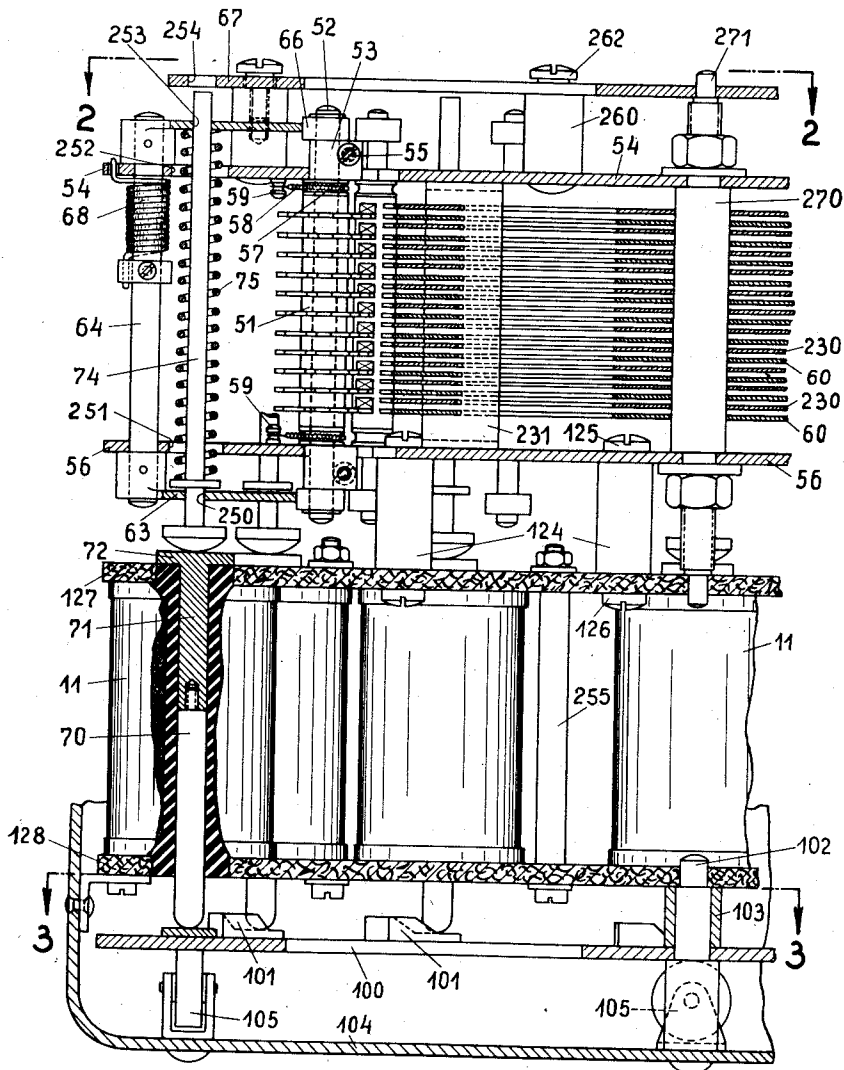


51

*Fig. 1*



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CALCULATING MACHINE

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Fig. 2

