July 7, 1936. A. KOTTMANN 2,046,329

CALCULATING MACHINE

Original Filed June 1, 1934 5 Sheets-Sheet 1

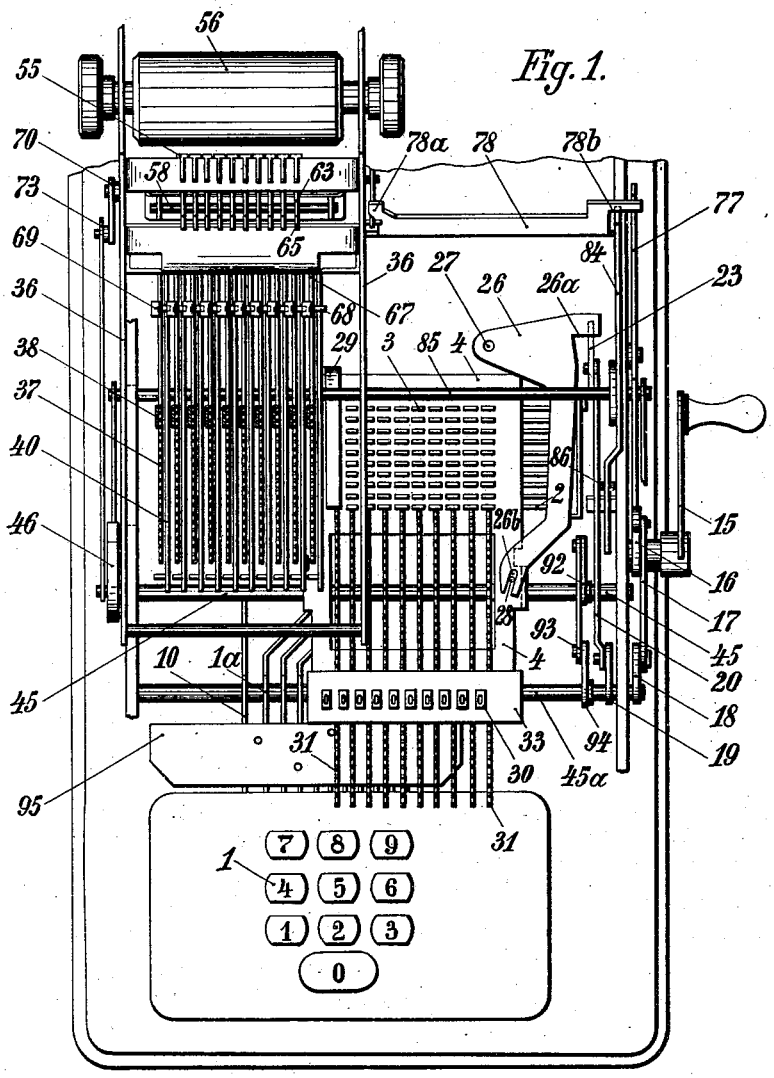

Fig. 1.

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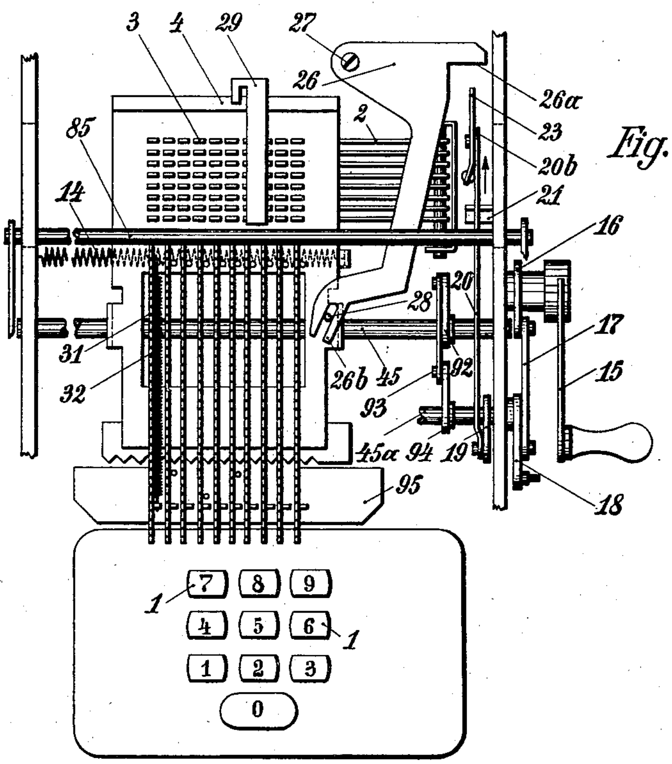

Fig. 2.

