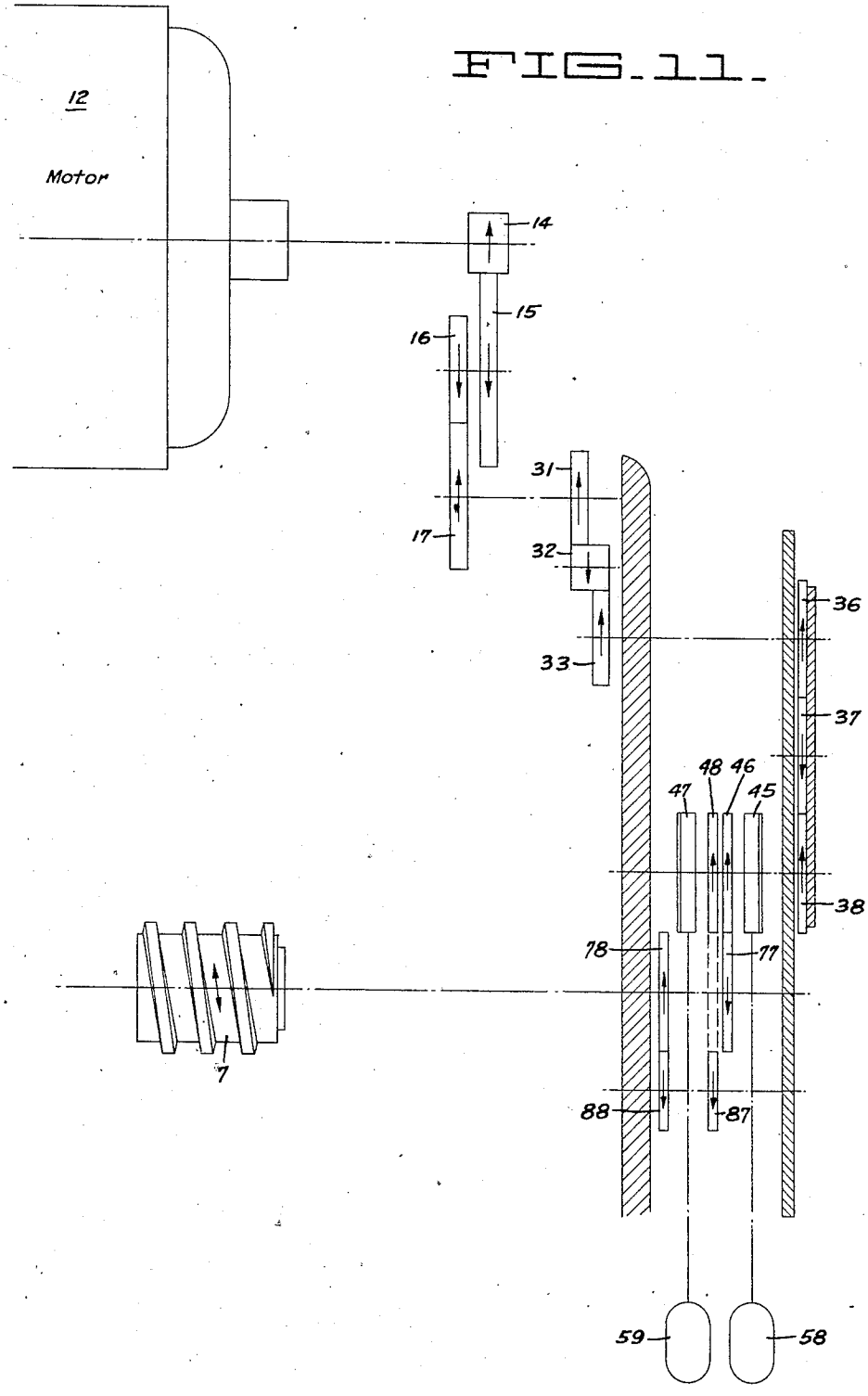
FIG. 11.



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Patented July 23, 1935 2,009,010

UNITED STATES PATENT OFFICE

2,009,010

CALCULATING MACHINE

Carl M. F. Friden, Oakland, Calif., assignor to Marchant Calculating Machine Company, Emeryville, Calif., a corporation of California

Application March 30, 1927, Serial No. 179,437
Renewed May 29, 1935

15 Claims. (Cl. 235—63)

The invention relates to calculating machines and particularly to calculating machines embodying a register which is displaceable with respect to the actuator to permit operation of the actuator on the register in different numerical orders. The invention relates further to means for moving the register into different operative positions with respect to the actuator.