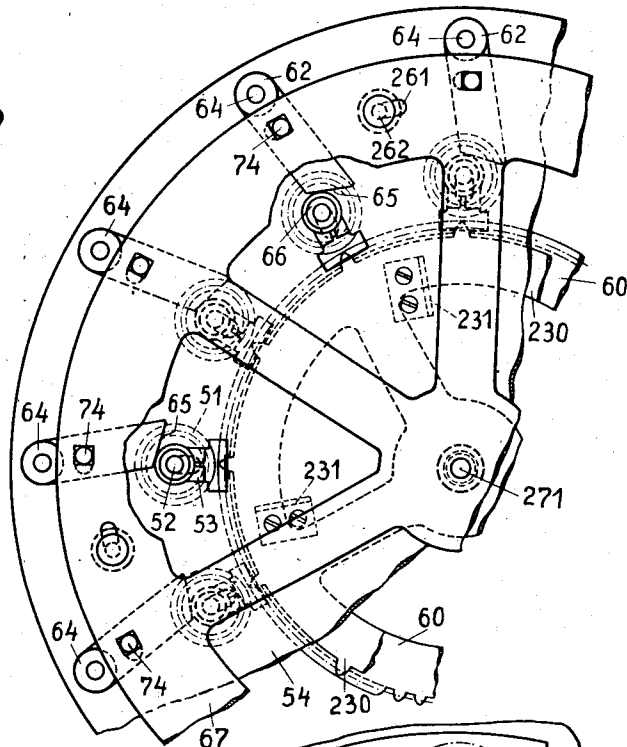
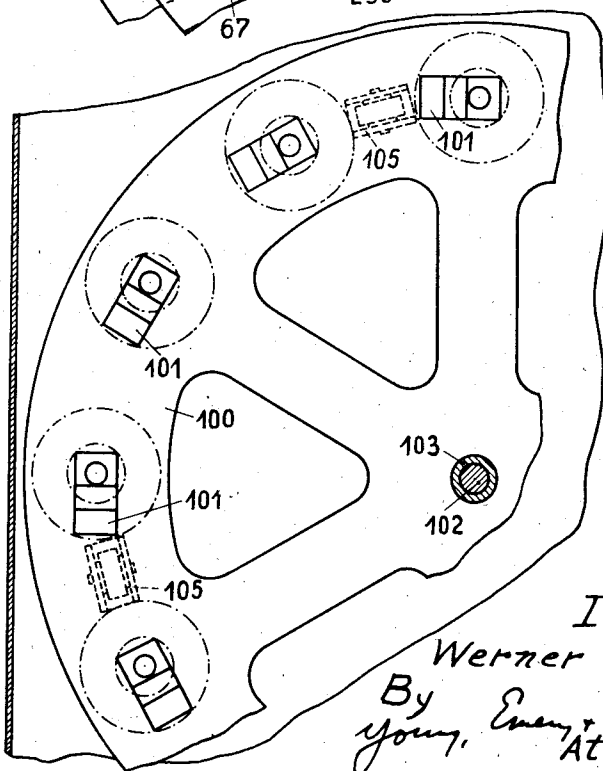


Fig. 3



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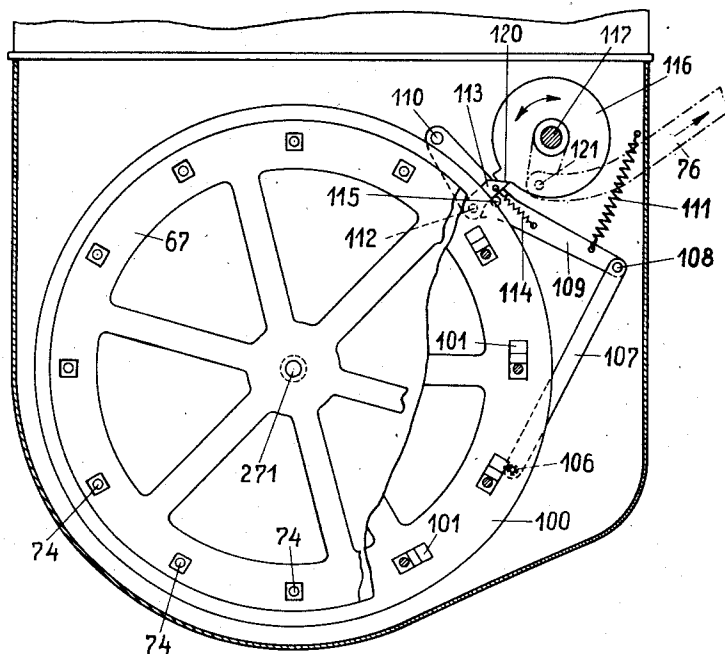
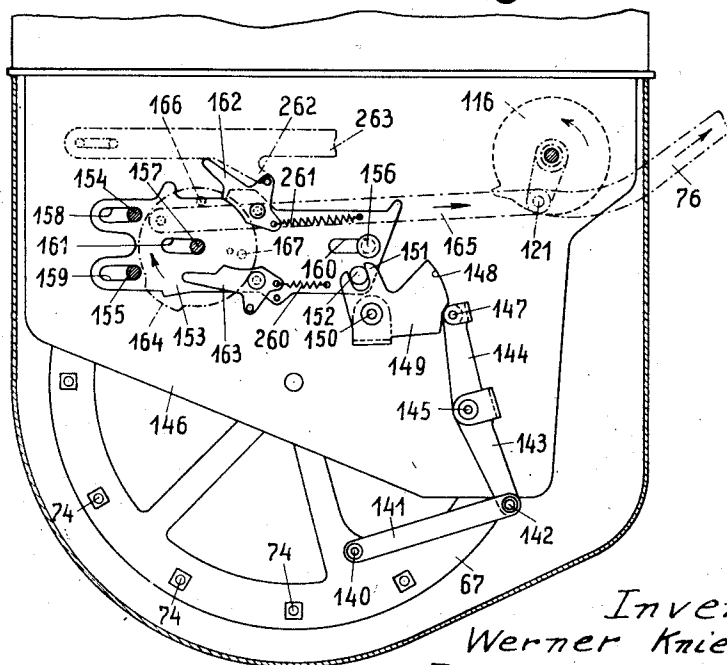