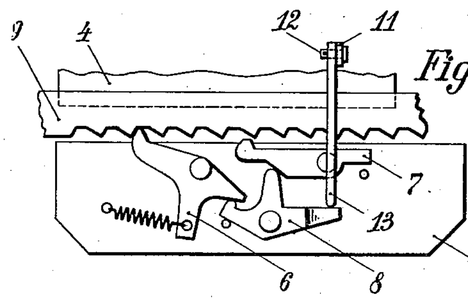

Fig. 3.

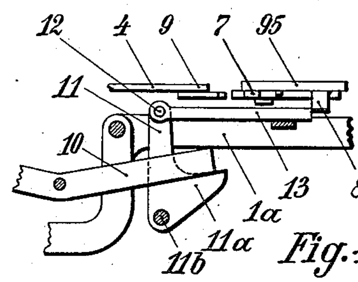

Fig. 4.

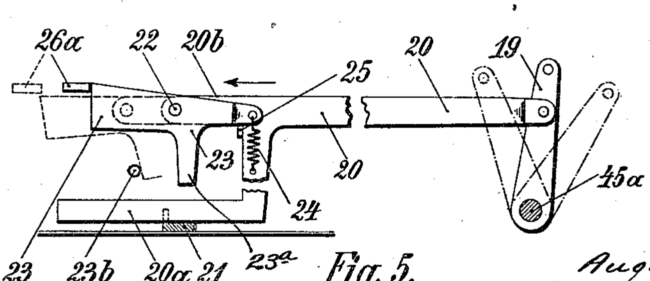

Fig. 5.

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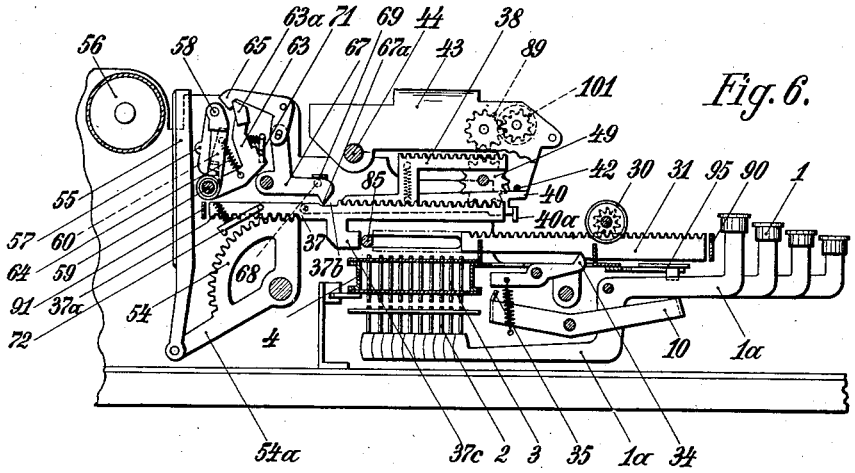

Fig. 6.

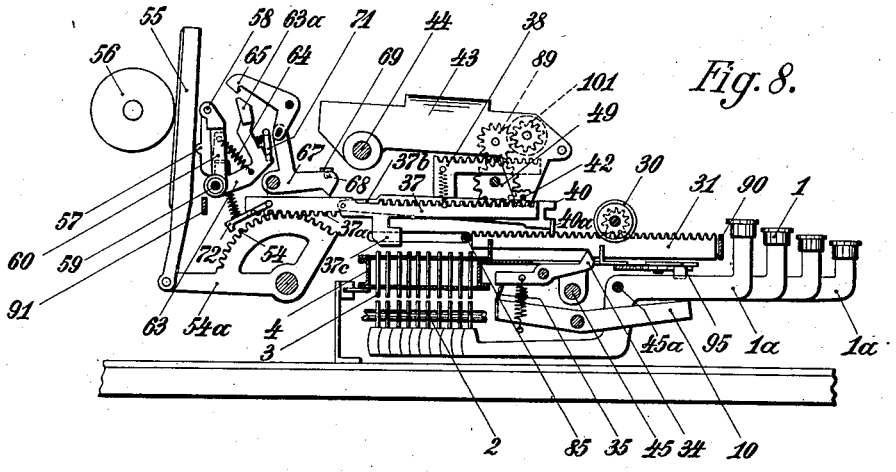

Fig. 8.