An object of the invention is to provide controllable power operated means for moving the register from one operative position to another, in either direction.

Another object of the invention is to provide driving means for the register, which, when in normal position, serves to lock the register against displacement.

Another object of the invention is to provide power operated reversible driving means for the register, the operation of said means being controlled by manually operated devices to control the distance and the direction of movement of the register.

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 the 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 embodiment of 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.

It is manifest that the invention comprising the means for automatically moving the register to different operative positions, may be combined with any suitable form of calculating mechanism. In the accompanying drawings, I have shown the invention embodied in a calculating machine such as is fully disclosed in my Patent No. 1,643,710, granted September 27, 1927, to which reference is hereby made for a disclosure of the complete calculating machine. In the present drawings, I have shown the longitudinally displaceable register and the mechanism cooperating therewith to displace and control the displacement of the register, together with other cooperating mechanism, but I have not believed it advisable to disclose the entire calculating machine, since such machine is fully disclosed in my patent above referred to.

Referring to said drawings:

Figure 1 is a side elevation of a portion of calculating machine embodying my invention, portions thereof being broken away to more fully disclose the structure.

Figure 2 is a detail, in section, of one of the clutches for controlling the application of power to the means for displacing the register.

Figure 3 is a top or plan view of a portion of calculating machine, parts thereof being broken away to disclose the carriage on which the register is mounted, and the means for controlling the application of power from the motor to the carriage moving means.

Figure 4 is a vertical transverse section through the calculating machine showing the carriage and its driving means, together with the means for controlling the application of power to the driving means.

Figure 5 is a transverse vertical section through the carriage and its driving means.

Figure 6 is a section through the carriage driving means shaft, taken at right angles to the section of Figure 4.

Figure 7 is a front elevation and Figure 8 is a side elevation of one of the pawls forming part of the mechanism disclosed in Figure 6.

Figure 9 is a side elevation of a ratchet gear which cooperates with the pawls shown in Figures 7 and 8.

Figure 10 is a vertical section through a portion of the calculating machine showing the mechanism for controlling the application of power to the actuator and the means interlocking the carriage shifting control and the actuator control.

Figure 11 is a diagrammatic representation of the transmission and control mechanism for operating the carriage shifting means.

Figure 12 is a cross section through the carriage and its driving means, showing a modified form of driving means.

Figure 13 is a front elevation of a portion of the carriage and its driving means showing the modified form of driving means shown in Figure 12.

The invention relates to calculating machines having a register, usually termed the product register, which is movable into different operative positions with respect to the actuator, for the purpose of making direct action of the selected values in the actuator, on the figure discs of the register, of different numerical order possible. The register is ordinarily arranged on a carriage which is disposed in longitudinally displaceable relation to the axis of the actuator, so that the carriage may be readily moved into different operative positions. In the present construction, the carriage is shifted in a straight line

from one operative position to another, but it is apparent that the path of movement from one displaced operative position to another, is not material to the invention.

The invention relates particularly to controllable power operated means for moving the carriage in either direction from one operative position to another. The source of power is preferably a motor operating in a single direction and clutching and reversing mechanism is interposed between the motor and the carriage driving member and such mechanism is controlled by manually operative devices, so that the carriage may be readily shifted for any desired distance in either direction by manipulation of the manually operative elements, by the operator of the machine.

The value to be calculated is introduced into the actuator 2, in any suitable manner, preferably by the depression of value keys as is shown in my said patent. The actuator is rotatable either forwardly or reversely, to transmit the values entered therein, into the register 3 which comprises a plurality of reversible numeral wheels. The register is usually mounted in a carriage 4 which is movable transversely of the machine. In the present instance, the bottom plate 5 of the carriage slides on the guide plate 6 so that the carriage moves in a straight line from one position to another.

The driving means, for moving the carriage from one operative position to another, comprises a rotatable element, in the present instance a worm 7 which is journalled below the carriage and which engages a rack formed by the apertures 8 formed in the carriage bottom plate 5. The worm 7 is preferably in continuous engagement with the carriage bottom plate so that when the worm is stationary, it forms a lock which prevents movement of the carriage in either direction. The worm 7 is secured to a driving shaft 9 which is rotatable in either direction and means are provided, under manual control of the operator for determining the duration and the direction of rotation of the driving shaft 9.