**Fig. 5**



67  
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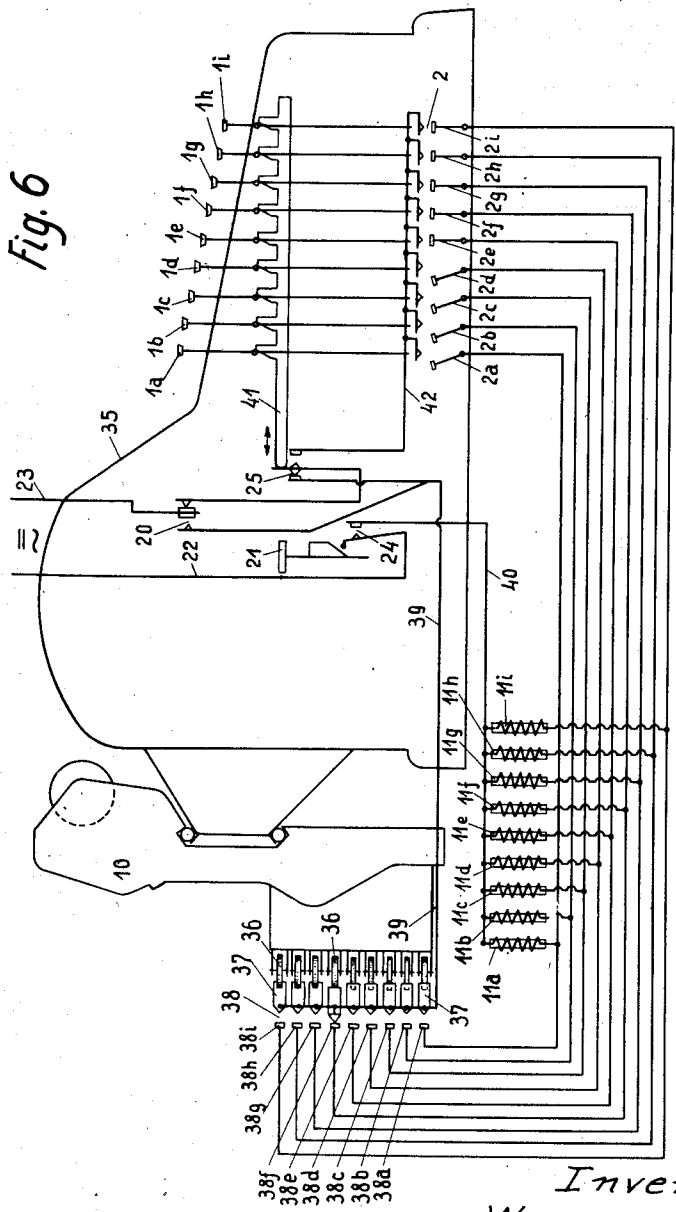
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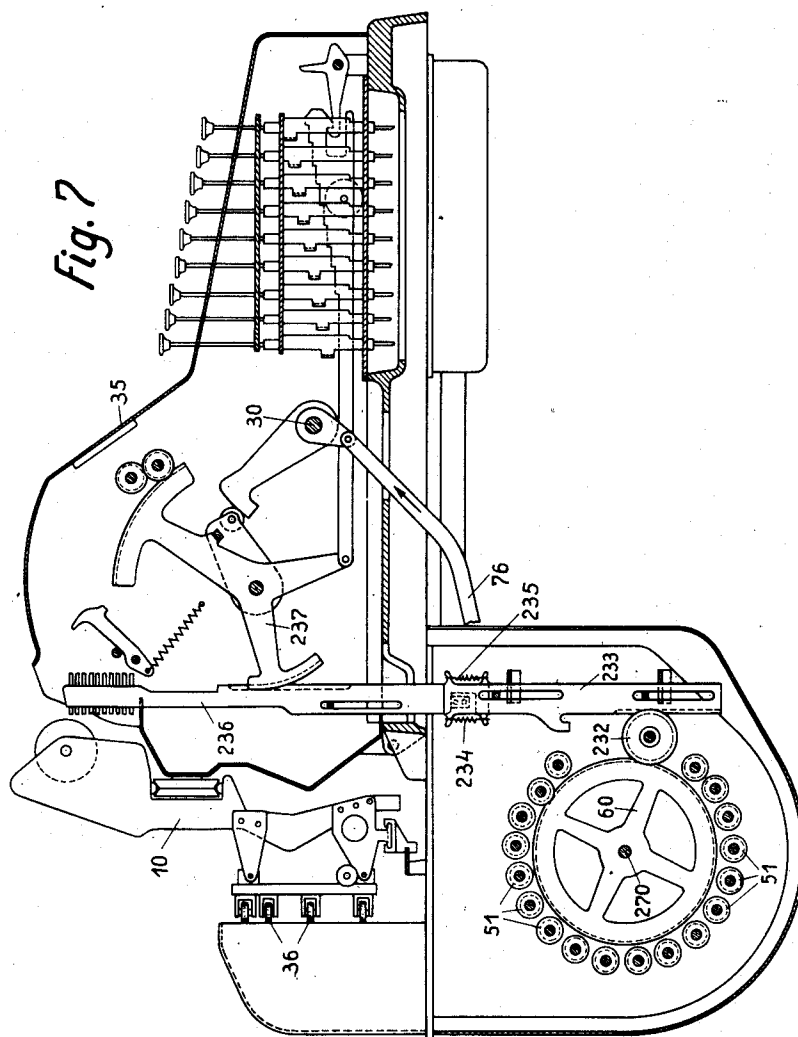
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## UNITED STATES PATENT OFFICE

