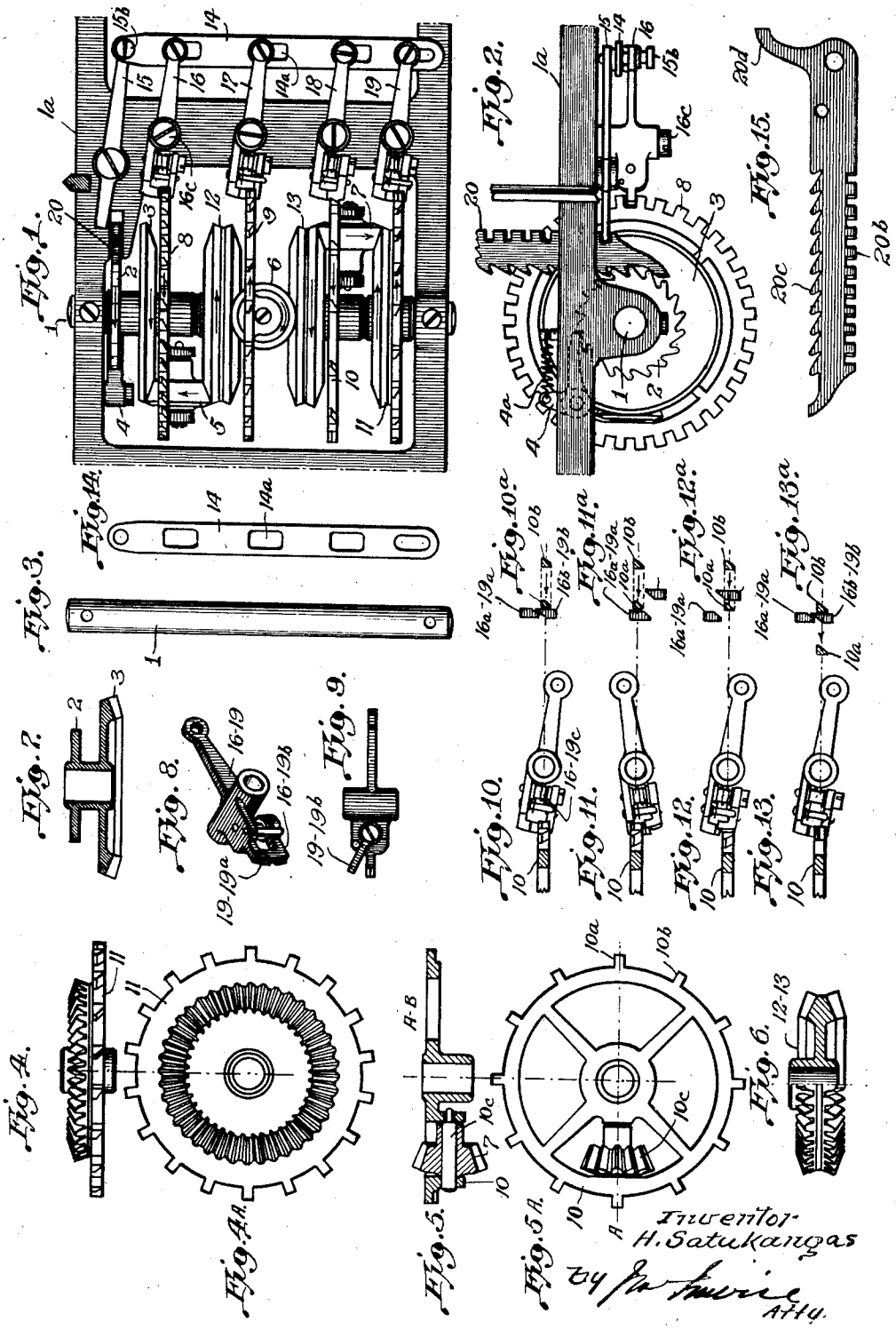
June 2, 1936. H. SATUKANGAS 2,042,909

NAUGHT MECHANISM FOR USE IN TEN KEY ADDING MACHINES

Filed Feb. 14, 1933 3 Sheets-Sheet 1



June 2, 1936. H. SATUKANGAS 2,042,909