This invention is preferably applied to a calculating machine which is provided with a motor for driving the actuator, and the same motor is employed for also driving the worm 7. Arranged on the frame of the machine is an electric motor 12 which is connected through suitable transmission devices including a flexible coupling 13, transmission gears 14, 15, 16 and 17 and a slip clutch 18, with the main driving shaft 19 of the machine. Secured to the main driving shaft 19, at one end thereof, is a ratchet wheel 22 which is disposed within the clutch housing 23 (Fig. 10) which is in turn secured to the reversing gear mechanism 24 (Fig. 3), manipulation of which causes rotation of the actuator either in the forward or reverse direction. Pivoted within the clutch housing 23 is a clutch dog 25 which is movable into engagement with the ratchet wheel 22 to cause engagement of the clutch, thereby causing the drive shaft 19 to drive the clutch housing 23. The clutch housing 23 is provided with an aperture on its periphery through which a foot 26 on the end of the clutch dog 25 extends into cooperation with the end of the clutch lever 27, movement of said lever serving to control the operation of the clutch, as fully set forth in my patent above referred to. The clutch lever 27 is controlled by the plus and minus bars 28 and 29 which are arranged at the right hand side of the machine. By manipulation of these bars, the actuator is rotated by the motor either in a forward or reverse direction.

Secured to the drive shaft 19 (Fig. 3) is a gear 31 which drives through the idler gear 32 to the gear 33 which is secured to the shaft 34. Power is transmitted from the shaft 34 to the clutch shaft 35 by the gears 36, 37 and 38 so that the clutch shaft is driven in time with the motor. Secured to the clutch shaft and rotatable therewith, are two ratchet wheels 41 and 42 which form part of clutches to control the movement and the direction of movement of the worm 7. Associated with each ratchet wheel is a sleeve 43, 44 rotatably mounted on the shaft 35. Secured to the sleeve 43 is a clutch housing 45 and a drive gear 46 and secured to the sleeve 44 is a clutch housing 47 and a drive gear 48. Both clutches are of the same construction and in Figure 2 I have shown the construction of one of them. Pivoted within the clutch housing is a clutch dog 51 having a tooth 52 adapted to engage the ratchet wheel 41. This tooth is normally pressed toward the ratchet wheel by the spring 53 and is normally held out of engagement with the ratchet wheel by the clutch lever 54 which is provided on its end with a tooth 55 which projects through an aperture in the periphery of the clutch housing 45 into engagement with the tooth 56 on the end of the clutch dog 51. When the lever 54 is rocked to move it out of engagement with the tooth 56, the spring 53 forces the tooth 52 into engagement with the ratchet wheel 41, thus causing engagement of the clutch. When the clutch lever 54 is subsequently released, the tooth 55 engages the tooth 56, upon rotation of the clutch housing, and moves the parts into the position shown in Figure 2, disengaging the clutch, and locking the clutch housing against rotation. The clutch 47 is provided with a similar clutch control lever 57, the levers 54 and 57 are operated by the keys 58 and 59 which are respectively mounted on the key stems 61 and 62. The key stems or key levers 61 and 62 are pivoted on the shaft 63 and at their inner ends, are slidably, pivotally connected respectively with the clutch levers 54 and 57, so that depression of the key 58 will cause engagement of the clutch 45 and depression of the key 59 will cause engagement of the clutch 47. Each key lever is normally held in elevated clutch disengaging position by a spring 64. The clutch levers 54 and 57 are mounted on a shaft 65 and have limited rotational movement with respect to the shaft by virtue of a tooth 66 on the lever engaging in a slot 67 in the shaft which is of greater width than the tooth. This slot is of sufficient width to permit the shaft to be moved sufficiently by one clutch lever to cause engagement and disengagement of one clutch without causing movement of the other clutch lever so that the two clutches are independently controlled. The movement of the shaft is employed to prevent simultaneous operation of the actuator control and the register control, as will be set forth hereinafter. To prevent simultaneous operation of the two keys 58 and 59 a pivoted T shaped member 71 is disposed below the horizontal portions of the levers 61 and 62, so that both levers may not be depressed at the same time.

When the levers 61 and 62 are in normal position, the clutches 45 and 47 are locked in position and since these clutches are connected to the worm 7, the worm is consequently locked against rotation. Depression of the key 58 causes

the motor to drive the gear 46 and depression of the key 59 causes the motor to drive the gear 48. The gear 46 is connected to the worm shaft 9 in such manner that rotation thereof causes the worm shaft to rotate in one direction and the gear 48 is connected to the worm shaft in such manner that rotation thereof causes the worm shaft to rotate in the opposite direction, the connection being such that depression of the key 58 rotates the worm shaft in a direction to move the carriage to the right and depression of the key 59 rotates the worm shaft in a direction to cause movement of the carriage to the left. The transmission mechanism between the respective clutches 45 and 47 and the carriage 4 is such that the carriage is moved one step, that is from one operative position to the next adjacent operative position for each rotation of the clutch and the clutch levers 54 and 57 are so positioned, that when the clutch is locked, the carriage is locked in operative position.