2,228,830

## CALCULATING MACHINE

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Application December 19, 1938, Serial No. 246,714  
In Germany December 21, 1937

2 Claims. (Cl. 235—60)

This invention relates to calculating machines having a plurality of accumulators for which a drive connection can be selectively established, for the purpose of bringing the accumulators in mesh with amount transmitting actuators.

An object of the present invention is to provide a calculating machine in which a rapid and reliable selection and engagement of accumulators is effected.

According to the invention the driving connections are first preparatorily set up for all accumulators subject to selection by means of members actuated by the machine drive, and the driving connections are maintained by means of an auxiliary power controlled by selecting means in the machine, only for those accumulators which are actually selected.

An example of a machine embodying the invention of the application is illustrated in the drawings in which:

Figure 1 is a section through a mechanism for selecting and engaging the accumulators,

Fig. 2 is a partial elevation of the engaging means taken at line 2—2 of Fig. 1,

Fig. 3 is a section through the accumulator selector mechanism taken at line 3—3 of Fig. 1,

Fig. 4 is an elevation of the drive means of the cams for actuating the coupling members,

Fig. 5 is a view of the control means for engaging the accumulator,

Fig. 6 is a diagram of connections of an electrical system for selecting the accumulators, and

Fig. 7 is a section through the machine.

Figure 6 shows a diagram of connections of a machine in which the accumulators are selected by auxiliary power employing electric current. The accumulators can be selected both by selector keys 1a to 1i, and in dependency on the movement of the paper carriage 10 by means of contacts 38a—38i. The selection of the accumulators is effected by means of solenoids 11a—11i. Electric current is supplied through main conductors 22 and 23. The main conductor 22 leads to a main switch 24 and thence to a bus conductor 40 for the solenoids 11a—11i. From the solenoids the current flows through the lower conductors either through contacts 38a—38i, return conductor 39, and switches 25, 20 to the second main conductor 23, or over contacts 2a—2i, the return conductor 42 and switches 25, 20 to the second main conductor 23. The main switch 24 is closed on depression of the motor key 21, and on return of the motor key into position of rest at the end of the working cycle of the machine, it reopens. By closing the

main switch 24 the contacts closed by the paper carriage 10 or by the selector keys before the machine operation, are made operative so that the operation of the parts, set by means of the contacts, for selecting the accumulators, at the beginning of each machine operation takes place.