NAUGHT MECHANISM FOR USE IN TEN KEY ADDING MACHINES

Filed Feb. 14, 1933 3 Sheets-Sheet 2

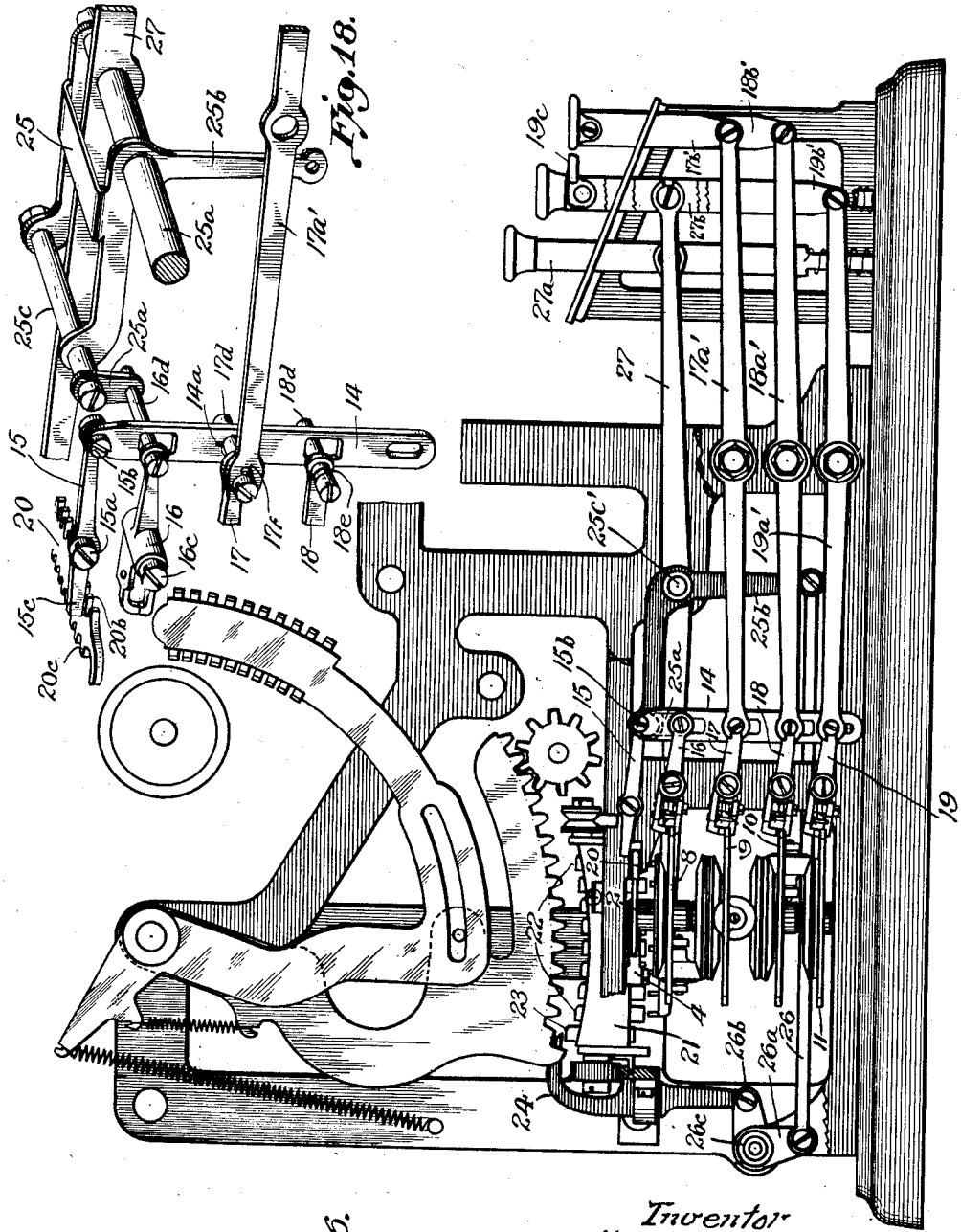


Fig. 16.

Inventor
H. Satukangas
by [illegible] Atty.