The construction of these clutches, as hereinbefore described, is such that their operation cannot be interrupted until one or more complete cycles of operation have taken place, and this cyclic operation permits the carriage to be shifted either one or a plurality of steps without the necessity of repeatedly depressing the control key, while insuring that the carriage will always be left in a proper operating position at the conclusion of any such shifting operation.

In the present construction, the clutch shaft 35 is arranged directly below the worm shaft 9. Secured to the end of the worm shaft 9 by the pin 73 is a hub 74 and rotatably mounted on the worm shaft 9 is a sleeve 75 between which, and the hub 74, is a ball detent friction clutch 76 which normally causes the hub to be driven by the sleeve, but which acts as a slip clutch, to prevent injury to the mechanism, in the event that the carriage should stick. This ball detent clutch 76 is merely a safety device and may be eliminated if the safety factor which it provides is not desired. In such event, the sleeve 75 may be directly secured to the worm shaft 9. Rotatably mounted on the sleeve 75 are two gears 77 and 78, which are respectively engaged by ratchet washers 81 and 82 which are splined to the sleeve 75 and which are respectively pressed into engagement with the gears 77 and 78 by the interposed spring 83. The gears 77 and 78 are provided with apertures 84 (Fig. 9) in which the teeth 85 (Fig. 7) of the ratchet washers seat, thereby providing a ratchet clutch between the sleeve and each gear 77 and 78. The teeth 85 of the two ratchet washers 81 and 82 are faced in opposite directions so that while one of the ratchet washers is being driven by its cooperating gear, the other washer clicks over the face of its cooperating gear, thereby permitting the worm shaft 9 to be driven in either direction.

The gear 46 associated with the clutch 45 meshes with the gear 77 so that rotation of the gear 46 causes rotation of the gear 77 and consequently rotation of the worm 7 to move the carriage towards the right. The gear 48 of the clutch 47 is connected to the gear 78 through the two idler gears 87 and 88 secured to the idler shaft 89, the gear 87 meshing with the gear 48 and the gear 88 meshing with the gear 78 so that the gear 78 is rotated in the opposite direction to the gear 77. Therefore, when the key 59 is depressed, the gear 78 is rotated in the opposite direction to the direction of rotation of gear 77 so that the worm shaft 9 is rotated in a direction to move the carriage towards the left.

Means are provided for preventing the engagement of the clutch 23, which drives the actuator, when either of the clutches 45 or 47 is in engagement and vice versa. Pivoted in the machine, below the clutch control lever 27 of the actuator clutch 23 is a lever having one arm 91 arranged in contact with the lever 27 so that the arm 91 is moved when the lever 27 is operated. To cause engagement of the clutch 23, the lever 27 is rocked in a counter clockwise direction, moving the arm 91 backward. The other arm 92 of the lever is provided on its end with a pin 93 which underlies and is in contact with the lever 94, so that this lever 94 is moved upward or in a clockwise direction (Fig. 10) when the clutch control lever is rocked to cause engagement of the clutch. The lever 94 (Fig. 1) is secured to a shaft 95 to which is also secured a lever 96, the lever 96 is connected by means of the link 97 with the lever 98 which has a limited freedom of rotational movement with respect to the shaft 65, by virtue of the tooth 99 of the lever engaging in a wider slot 101 in the shaft. The carriage shift clutch control levers 54 and 57 are mounted on the shaft 65 and when these levers are in the normal clutch disengaging position as shown in Figure 1, the lever 98 and consequently the lever 91 is free to rock so that, when neither of the keys 58 or 59 is depressed, the actuator clutch control lever 27 may be operated. In the event however, that either of the levers 58 or 59 is depressed, the shaft 65 is rotated sufficiently to bring the opposite face of the slot 101 into contact with the tooth 99 on the lever 98, thus preventing movement of the lever 98 in a counter clockwise direction and thereby preventing operation of the clutch control lever 27. Conversely, when either of the bars 28 or 29 have been depressed, moving the lever 91 backward, the tooth 99 of the lever 98 is moved into contact with the opposite face of the slot 101, thereby locking the shaft 65 against rotation in a clockwise direction, and thereby preventing depression of either of the keys 58 or 59.