The selection of an accumulator by the paper carriage takes place as follows. Rollers 36 consisting preferably of fiber or other non-conducting material are adjustably and exchangeably mounted on the paper carriage, which rollers cooperate with contact carriers 37 which operate the contacts 38. All the contacts 38 on the side of the contact carrier 37 are connected by means of a common conductor 39. This conductor extends either through the switch 25 and the switch 20, or through only the switch 20, to the supply conductor 23. If, as in Fig. 6, the carriage contact 38f corresponding to the solenoid 11f is closed, current will flow upon closure of the main switch 24, over 24, 40, 11f, 38f, 37, 39, 25, 20 to conductor 23 and actuates an iron core of the solenoid 11f in such a manner that the accumulator corresponding to the said carriage contact is selected.

The selection of an accumulator by one of the selector keys 1a to 1i takes place as follows. On depressing any one of the selector keys, the switch operating bar 41 is moved to the right whereby the two-way switch 25 is so actuated that the conductor 39 leading to the carriage contacts 37, 38 is disconnected from the supply conductor 23, and the conductor 42 is connected to said conductor 23. In this manner all the carriage contacts 38 are rendered inactive and the selection of an accumulator between selector keys can take place without obstruction and independently of any accumulator which may have been engaged by the paper carriage 10 in the corresponding position. On depressing the selector keys, contacts 2a—2i are operated which are connected through the bus conductor 42 and two-way switch 25 to the supply conductor 23, and also, similarly to the carriage contacts 38, are connected to the solenoids. If for example the key 1e is depressed, the corresponding contact 2e and solenoid 11e are connected, while at the same time the solenoid 38f switched in through the carriage contact 38, Fig. 8, is rendered inoperative by the shifting of the two-way switch 25 and the disconnection of the conductor 39.

The accumulators 51, Fig. 2, have shafts 52 carrying guides 53 by which they are guided in

radial slots of slide plates 54, 56, Fig. 1, of an accumulator supporting frame. This frame 54, 56 along with the actuators for the accumulators hereinafter described is arranged below the machine, Fig. 7, preferably forming a drum shaped unit. The guides 53 are fastened by means of screws 55 on the shafts 52 of the accumulators 51, and inside the side plates 54—56 collars 57 provided with grooves in which tension springs 58 are accommodated. The springs 58 are attached to pins 59 and act generally to draw the accumulators outwardly away from the center of the drum. The accumulators 51 are actuated by actuator gears 60 common to all the accumulators. Along side each actuator gear is located the tens transfer wheel 230. The actuator gears 60 and the tens transfer wheels 230 are thus alternately arranged alongside each other. Both wheel sets 60, 230 are mounted loosely on a shaft 270 which also serves to space the side plates 54, 56. The wheels 60, 230 are guided in combs 231 which also serve to stiffen the accumulator supporting frame.

The actuator gears 60, Fig. 7, are connected through intermediate wheels 232 with actuator racks 233. Springs 234, 235 connect the actuator racks 233 with bars 236. The guide bars 236 are engaged by rack sectors 237 the movement of which is controlled in known manner by the digit keys.

The tens transfer wheels 230 operate to release a tens transfer mechanism, not shown.

The accumulators 51 are brought into engagement with the actuator gears 60 in the following manner. On the plates 54, 56 of the accumulator frame there are rotatably mounted on axes 64, engaging levers 62, 63 for each accumulator. These engaging levers 62, 63 have bevels 65 at their lower ends, Fig. 2, which cooperate with rollers 66 on the ends of the accumulator shaft 52 in such a manner that on turning of the levers 62, 63 in clockwise direction, Fig. 2, the accumulators are brought into engagement with the actuator gears 60 by the pressure of the bevel 65 on the roller 66. To engage an accumulator the levers 62, 63 must be coupled with an engaging wheel 67, Figs. 1, 2 and 4. The engaging wheel 67 is mounted on a stub portion 271 of the shaft 270 and is attached to the side plate 54 by means of distance pieces 260, the wheel having elongated holes 261 therein through which guide screws 262 extend, to permit a to and fro or oscillatory movement of the engaging wheel 67. The coupling is effected by means of a pin 74. Tension springs 68 wound about the shaft 64 and attached to the side plate 54, act as restoring springs for the levers 62, 63, Fig. 1.

