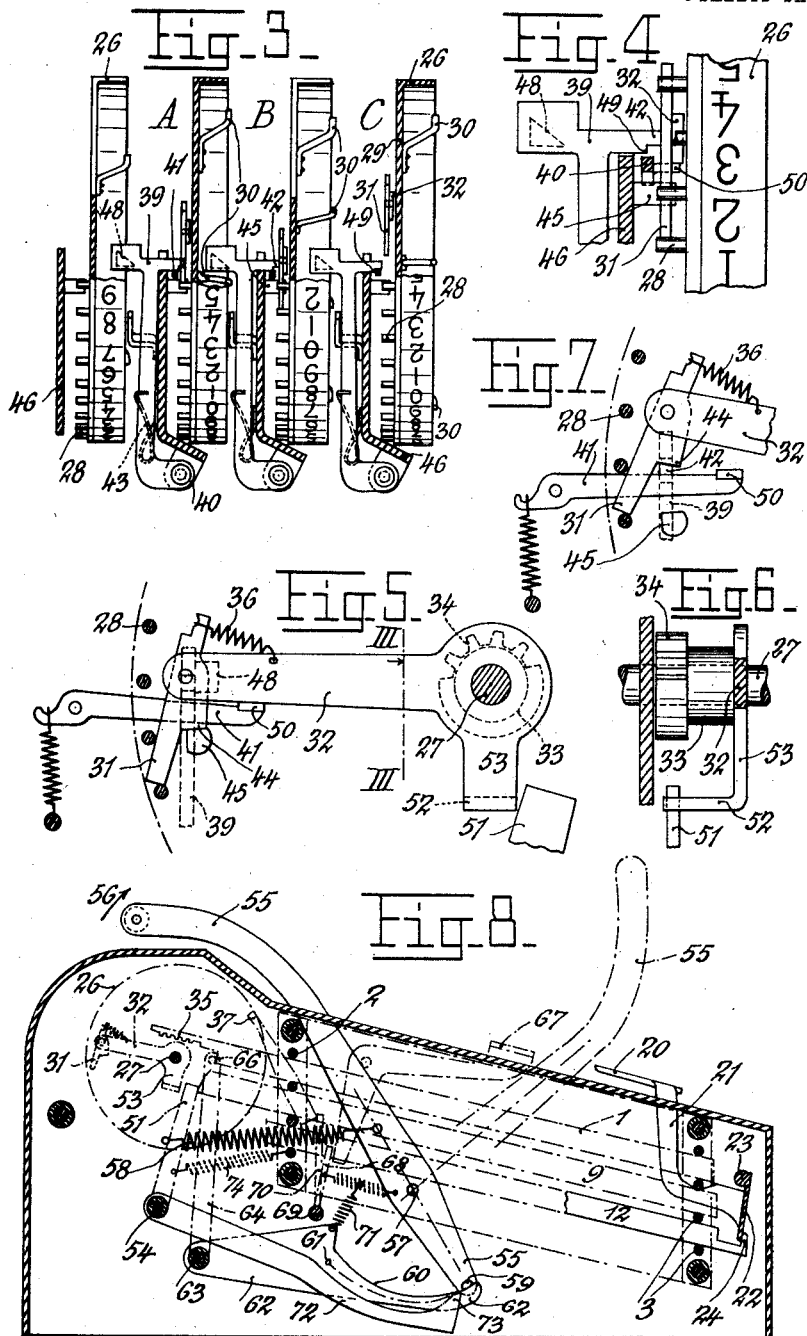


A. T. MOE.
CALCULATING MACHINE.
APPLICATION FILED MAY 17, 1910.

1,011,073.

Patented Dec. 5, 1911.