In some instances, it may be desirable to free the carriage from the worm when the carriage is moved into operative position so that the carriage may be readily shifted by hand. If this is desirable, the worm may be cut away as shown in Figures 12 and 13, so that when the worm is in a position of rest, it is out of engagement with the carriage bottom plate 5. When this construction is employed, the carriage bottom plate is provided with a plurality of apertures 102 having the same spacing as the operative positions of the carriage and the carriage slideway is provided with one or more spring pressed balls 103 adapted to seat in the apertures 102, to position the carriage in operative position and to prevent accidental movement of the carriage or accidental stoppage thereof in a position other than operating position.

I claim:

1. In a calculating machine, a register having a plurality of longitudinally spaced operative positions, means for locking said register in selected operative position and manually controllable motor driven means for driving the locking means to move the register to different operative position.

2. In a calculating machine, a register having a plurality of spaced operative positions, driving means operatively connected to said register, a motor, a clutch interposed between the motor and

the driving means, means normally holding the clutch disengaged and holding the driving means in position to hold the register in an operative position and manually operable freely retractable means for controlling said clutch holding means.

3. In a calculating machine, a register having a plurality of spaced operative positions, driving means therefor including a motor, a freely retractable operating member and unitary means whereby said member may be manually operated to cause said motor to move said register and manually released to terminate the movement and position the register in an operative position.

4. In a calculating machine, a longitudinally movable register having a plurality of longitudinally spaced operative positions, driving means including a motor for moving said register longitudinally and clutch means in said driving means operable to cause longitudinal movement of said register and to lock the register in operative position.

5. In a calculating machine, a longitudinally movable register having a plurality of longitudinally spaced operative positions, driving means operatively connected to said register, a motor, a cyclic clutch having one member connected in fixed relation to the driving means and the other member connected to the motor, means normally locking said one member and manipulable means for unlocking said one member and causing engagement thereof with the other member for a single cycle of operation of said clutch.

6. In a calculating machine, a longitudinally movable register having a plurality of longitudinally spaced operative positions, driving means operatively connected to said register, a motor, a clutch having one member connected in fixed relation to the driving means and the other member connected to the motor and control means operable to disengage the clutch and stop said first mentioned clutch member in position to stop the register in operative position.

7. In a calculating machine, actuating means, a register cooperating therewith, said register and actuating means being relatively movable longitudinally into a plurality of operative positions, a motor, means for connecting the actuating means to the motor to perform a calculation and means driven by the motor for causing relative longitudinal movement of the register and actuator and preventing operation of said first means.

8. In a calculating machine, a movable carriage, a register mounted on said carriage, a rotatable driving element in continuous engagement with said carriage, a motor, a cyclically operable clutch interposed between the motor and the driving means, and control means normally locking said clutch against movement and operative to release and cause engagement of the clutch for a cyclic operation thereof.

9. In a calculating machine, a register having a plurality of regularly spaced operative positions, mechanism for displacing said register including a motor and a normally disengaged locked clutch cyclically operable to move said register a single space, a manually depressible, freely retractable key and unitary means operable by depression of the key for unlocking and engaging the clutch.

10. In a calculating machine, a register shiftable to a series of spaced operative positions, mechanism for shifting said register including a source of energy, a controllable transmission comprising a cyclically operable clutch, and means for interrupting operation of said clutch operable only upon completion of one or more complete cycles of operation.

11. In a calculating machine, actuating means, a register cooperating therewith, said register and actuating means being relatively movable longitudinally into a plurality of operative positions, a source of energy, means including cyclically operable elements driven by said source of energy for causing relative longitudinal movement of the register and the actuating means, and means for reversing the direction of said relative movement.

12. In a calculating machine, actuating means, a register cooperating therewith, said register and actuating means being relatively movable longitudinally into a plurality of operative positions, a source of energy, means including cyclically operable elements driven by said source of energy for causing relative longitudinal movement of the register and the actuating means, and manually operable means for reversing the direction of said relative movement.

13. In a calculating machine, a register having a plurality of regularly spaced operative positions, mechanism for displacing said register including a source of energy and a cyclically operable clutch, a freely movable key and unitary means operable by opposite movements of the key for initiating and terminating operation of said clutch.

14. In a calculating machine, a register movable to a plurality of longitudinally spaced operative positions, normally locked cyclically operable power driven means for moving said register between adjacent operative positions, and unitary means operable by a single manual stroke for unlocking said power driven means for a single cycle of operation thereof.

15. In a calculating machine, a register shiftable to a plurality of spaced operative positions, mechanism for shifting said register comprising a source of energy and a cyclically operable power transmission operable to cause a single space shift of said register for each cycle of operation thereof, and retractable means operable by a single manual stroke for controlling said transmission to initiate operation thereof upon movement of said retractable means in one direction and to control interruption of the operation of said transmission upon retraction.

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