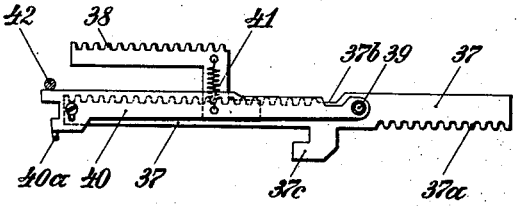

Fig. 7.

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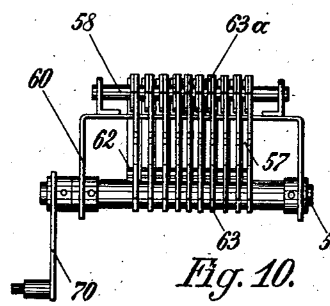

Fig. 10.

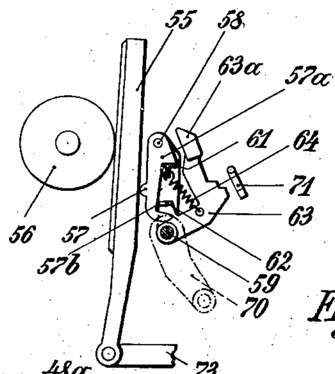

Fig. 9.

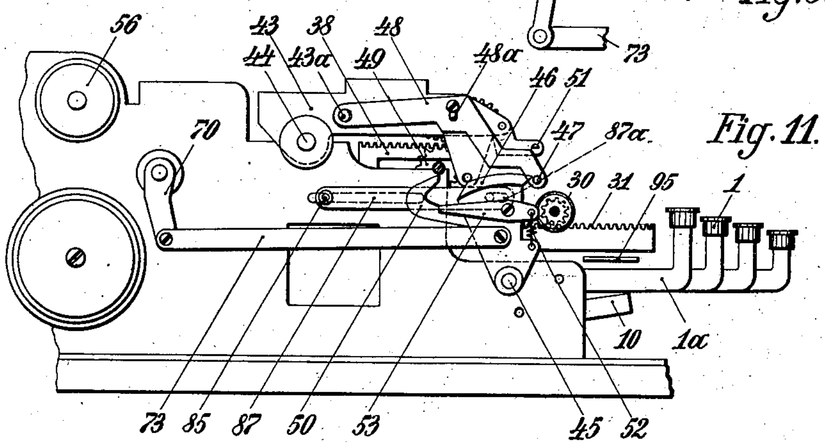

Fig. 11.

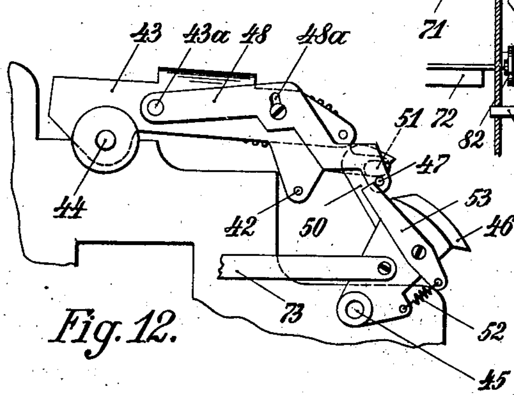

Fig. 12.

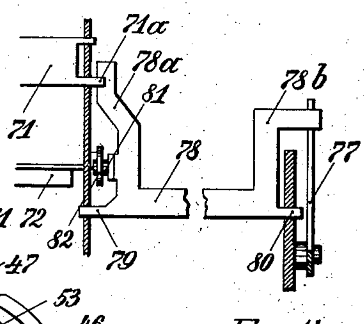

Fig. 14.