3 SHEETS—SHEET 2.



Witnesses
John H. Hennigan
John H. Hennigan

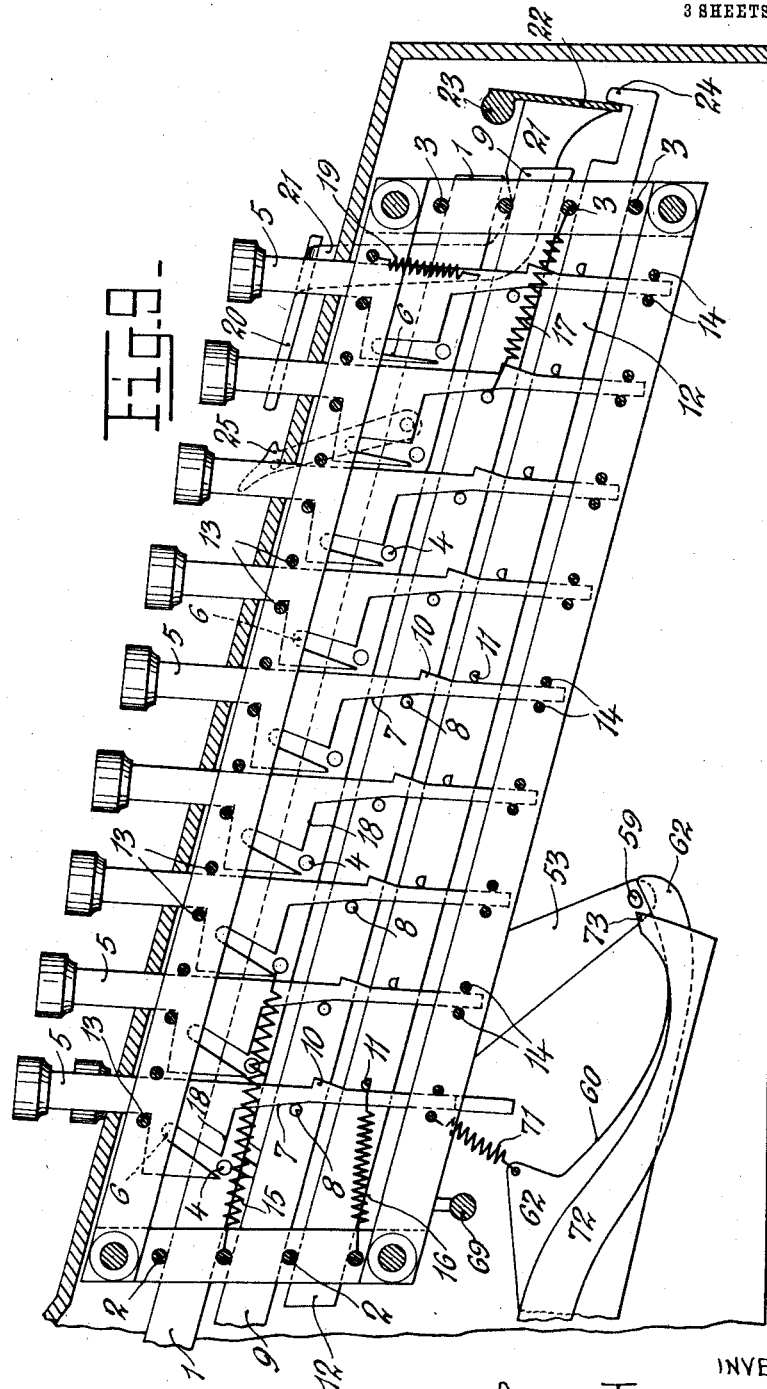
Inventor,
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by *Howard Desautel*
Attorney

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3 SHEETS—SHEET 3.



WITNESSES:

J. H. Benigan.
John A. Harding.

INVENTOR,
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UNITED STATES PATENT OFFICE.

ADOLF THORVALD MOE, OF CHRISTIANIA, NORWAY.

CALCULATING-MACHINE.

1,011,073.

Specification of Letters Patent.

Patented Dec. 5, 1911.

Application filed May 17, 1910. Serial No. 561,839.

To all whom it may concern:

Be it known that I, ADOLF THORVALD MOE, mechanician, citizen of the Kingdom of Norway, residing at Maridalsveien 6, Christiania, Norway, have invented a new and useful Improvement in Calculating-Machines; and I do hereby declare the following to be a full, clear, and exact description of the same.

My present invention has for its object to provide a calculating machine, in which the digit keys may affect the adding mechanism at simultaneous depression.