The coupling of the engaging levers 62, 63 with the engaging wheel 67 by means of the pin 74 takes place as follows. The accumulator supporting frame 54, 56 has attached to the side plate 56 by means of distance pieces 124 and screws 125, 126, a second drum-shape supporting frame having side plates 127, 128 spaced by struts 255. The solenoids 11 are arranged in the supporting frame 127, 128 in such a manner that the core of a solenoid 11 lies in the axis of each coupling pin 74. The core of the solenoids consist of an iron member 70 and members 71 of non-magnetic material preferably aluminum. The cores are slidable in the solenoids. The coupling pins 74 are held by springs 75 in contact with the solenoid cores, and the spring 75 of the pin 74 urges the aluminum members 71 of the cores into the solenoids 11, and the iron members

70 out of the solenoids 11. On energization of a solenoid 11 the iron core member 70 is thus drawn into the solenoid 11 and the aluminum core member 71 is moved out therefrom, or the aluminum core member is held in the out position and the iron core member in the in position. The aluminum core member 71 has at its front end a collar 72 which when the core is withdrawn from the solenoid, presses against the coupling pin 74. The pin 74 passes through a hole 250 in the lever 63, through openings 251, 252 in the plates 56 and 54, and through a passage 253 in the lever 62, in which it can slide longitudinally and be brought into engagement with openings 254 in the engaging wheel 67. The spring 75 urges it into its inoperative position.

In front of the supporting frame 127, 128 for the solenoids 11 a disk 100, Fig. 1, is pivotally mounted on a pin 102 fixed in the side wall 128. A spacing roller 103 maintains exact spacing between the disk 100 and the side wall 128. The disk 100 carries cams 101 each of which corresponds to an iron core member 70 of a solenoid 11, Figs. 1 and 3. Guide rollers 105 fixed on the casing 104 of the selector mechanism serve to support the disk 100. To this disk a lever 107 is jointed at 106, Fig. 4, which is connected at 108 with another lever 109 pivoted at 110 in the machine casing. A spring 111 urges the lever 110 in counter-clockwise direction. A pawl 113 is mounted on a pin 112 on the lever 109 and a spring 114 holds the pawl in contact with a pin 115 on the lever 109. A cam 120 formed on a disk 116 cooperates with the pawl 113, said disk 116 being mounted on a shaft 117 and connected at 121 with a connecting rod 76. The rod 76, under the action of the drive shaft 30, Fig. 7, imparts an oscillating movement to the disk 116 during each machine operation and the disk 116 in the forwarding stroke of the machine turns in counter-clockwise direction and in the back stroke of the machine turns clockwise. The counter-clockwise movement of the disk 116 is transmitted through the lever 107, 109 during the forward movement of the machine drive and turns the disk 100 in clockwise direction. After the disk 116 is turned through 8° the cam 120 on the disk 116 passes the pawl 113 and releases the same. Whereupon the spring 111 returns the lever 109 and the disk 100 to the position shown in Fig. 4. During the back stroke of the machine drive the disk 116 performs a return movement in clockwise direction during which the pawl 113 is turned clock-wise against the action of the spring 114 so that no movement of the lever 109, 107 and disk 100 can take place.

On the engaging wheel 67, Fig. 5, a link 141 is jointed at 140 which link is connected through a pin 142 with a two armed lever 143, 144 pivoted at 145 to an intermediate wall 146 of the machine casing and carrying a roller 147 on its upper arm 144. This roller 147 cooperates with a cam surface 148 on a bell-crank lever 149 which is pivoted on an axis 150 and has its free arm formed as a fork 151. The fork 151 embraces a pin 152 fixed on a slide plate 153. The slide plate is movably supported on the intermediate wall 146 by means of pins 154, 155, 156, 157 and slots 158, 159, 160 and 161. The slide plate 153 carries pawls 162, 163. In front of the slide plate 153 a cam disk 164 is mounted on the pin 157 and is shown in broken lines in Fig. 5, which disk is connected by means of a rod 165 with the rod 76, at the pin joint 121 on the disk 116. The cam disk 164 has pins 166 and 167 with which the

pawls 162, 163 can be engaged by control means not shown. The pawl 163 is turned by a spring 260 and the pawl 162 by a spring 261 into the operative position. The pawl 162 serves to set the machine for total taking and normally this pawl is held in the inoperative position against the action of spring 261, by means of an extension 262 of an operating bar 263. The instant of engagement of the pawls 162, 163 with the pins 166, 167 is determined by the particular operation to be carried out in the machine. By means of the aforesaid control means the pawls 162, 163 are brought into the path of the pins 166, 167. The control of these pawls and the mode of operation of the slide plate 153 is as disclosed in U. S. patent application Serial No. 744,441.