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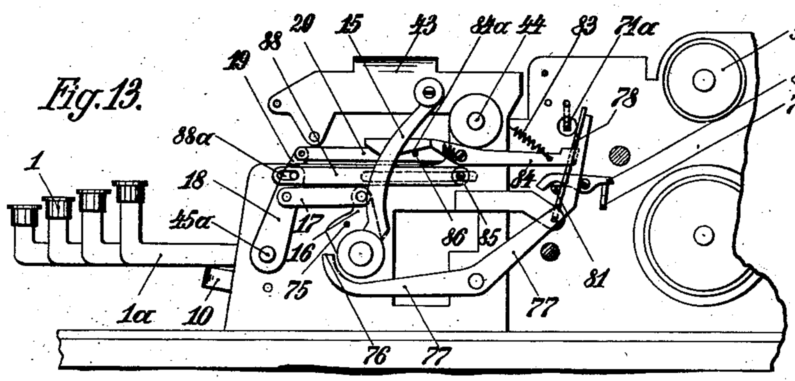
Fig. 13.



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UNITED STATES PATENT OFFICE

2,046,329

CALCULATING MACHINE

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Original application June 1, 1934, Serial No. 728,603. Divided and this application March 5, 1935, Serial No. 9,510. In Germany June 6, 1933

6 Claims. (Cl. 101—93)

This invention relates to calculating machines of the kind including printing mechanism comprising type bars associated with the respective ordinal actuators for setting up the digits and adapted to be set thereby relatively to the printing line of a platen or paper roller, the present application being a division of applicant's co-pending application, Serial No. 728,603, filed June 1, 1934.

An object of the present invention is to provide a uniform non-impactive printing pressure to the type bars which shall be independent of the effort applied to the keys or other operating devices of the machine.

Another object of the present invention is to provide printing contact between the paper on the platen and the type bars by converting kinetic energy of moving weights into gradual pressure against the type bars.

The invention will be described with reference to the accompanying drawings.

Figure 1 shows the calculating machine according to the invention, the cover plates and accumulator being removed.

Fig. 2 is a plan of the setting gear, with the setting members.

Fig. 3 is a view, from below, showing the ratchet gear for the setting member carriage.

Fig. 4 is a side elevation of the members for actuating the ratchet gear.

Fig. 5 shows the actuating device for the return stroke of the carriage.

Fig. 6 is a longitudinal section through the entire machine, with the parts in the initial position.

Fig. 7 shows the arrangement of an actuating rack.

Fig. 8 is a view corresponding to Fig. 6 and shows the position of the parts when the operating handle is drawn forward, shortly before the printing of a calculated value.

Fig. 9 shows the change in position of the parts of the printing mechanism after the impression.

Fig. 10 represents details of the printing mechanism.

Fig. 11 is a side elevation of the drive for the control of the accumulator.

Fig. 12 shows the accumulator, with its control members in position after being coupled, to the actuating members.

Fig. 13 is a side elevation showing the parts in their positions for addition.

Fig. 14 is the front elevation of a detail of a control member.

The numerical values to be introduced into the machine are introduced in known manner, by means of the keys 1 (Figs. 1 and 6), key levers 1*a* and intermediate levers 2, into the setting pins 3 of the carriage 4. The setting pins thus raised serve as stops for racks forming the setting members 31, which are mounted in guide notches of the carriage 4, and, in being set, actuate at the same time indicating wheels 30 which are also mounted on said carriage. The number of setting members 31 is the same as that of the rows of setting pins 3. When any of the keys is struck, the corresponding key lever 1*a* depresses a lever 10 (Figs. 6 and 8) which by means of a lug 35 releases a pawl 34 engaging the corresponding setting member 31. Said member 31, which was previously retained in the neutral position by the pawl 34, is then free to be actuated by a spring 32 (Fig. 2) and moves towards the left (Figs. 6 and 8) until its end bears against a simultaneously raised setting pin 3, thus setting the member 31.

By means of a ratchet mechanism 6, 7, 8 (Fig. 3) which acts on a rack 9 on the carriage 4 and is mounted on a plate 95 of the machine frame, the carriage 4 is moved to the left (Figs. 1, 2) to an extent corresponding to the spacing of two adjacent rows of setting pins by the action of a spring 14 (Fig. 2) each time a key is struck, so that the rows of setting pins pass in succession over the ends of the intermediate levers 2 and the pawls 34 pass in succession over the lug 35 on the lever 10.