The invention is illustrated in the accompanying drawings, in which:—

Figure 1 is a part of a vertical longitudinal section on the line I—I in Fig. 2. Fig. 2 is a corresponding plan view, partly in section. Fig. 3 shows a part of the adding mechanism seen from the rear and representing essentially a section on the line II—II in Fig. 1. Figs. 4 and 5 are respectively a rear view and a side view of a mechanism controlling the carrying and shown in one position. Fig. 6 is a cross section on the line III—III in Fig. 5. Fig. 7 shows the said controlling mechanism in another position, the said Figs. 4–7 being drawn to a larger scale. Fig. 8 is a longitudinal section of the machine on the line IV—IV in Fig. 2 and showing to a smaller scale the several main mechanisms of the machine. Fig. 9 is a longitudinal section through the key bank of the machine.

I first shall describe the key bank shown in Fig. 9. Each adding or total wheel 26 is fed forward by a rack 35 connected with a bar or rail 1 extending forwardly side by side of its appertaining key row. The bar 1 is movable longitudinally between guiding pins 2 and 3 and is provided with nine pins 4. Correspondingly to each of these pins is a key 5, and these keys are in turn provided with inclined slots 6 for each pin 4. When therefore a key is depressed, the slot forces its pin 4 and consequently the whole bar 1 to the right through a distance corresponding to the degree of inclination of the key slot 6. As all keys of the same row have slots of different degree of inclination, the latter being least for the “1”-key and increasing uniformly stepwise until the “9”-key, the bar 1 is moved to the right

just a distance corresponding to the digit, which the depressed key represents. Each key, moreover, is provided with an inclined face 7, which through the medium of pins 8 moves to the left a bar 9 which adjusts the mechanism effecting the carrying. Finally each key has a hook 10, which when the key is depressed, projects beneath a pin 11 fixed on a movable bar 12. The keys are guided by pins 13 and 14 and are pulled upward by springs 19. Springs 15 and 16 tend to pull the bars 1 to 12 respectively to the left, and a spring 17 tends to hold the bar 9 toward the right. When a key 5 is depressed, its slot 6 forces the pin 4 in question a corresponding distance to the right oppositely the action of the spring 15, whereby the other pins 4 of the same row move beneath noses 18 provided on the respective keys, whereby the latter are barred and cannot be depressed. At the same time the carrying adjustment key 9 is moved to the left opposing the action of the spring 17 and the nose 10 of the key passes beneath the pin 11, the latter then instantly snaps back under the influence of the spring 16. The depressed key now is locked in its depressed position and at the same time the other keys of the same row are barred. As soon as the operator has assured himself of the correct keys having been depressed, he releases all the bars 12, whereby the depressed keys snap up again, and at the same time the springs 15 pull the bars 1 back and thereby feed forward the total wheels through the medium of a mechanism hereinafter described. The simultaneous releasing of all the bars 12 is effected by the depression of a special key 20 connected by the arm 21 with a cross plate 22 located at the front end of the machine. Said plate is pivoted at 23 and its edge projects behind noses 24 on the forward ends of the bars 12, so that all the bars 12 are moved oppositely the spring action to the right and release the depressed keys. If the machine is to be used for multiplication, the locking bars 12 preferably are placed out of action. This latter is effected by depressing the key 20 and locking the same in depressed position by turning up the hook or catch 25.

Now I shall describe the adding mechanism, which forms the most important part

of the invention and is shown in the Figs. 1 to 7. The adding or total wheels 26 are turnable on a common fixed cross shaft 27 and are in well known manner provided with a definite number (for instance 40) of pins 28. The four arms 29 of each total wheel has each a projection or finger 30. The pins 28 are arranged in a circle and acted upon from inside by pawl 31 turnable on the end of an arm 32. The pawl 31 is by a spring 36 pulled into engagement with the pins 28. The arms 32 are likewise loose upon the shaft 27 and connected with a hub 33 (Fig. 6) carrying a row of teeth 34 engaged by a rack 35 formed on the left end of the bar 1 appertaining to the total wheel 26 in question. At the front side of each total wheel 26 a detent 37 engages the pins 28 from the outside. Said detent turns on one of the guide pins 2 and is by a spring 38 pulled into engagement with the pins 28 (Figs. 1 and 2). It now is seen, that when a key 5 is depressed and the bar 1 with rack 35 in question is moved to the right, the rack turns its arm 32 upward in clockwise direction. During this movement the pawl 31 snaps over a number of pins 28 corresponding to the value or digit of the depressed key 5, the total wheel 26 being held fast by its detent 37. When then the key 5 is released and snaps up, the spring 15 pulls back the bar 1 to the left, whereby the arm 32 is turned back to its resting position. During this movement the pawl 31 takes with it the wheel 26 through the predetermined number of steps, while pins 28 snap forward beneath the detent 37.