In the forward stroke of the machine the cam disk 164 performs a movement in the clockwise direction, and in the back stroke of the machine a movement in counter-clockwise direction. If before the beginning of a machine operation the pawl 162 is released by the operating bar 263 and is turned by the spring 261 into operative position, then the pin 166 causes the slide plate 153 to move to the right in Fig. 5 at the beginning of the machine operation. During the righthand movement of the slide plate 153 there takes place a rocking of the bell crank 149 in clockwise direction (Fig. 5) by means of the pin 152, and the cam surface 148 of the lever causes the turning of the two armed lever 143, 144 in clockwise direction, whereby the link 141 moves the engaging disk 67 in clockwise direction. The accumulators coupled to the engaging disk 67 by means of the coupling pin 74 are thus brought into engagement at the beginning of the machine operation with the actuator gears 60, for the purpose of total taking. The dimensions of the actuator and coupling members are such that the engaging movement of the disk 67 finishes after about 20° of the crank stroke, and after a crank stroke of about 25° the total taking begins. If instead of the pawl 162 the pawl 163 comes into action through the actuating rods not shown, then the pin 167, in the back stroke of the machine operation pushes the slide plate 153 to the right in Fig. 5, acting through the pawl 163. The accumulators thereby coupled with the engaging wheel 67 come into engagement with the actuator gears 60 at the beginning of the back stroke for adding.

The mechanism of the invention operates as follows.

Before the beginning of the machine operation a contact corresponding to the accumulator to be selected is closed by means of a selector key or by the paper carriage. At the beginning of the machine operation all the solenoid cores are at once brought into the operative position by the cam disk 100, and likewise the coupling pins 74, and at the same time by closing the main switch 24 the solenoid 11 determined by the depressed selector key or the active carriage contact is energized. The other solenoids do not receive current. After about 8° of the crank movement of the ma-

chine drive the cam disk 100 returns to its original position and therefore allows the springs 75, the coupling pins 74 and the solenoid cores 11 also to return to their normal position. The coupling pin associated with the solenoid which is energized is held against the action of its spring 75 in its operative position by means of the solenoid, that is in engagement with the engaging disk 67. In the following rocking movement of the engaging wheel 67 the accumulator 51 corresponding to this coupling pin 74 is brought into engagement with the actuator gears 60 by means of the engaging levers 62, 63. The work to be done by the auxiliary power, that is the electric current, is thus limited to holding the actuator coupling pin 74 in the engaged position while the bringing of the accumulators into operative position is positively effected by the machine drive. The engaging disk 67, according to the particular machine operation, disengages the selected accumulator at the end of the forward stroke or at the end of the backward stroke of the machine drive. At the end of the backward stroke of the machine drive the main switch 24 is opened by return of the motor key to its normal position, and the corresponding coupling pin 74 is brought out of engagement with the engaging wheel 67. The coupling wheel 74 returning to its normal position pushes the iron core 70 of its associated solenoid 11 out of the solenoid and into its normal position shown in Fig. 1.

Obviously the invention is not limited to a machine with common ten transfer means for the accumulators. Without departing from the invention it is possible to select a plurality of accumulators simultaneously each accumulator having its own tens transfer means.

I claim as my invention:

1. A calculating machine comprising a drive means, a plurality of selectable accumulators, a set of differential actuators serving all of said accumulators in common, means for engaging the accumulators with the actuators, a normally ineffective coupling means between each accumulator and said engaging means, an operating member movable by the drive means, means on said operating member for temporarily enabling the coupling means between and the engaging means and all of said accumulators near the beginning of an operation of the drive means, means for selecting accumulators to be engaged with said actuators, and auxiliary power means controlled by said selecting means, said auxiliary power means maintaining enabled only the couplings of selected accumulators during further operation of the drive means.

2. A calculating machine according to claim 1, wherein a spring is provided for normally maintaining each coupling means in ineffective position, and wherein the coupling means are adjustable by the means on the operating member against the force of said springs, said springs returning the coupling means not maintained in adjusted position by said power means following operation of said operating means.

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