The ratchet mechanism is actuated by the lever 10 (Fig. 6) arranged below the key levers 1*a* (Fig. 6). When any of the keys 1 is struck, the corresponding key lever 1*a* depresses the lever 10, which in turn depresses the arm 11*a* of a lever 11 (Fig. 4) and thus turns the lever 11 about the pivot 11*b*. A presser bar 13 which in turn rocks a pawl 8 is articulated at 12 to the lever 11. The pawl 8 actuates the two ratchet pawls 6, 7 in the desired manner.

The carriage 4 is returned to its original position when, to effect an addition or a subtraction, the handle 15 is rocked forwardly and backwardly. The movement of the handle 15 is transmitted, by intermediate members 16, 17, 18 (Figs. 1 and 13), a shaft 45*a*, a one-armed lever 19 (Figs. 1 and 5), and a thrust bar 20, to a thrust pawl 23. The bar 20 has an arm 20*a* (Fig. 5) by which it is guided in a member 21 mounted in the base of the machine. The thrust pawl 23 is pivoted on a pin 22 and bears, under the

action of a spring 24, against a stop 25 on the thrust bar. As long as the handle 15 is in normal position, the thrust pawl 23 is held in the position shown in dotted lines in Fig. 5 because the arm 23a of the pawl 23 bears against a pin 23b on the machine frame. When the handle is moved forwardly the bar 20 is moved to the right (Fig. 5) whereby as the arm 23a of the pawl 23 is retracted from the pin 23b, the pawl passes into the position shown in full lines in Fig. 5. When the handle 15 is returned to normal position and the bar 20 with pawl 23 moves to the left in Fig. 5, the pawl 23 encounters an arm 26a on a driver lever 26 (Figs. 1, 2, 5) pivoting on a pin 27 and having an arm with a forked end 26b engaging a pin 28 on the carriage 4. The rocking movement of the lever 26 forces the carriage 4 back into the original position (Fig. 1), while, at the same time, the pins 3, set at the beginning of the operation, are forced back into their original position, sliding under a member 29 provided with a bevel. Shortly before the handle 15 returns to its initial position the arm 23a of the pawl 23 again encounters the pin 23b on the machine frame whereby the pawl is restored to the position shown in dotted lines in Fig. 5. If a new number is now set up in the carriage 4 and the latter moves from its normal position, the arm 26a of the lever 26 can move freely over the pawl 23. The return of the setting members 31 will be described later.

Driving or transmission racks 37 (Figs. 1, 6, 7, and 8) on which are riveted secondary racks 38, are provided in the same number and displaceable in the same direction and to the same extent as the setting members 31 in a frame 36 (Fig. 1) mounted in the frame of the machine. Secured on the transmission racks 37 are coupling members 40 (Figs. 1, 6, 7, 8) which are adapted to turn on pivot pins 39, and are swung by springs 41 (Fig. 7) in the direction of a member 42 (Figs. 6 and 8) on a frame 43 carrying an accumulator 101, said frame being disposed above the racks 37 and pivotally mounted on a shaft 44. The accumulator 101 can be raised and lowered by turning the accumulator frame about the shaft 44 and thus brought into or out of engagement with the racks 38 by means of the intermediate pinions 89. The accumulator 101 is raised and lowered by means of a curved member 46 (Figs. 11 and 12) mounted on a shaft 45 which is actuated through intermediate members 92, 93, 94 (Fig. 1) by a shaft 45a, which also effects the return movement of the carriage 4 and is actuated in turn by the handle 15. When the forward movement of the handle 15 and of the curved member 46 begins, the latter engages a guide roller 47 (Fig. 11) of a lever 48, pivotable for a distance determined by a pin and slot guide 48a about a pin 43a on the accumulator frame 43, and causes the accumulator 101 to descend as the movement of the curved member continues, and to engage, through the intermediate pinions 89, with the rack 38. The member 42 mounted on the accumulator frame and descending with the accumulator simultaneously brings angular projections 40a of the coupling members 40 into engagement with the teeth of the setting members or control racks 31 (Fig. 8).

Together with the curved member 46 a positive movement is imparted to a riveted hook 50 (Figs. 11, 12) which engages behind a pin 51 provided on the accumulator frame and thus retains the accumulator in the coupled position (Fig. 12).

At the same moment that the locking hook 50 engages behind the pin 51, the under side of the curved member 46 has passed out of contact with the guide roller 47 of the lever 48. The roller 47 and lever 48 are forced up (Fig. 12) at the same moment by a lever 53 attached to the curved member 46 and under the tension of a spring 52, so that during the return of the handle into its original position, the guide roller 47 runs back over the upper surface of the curved member and is able to swing the accumulator back into neutral position by suitably disposed springs (not shown).