The proper mechanism effecting the carrying consists for each total wheel in a carrying pawl 39 (Figs. 1 and 3) pivoted at 40 and turning crosswise of the machine, and further a spring-acted controlling pawl 41 cooperating with the carrying pawl. The carrying pawl 39 has a lateral tooth 42 (Fig. 4), which by the pawl spring 43 (Fig. 3) tends to move in the direction toward the wheel 26 in such a manner, that the tooth 42 is beneath an offset 44 (Figs. 5 and 7) formed on the feeding pawl 31. The parts now take up the normal position shown in Fig. 1 and at A in Fig. 3. When now the pawl 39 is moved laterally away from the wheel 26, so that the tooth 42 releases the offset 44 of the feeding pawl 31, the spring 15 (Fig. 9) through the parts 1, 35, 34, 32, 31 and 28 feeds forward the total wheel 26 one extra step until the offset 44 of the pawl 31 stops against a fixed projection 45 attached to the plate 46 carrying the carrying pawl 39. The parts then take up the position shown in Fig. 5 and at B in Fig. 3. This releasing of the pawl 39 now takes place by the turning of the next lower total wheel just the instant, in which the latter wheel turns from the step position in which the digit "9" is

seen through the opening 47 (Fig. 1), to the next step position, in which the digit "0" is seen through said opening. During the movement between these two positions one finger 30 of the wheel 26 will meet and slide past an upwardly inclined projection 48 formed at the side of the carrying pawl 39. Thus as soon as one of the total wheels 26 passes from "9" to "0" the carrying pawl 39 of the next higher total wheel is released. The latter pawl is caught in released position by the controlling pawl 41, which by the action of its spring snaps up at the side of the offset 49 of the carrying pawl, whereby the parts take up the position shown at C in Fig. 3. If now the pawl 31 still effects its normal feeding movement downwardly and thus has not yet (as shown at C in Fig. 3) come to its resting position the pawl 39 is temporarily held in released position, and when the pawl 31 the next instant reaches its resting position, it simply will continue past the tooth 42, until it arrives to the position of Fig. 5 in which the total wheel in question has been moved forward one extra step. During the last part of the extra-step movement (carrying movement) the arm 32 meets a side nose 50 of the controlling pawl 41, which is hereby released from the offset 49, and the pawl 39 acted upon by its spring 43 now snaps forward in close engagement with the side face of the feeding pawl 31 as shown in Fig. 4. When the depressed keys 5 have been released, therefore some of the feeding arms 32 take up their resting position (Fig. 1) and the others have been fed forward an extra step so as to take up the position of Fig. 5. However, in order that the described carrying mechanism, when a key 5 then is depressed, may again be able to effect eventual carrying, necessarily all of the feeding arms 32 not appertaining to the said key and taking up the extra position of Fig. 5, must be turned up into resting position, before the key 5 is locked by the pin 11, because the arms 32 only in the resting position can receive and effect the carrying. This adjustment of the arms 32 is effected by the bar 9, which by the depression of any key 5 of its row is moved to the left by means of the inclined face 7. The bar 9 transmits its movement to an arm 51 (Figs. 1, 5 and 6) and through the latter to a nose 52 on an arm 53 integral with the arm 32. The movement of the bar 9 is so sized, that it imparts to its arm 32 just an upward turning corresponding to one step, so that the arm goes up into resting position. But as the arm 51 is rigidly fixed on a shaft 54 together with similar arms 51, one for each of the other feeding arms 32, the movement from a single bar 9 (and thus from a single key 5) is transmitted through these arms 51 simultaneously to all the other feeding

arms 32 taking up the extra position of Fig. 5. By this movement of the arms 32 up to resting position a small space is formed at the left hand side of each pin 4 between the same and the active wall of the slot 6 (see Figs. 1 and 9). On the other hand, when all keys 5 are in released (uppermost) position, there must be present such a space between the noses 53 and the arms 51, that the feeding arms 32 are free to move down to the position of Fig. 5, when a carrying shall be effected.

In order to better understand the carrying mechanism, I shall now describe its complete operation by way of an example. If through the opening 47 is seen for instance the number 957 and if to this number for instance the number 245 shall be added, then I depress simultaneously or successively the "5"-key in the units row, the "4"-key in the tens-row and the "2"-key in the hundreds-row. All the depressed keys are locked by the pins 11 and at the same time the other keys in the operated rows are barred. The feeding arms 32 acted upon from the three depressed keys are turned upward respectively 5, 4 and 2 steps from their resting position. The other feeding arms 32 are brought up to resting position ready for receiving eventual carrying, their carrying pawl teeth 42 projecting beneath the offsets 44 on the pawls 31. When now the key 20 is operated and the depressed keys 5 are thereby released, their feeding arms 32 simultaneously are turned down toward resting position. Presuming first that all feeding arms 32 move downward with the same angular velocity, the hundreds-arm 32 first is turned 2 steps, whereby the hundreds-wheel 26 passes from "9" to "1." One finger 30 of the said wheel therefore slides over the inclined nose 48 of the thousands-pawl 39, which is released and the feeding arm 32 of the thousands-wheel receives the carrying, *i. e.* the wheel turns one step and adjusts the digit "1" in the opening 47. Also the hundreds wheel is turned from "9" two steps and presents the digit "1" in the opening. Then the tens-arm 32 arrives to resting position, and the tens-wheel presents the digit $5+4="9"$ in the opening 47. Finally the units-arm 32 completes its movement, whereby the units-wheel is fed forward 5 steps from "7" to "2." However, when the wheel during this movement passes from "9" to "0," one of its fingers 30 releases the carrying pawl 39 of the tens-wheel the latter thereby being turned one extra step from "9" to "0," but during this latter movement one finger 30 of the tens-wheel in turn releases the carrying pawl 39 of the hundreds-wheel, so that this wheel also is turned one extra step from "1" to "2." The adding now is completed and the number 1202 ($957+245$) is seen in

the opening. However, if for instance the units feeding arm 32 moves so quickly to resting position, that it during the passage of its wheel from "9" to "0" releases the carrying pawl 39 of the tens-wheel, before the tens-feeding-arm has arrived the resting position, the tens-carrying-pawl 39 is temporarily held in released position by its controlling pawl 41, which snaps up at the side of the offset 49. When then the tens-arm 32 arrives at resting position, it continues directly to the extra position (Fig. 5), *i. e.* it receives the carrying and finally releases also its controlling pawl 41 (Figs. 4 and 3, B).

From the above is understood, that the carrying always must be correctly translated independently of the mutual positions and the moving velocities of the feeding arms 32.

Finally I shall describe the action of the zero-adjustment mechanism. The same is shown in Figs. 1, 2, 8 and 9. The zero-adjustment is effected by turning the arm 55 in the direction of the arrow 56. By this turning, which takes place about the pin 57 against the action of the spring 58, the pin 59 of the arm 55 slides along the curved path or edge 60 of the arm 62 to the point 61, whereby the said arm 62 is moved together with the shaft 63 and all arms 64 attached thereto. The pins 65 (Figs. 1 and 2) of the arms 64 strike offsets 66 on the rack bars 1, so that the feeding arms 32 are turned up through ten steps. The detents 37, however, would prevent a backward movement of the total wheels. Therefore these detents must be released, before the arm 55 is turned. This releasing is effected by depression of the key 67 (Fig. 8), whereby the arm 68 on the shaft 69 turns all arms 70 toward the counter arms of the pawls 37 and releases the pawls 37. By the turning of the arm 55 therefore all feeding arms 32 take with them their wheels 26 by the friction of the pawls 31 against the pins 28. However, as soon as one of the fingers 30 of the several wheels 26 meets the under face of the inclined nose 48 of the carrying pawl 39, each wheel is stopped in zero-position. When the arm 55 is turned to the dotted position, the key 67 is released and the parts 55, 62 and 64 are pulled back into normal position by the springs 58 and 71. As the arm 55 must be barred, when one of the keys 5 is in depressed position, the shaft 54, which always from the bar 9 in question through its arm 51 is turned by the depression of a key, is provided with a lateral arm 72, the end portion 73 of which moves up behind the pin 59 of the arm 55 as shown in Fig. 9, so that the arm 55 is barred, as long as one or more keys 5 are depressed, but is released (Fig. 8), when all keys are in uppermost position.