Consequently, during the forward movement of the handle 15, the accumulator is brought into engagement with the racks 38, and is disengaged during the return movement. Similarly during the forward movement of the handle, the transmission racks 37, 38 are coupled with the setting member 31 by the coupling members 40 actuated by the accumulator frame 43 through the member 42, the coupling being disengaged in the return movement.

When the handle 15 is moved forward, a driver bar 85 (Figs. 1, 2, 6, 8, 11) is advanced the distance corresponding to the numerical value "9" by connecting rods 87, 88 (Figs. 11, 13). By this means all the setting members 31 previously set in accordance with the items to be added, are returned to the zero position. Thereby the transmission racks 37 coupled to the setting members 31 by the coupling members 40 are moved through a distance corresponding to the amount set. Excessive movement is prevented by a limiting bar 90 (Figs. 6 and 8), which is mounted in the carriage 4 transversely in the front of the ends of the setting members 31 and stops the latter from being moved beyond the zero position.

As soon as the handle 15 has reached the end of its forward stroke the accumulator 101 comes out of engagement with the transmission racks 37, 38 as already described and the setting members 31 are uncoupled from the transmission racks, said members and the numerical control rollers 30 being thus again set to zero.

In the return stroke of the handle 15 and driver bar 85 into the original position, the latter encounters hooked projections 37c (Figs. 6, 7, 8) of the racks 37 and pushes the latter back into the original position (Fig. 8). Excessive movement is prevented by a limiting bar 91 (Figs. 6, 7, 8) mounted in the frame 36 transversely across the ends of the racks 37 which prevents them from being moved beyond the original position. Consequently, the movement of the transmission racks 37, 38 is wholly positive no springs being employed therefor.

When the setting members are in the position corresponding to the numerical value "9" the driver 85 is closely engaged between the opposing surfaces of the hooks 37c and setting members 31. When said members are set for the value "0" the driver can reciprocate between the two surfaces to an extent corresponding to the value "9" without displacing the racks 37 or the members 31. When the member 31 is set in accordance with the value "3" the driver 85 describes at first, at the beginning of both the forward and return strokes, an idle movement corresponding to the value "6" and then pushes the setting member 31, or the driving rack 37 back into the original position. The driver 85 therefore actuates each of the driving racks 37 by the aid of two stops (hook 37c, setting

member 31) that are provided thereon and project within the sphere of movement of the driver, the one stop (hook 37c) being fixed on the driving rack 37 and the other (setting member 31) being engaged with the driving rack after being key-set.

The drawbars 87 and 88 moving with the driver 85 are connected by means of longitudinal slots 87a, 88a (Figs. 11 and 13) with the arm 18 and the curved member 46 of the shaft 45a and 45. Consequently, at the beginning of the forward and return strokes, the handle 15 describes a certain movement during which the driver 85 is not moved. During this movement, the accumulator 101 is brought respectively into and out of engagement and the setting member coupled with or uncoupled from, the driving racks. These operations therefore proceed with the driver 85 at rest.

Intermediate pinions 49 (Figs. 6, 8) are in engagement with the transmission racks 37. The upper portions of the toothed rims of these intermediate pinions 49 are on a level with the gear teeth of the racks 38 riveted on the transmission racks 37. The accumulator 101 is laterally displaceable to a slight extent. When it is pushed towards the right, the intermediate pinions 89 of the accumulator engage with the racks 38 and when the accumulator is pushed towards the left, they engage with the intermediate pinions 49 of the gear driving the accumulator. In the former case, the action is one of addition, and in the latter case one of subtraction.

The rear ends of the lower edges of the transmission racks 37 are provided with gear teeth 37a (Figs. 6, 7, 8) which are engaged by the toothed sectors 54, these latter, in turn, carrying on arms 54a type carriers 55 of the printing mechanism. In proportion as the racks 37 are moved by the setting members 31 with which they are coupled the type carriers are also raised, in a positive manner, so that, in accordance with the setting of the racks and type carriers, the values transferred into the counting mechanism can be printed on a strip of paper clipped on to a platen 56 (Fig. 8).

The impression mechanism of the printing device (Figs. 1, 6, 8, 9, 10) consists of a number of press pawls 57, corresponding to the number of orders in the accumulator, said pawls being adjacently disposed on a shaft 58 fixed in a frame 60 (Figs. 6, 8, 10) adapted to swing on a shaft 59, parallel with the axis of the platen. The movement of these press pawls 57 about the shaft 58 in the direction of the platen is restricted by a bar 61 (Fig. 9), against which the projections 57a of the pawls 57 bear. Pressure levers 63 carrying weights 63a are allotted to the pawls 57, and are controlled by springs 64, but are normally held in a neutral position by locking pawls 65 (Figs. 6 and 8). In addition a locking bar 71 common to all the pressure levers is mounted in the frame of the machine and engages in notches in the levers 63, being released just before the printing operation by devices which will be described later.

The locking pawls 65 form part of the zero-printing device and coact with releasing pawls 67, the number of which is the same as that of transmission racks 37. When the corresponding transmission racks are in neutral position, the tip 67a of each releasing pawl 67 engages in a recess 37b of the transmission rack (Fig. 6). As soon as the transmission rack leaves its original position, its unrecessed portion passes under the tip of the pawl, thereby turning the pawls 67 and 65 and effecting the release of the pressure lever 63 (Fig. 8). On their right side, the pawls 67 are provided with pins 68, while the left sides are provided with lugs 69 of such dimensions that, in each case, the pin 68 of each pawl lies under the lug of the next lower, adjacent pawl, so that if any pawl be raised by its allotted transmission rack all the pawls lying to the right of it in Fig. 1 will also be raised whereas the pawls on the left will remain in the locked position. In printing a value containing a smaller number of figures than there are orders in the printing mechanism, the pawls 65, 67 prevent the impression of "0's" in front of the first numeral of the multi-numeral value to be printed, whereas zeros inside the row of numerals are printed.

During the forward movement of the handle 15, the frame 60, with the press pawls 57, is swung, by means of the shaft 45a, shaft 45, curved member 46, drawbar 73 (Figs. 1 and 11) and the arm 70, towards the platen 56, in such a manner that the press pawls 57 bear against the back of the type carriers 55 and bring the latter so close to the platen 56 that the type characters almost touch the paper, whereas the pressure levers 63 are held at first in their original position in relation to the frame of the machine by the bar 71. During the swinging of the frame 60, tension is applied to the springs 64 of the pressure levers 63, which springs are attached at one end to the cross bar 61 of the frame 60. Shortly before the handle 15 reaches the end of its forward stroke, a striker pin 75 (Fig. 13), which is arranged on the lever arm 16, connected to the handle, comes into contact with a surface 76 on a two-armed lever 77 and deflects the latter in such a manner that its second arm moves a pivotal release member 79 (Figs. 13, 14). The arm 78a of the member 78, which turns on two pivots 79 and 80, moves a pin 71a on the bar 71 when said member is deflected and swings the bar 71 out of the locking position. A roller 81, arranged on an angular bend of the same arm 78a influences a rocking member 82 (Fig. 13) so that the latter forces a straight-edge 72 (Figs. 13, 6, 8) into the toothed sector 54 (Fig. 8). These last described members are relatively arranged so that, in the first place, the straight-edge 72 engages in the tooth gaps of the sector 54, after which the arm 78a comes in contact with the pin 71a and effects the release of the spring-controlled pressure lever 63. The forward movement of the release member 78 brings a locking pawl 84 (Fig. 13), controlled by a spring 83, into position behind the arm 78b, and locks the release member until the handle is moved back again.

At the moment the locking bar 71 is being released, the springs 64 swing the pressure levers 63 on the shaft 59 and impart a high velocity to the weights 63a (Fig. 9). The bent surfaces 62 of the levers 63 then slide downwards on the rear surfaces 57b of the press pawls 57 and, transforming the kinetic energy of the weights 63a and levers 63 into pressure, press the pawls 57 and type carriers 55, slowly but forcibly, against the surface of the paper so that the impression on the paper is produced less by impact than by uniform pressure.