Instead of arranging one spring 17 for

each bar 9, one of the arms 51 may be acted upon by a single spring 74 as shown in Fig. 1.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In calculating machines, the combination of means as keys to be depressed or operated in accordance with the number to be added, feeding-pawls, means connecting the keys with said pawls so as to adjust the same according to the value of the depressed keys, total-wheels, fed forward by the feeding pawls during their return movement to resting position, carrying pawls arranged so as to normally stop the feeding pawls or their connections in resting position, releasing projections or fingers attached to each total wheel so as to release the carrying pawl of the next higher neighboring wheel and cause the same to move one extra step forward during the passage of the said total wheel from "9" to "0" and a mechanism arranged between each key and all feeding-pawls or their connections, said mechanism being so constructed, that it by the depression of a key in any one of the key rows moves all the feeding-pawls of the other rows which have received a previous carrying movement up into resting position ready for receiving a new carrying.

2. In calculating machines, the combination of keys to be depressed or operated in accordance with the number to be added, feeding-pawls, means connecting the keys with said pawls so as to adjust the same according to the value of the depressed keys, total-wheels, fed forward by the feeding-pawls arranged so as to normally stop the feeding pawls or their connection in resting position, releasing projections or fingers attached to each total-wheel so as to release the carrying pawl of the next higher neighboring wheel and cause the same to move one extra step forward during the passage of the said total-wheel from "9" to "0", a controlling pawl arranged for each carrying pawl and taking up such a position, that it catches the carrying pawl, when the latter is released and is then itself released by the feeding-pawl or its arm at the end of the carrying movement of the last-mentioned parts, and a mechanism arranged between each key and all feeding pawls or their connections, said mechanism being so constructed, that it by the depression of a key in any one of the key rows moves all the feeding-pawls of the other rows which have received a previous carrying movement up into resting position ready for receiving a new carrying.

3. In a calculating machine, the combination of a plurality of keys pivoted arms operatively connected with the keys and having feeding pawls each carrying a special

offset, total-wheels fed forward by the pawls during their return movement into resting position and arranged on the shaft of the pivoted arms, carrying pawls normally snapping in beneath the said offsets to stop the feeding pawls in resting position, releasing projections attached to each total wheel so as to release the carrying pawl of the next higher neighboring wheel for enabling the same to take one extra step (carrying movement) fixed projections (45) stopping the offset and the feeding pawl at the completion of the carrying movement, and a mechanism so arranged between each key and all feeding-pawls, that by the depression of a key in any one of the key rows all the feeding-pawls of the other rows which have received a previous carrying movement are moved up into resting position.

4. In a calculating machine, the combination of a number of keys, turnable arms operatively connected with the keys and having feeding pawls, each carrying a special offset, total-wheels fed forward by the pawls during their return movement into resting position and arranged on the shaft of the turnable arms, a carrying pawl, an offset (49) on the carrying pawl, a controlling pawl (41) cooperating with said offset (49) to hold the carrying pawl in released position, inclined noses attached to each carrying pawl and cooperating with releasing projections attached to each total wheel so as to release the carrying pawl of the next higher neighboring wheel for enabling the same to take one extra step (carrying movement), fixed projections stopping the special offset (44) and the feeding pawl at the completion of the carrying movement, and a mechanism so arranged between each key and all feeding pawls that by the depression of a key in any one of the key rows all the feeding pawls of the other rows which have received a previous carrying movement are moved up into resting position.