The thrust bar 20, moved by the handle 15 and actuating the return mechanism of the car-

riage of the setting members, carries a pin 86 (Fig. 13) which, at the beginning of the return stroke of the handle 15, lifts the curved arm 84a of the locking pawl 84 and thus frees the locking of the release member 78, by which means the straight-edge 72, obeying the pull of a spring 72a (Fig. 8) detaches itself from the teeth of the sector 54, and the locking bar 71 is released again. During the further return movement of the handle 15, the driver 85 actuated thereby pushes the transmission racks 37 back into the original position as already described thus returning the type carriers into their original position.

The frame 60 carrying the printing mechanism is also swung back during the return of the handle 15 into its original position by means of the shaft 45a, shaft 45, curved plate 46 and drawbar 73, the pressure levers 63 being again locked by the descent of the locking pawls 65, while, at the same time, the locking bar 71 is enabled by spring tension to engage in the notches in the pressure levers.

The return of the pawls 65 into locking position is rendered possible through the return of the allotted driving racks into neutral position so that the release or control pawls 67 are able to drop into the recesses 37b provided in the same, thereby enabling the pawls 65 to move into the locking position.

The invention has been described herein as applied to a ten key calculating machine, but it is to be understood that the invention is not limited to application to this particular machine nor to those of similar type, and may be employed in any calculating machine with settable type bars to which the printing force is applied when they are in selected printing positions.

I claim as my invention:

1. In a calculating machine having ordinal actuators and a platen, printing mechanism comprising for each ordinal place a type bar settable relatively to the printing line of the platen in accordance with the travel of the associated actuator, a press pawl movable during the setting of the type bar into a position bearing on the back of the type bar and adapted to hold the operating face of the latter close to the platen, a movable weight in which energy is stored during the movement of the press pawl, and means movable by said weight over the press pawl for converting the kinetic energy of the weight into pressure applied through said press pawl gradually to said type bar during printing.

2. In a calculating machine having ordinal actuators and a platen, printing mechanism comprising for each ordinal place a type bar normally spaced from the platen, means for setting said type bar relatively to the printing line of the platen in accordance with the travel of the associated actuator, a press pawl operable during the setting of the type bar to swing the latter close to the platen, a movable weight in which energy is stored during the movement of the press pawl, and means movable by said weight over the press pawl for converting the kinetic energy of the weight into pressure applied through said press pawl gradually to said type bar during printing.

3. In a calculating machine having ordinal actuators and a platen, printing mechanism comprising for each ordinal place a type bar normally spaced from the platen, means for setting said type bar relatively to the printing line of the platen in accordance with the travel of the associated actuator, a press pawl operable during the setting of the type bar to swing the latter close to the platen, a movable weight in which energy is stored during the movement of the press pawl, means movable over the press pawl for converting the kinetic energy of the weight into pressure applied through said press pawl gradually to said type bar during printing, and means for locking the type bar in printing position prior to the application of the gradual pressure thereto.

4. In a calculating machine having ordinal actuators and a platen, printing mechanism comprising ordinal type bars normally spaced from the platen, means for setting said type bars relatively to the printing line of the platen in accordance with the travel of the associated actuators, means for causing the type bars to approach close to the platen at the beginning of a printing operation, a movable weight assigned to each type bar, means including a spring attached to said weight and tensioned during said approach movement of the associated type bar, a locking bar arranged to retain the weight while the spring is being tensioned, speed-reducing force-increasing means operative between said weight and the type bar, and means for releasing the weight to complete the movement of the associated type bar towards the platen.

5. In a key set handle operated calculating machine having ordinal actuators and a platen, printing mechanism comprising ordinal type bars normally spaced from the platen, means for setting said type bars relatively to the printing line of the platen in accordance with the travel of the associated actuators, press pawls operable during the first part of the movement of the handle to swing the type bars close to the platen, a movable weight assigned to each type bar, means including a spring attached to said weight and tensioned during the said swing of the associated type bar, a locking bar arranged to retain the weight while the spring is being tensioned, speed-reducing force-increasing means operative between the weights and the press pawls, connections between the handle and the locking bar for releasing the weights to complete the movement of the type bars towards the platen, and means operable during the second part of the operation of the handle to restore said press pawls and weights to normal position.

6. In a printing mechanism, a platen, a type bar, means for causing the type bar to approach close to the platen at the beginning of printing, means including a flyweight and a spring cooperating therewith for storing potential energy and converting it into kinetic energy, a speed-reducing force-increasing device arranged between said flyweight and the type bar, and means operative after said approach movement of the type bar to complete its printing movement under the action of said flyweight and device.

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