5. In calculating machines, the combination of a number of keys, feeding pawls, operatively connected with the keys total wheels, fed forward by the feeding pawls during their return movement to resting position, carrying pawls normally stopping the feeding pawls in resting position, releasing projections attached to each total wheel so as to release the carrying pawl of the next higher neighboring wheel for enabling the same to take one extra step (carrying movement) a controlling pawl (41) having a lateral projection (50) and catching the released carrying pawl and being then released by its projection (50) being moved by the feeding arm (32) at the end of the carrying movement of the arm, and a mechanism so arranged between each key and all feeding pawls, that by the depression of a key in any one of the key rows all the feed-

ing pawls of the other rows which have received a previous carrying movement are moved up into resting position.

6. In calculating machines, the combination of a number of keys, feeding pawls, operatively connected with the keys, total wheels, fed forward by the feeding pawls during their return movement to resting position, carrying pawls normally stopping the feeding pawls in resting position, releasing projections attached to each total wheel so as to release the carrying pawl of the next higher neighboring wheel for enabling the same to take one extra step (carrying movement), a bar common to all keys of the same row, inclined faces (7) on each key for moving said bar longitudinally, pivoted arms (51) rigidly attached together for translating movement from the corresponding bar to all feeding pawl arms, so that a key by its depression imparts to all the feeding arms of the rows (in which carrying movement has taken place) a movement of one step up into resting position.

7. In calculating machines, the combination of a number of keys, feeding pawls, operatively connected with the keys, total-wheels fed forward by the feeding pawls during their return movement to resting position, carrying pawls normally stopping the feeding pawls in resting position, releasing projections attached to each total wheel so as to release the carrying pawl of the next higher neighboring wheel for enabling the same to take one extra step (carrying movement) pivoted arms (64) (coacting with one part (1) of the members connecting each key with its feeding pawl, a handle, a lateral arm (62) connected with all arms (64) and receiving through the handle a movement to carry all feeding arms back through ten steps whereby the total wheels stop in the zero position by their releasing projections (48) provided on each carrying pawl (39).

8. In a calculating machine, the combination of keys arranged in rows, feeding pawl arms, total wheels, a part (1) operatively connecting each key with its feeding pawl arm, an inclined face on each key, a bar (9) common to all keys in a row and acted upon by the inclined face, when one key is depressed, rigidly interconnected arms (51) receiving movement from the bars, a side arm (72) attached to the arms (51), pivoted arms (64) acting on the said part (1), a lateral arm (62) connected with all arms (64) and provided with a curved portion (60), a pivoted zero adjustment arm (55) having a pin acting on said portion so as to turn the lateral arm (62) and all arms (64)

for zeroizing the machine, the arm (72) barring the said pin and its arm (55) thereby preventing such zeroizing, when any one of the keys is in depressed position.

9. In a calculating machine, the combination of total wheels, keys arranged in rows each containing nine keys, a longitudinally movable bar (1) common to all keys of one row and transmitting their movement to the total wheels, nine pins (4) attached to each bar, inclined planes (6) being arranged on the keys and acting on the pins, said planes having different degree of inclination for the several keys and a nose attached to each key and barred by its corresponding pin (4), when any other key in the same row is depressed.

10. In a calculating machine, the combination of total wheels, keys arranged in rows each containing nine keys, a side nose (10) on each key, spring-actuated projections (11) releasably locking the keys in their depressed position, a longitudinally movable bar (1) common to all keys of one row and transmitting their movement to the total wheels, nine pins (4) attached to each bar, inclined planes (6) being arranged on the keys and acting on the pins, said planes having different degrees of inclination for the several keys, and a nose (18) attached to each key, and barred by its corresponding pin (4) when any other key in the same row is depressed.

11. In a calculating machine, the combination of total wheels, keys arranged in rows each containing nine keys, a side nose (10) on each key, spring actuated bars each having nine projections (11) releasably locking the keys of one row in depressed position, a key-operated pivoted cross plate (22) projecting behind noses of all bars for releasing all depressed keys at a time, a longitudinally movable bar (1) common to all keys of one row and transmitting their movement to the total wheels, nine pins (4) attached to each bar, inclined planes (6) being arranged on the keys and acting on the pins, said planes having different degree of inclination for the several keys and noses (18) attached to each key and barred by its corresponding pin (4), when any other key in the same row is depressed.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

ADOLF THORVALD MOE.

Witnesses:

AXEL LAHN,
MOGENS FRAAS BUGGE.