June 2, 1936. H. SATUKANGAS 2,042,909

NAUGHT MECHANISM FOR USE IN TEN KEY ADDING MACHINES

Filed Feb. 14, 1933 3 Sheets-Sheet 3

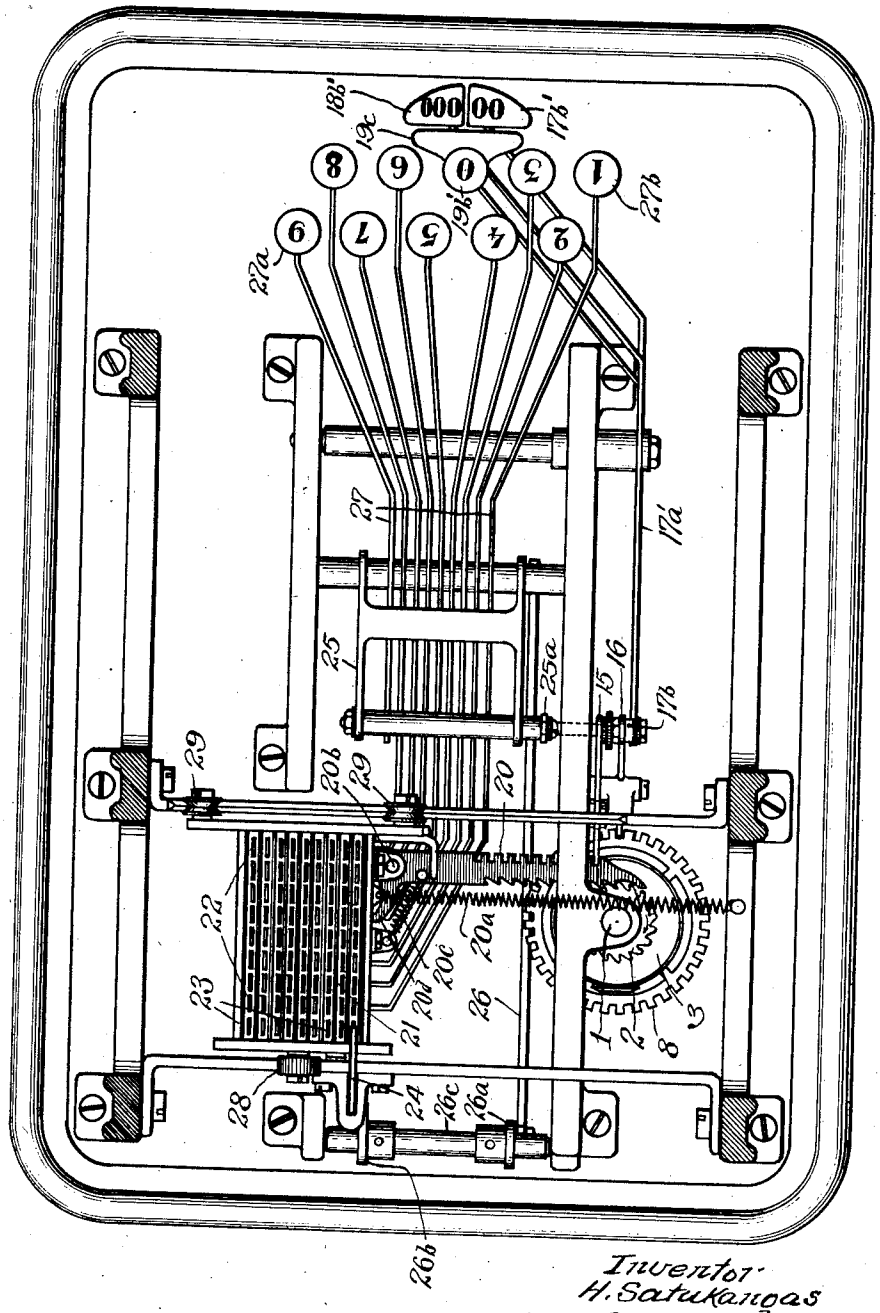


Fig. 12.

Inventor
H. Satukangas
By [illegible]
Atty.

Patented June 2, 1936 2,042,909

UNITED STATES PATENT OFFICE

2,042,909

NAUGHT MECHANISM FOR USE IN TEN KEY ADDING MACHINES

Hannes Satukangas, Pitajanmaki, Finland, assignor to Hannes Aarni, Lahti, Finland, and Johannes Heikki Kemila, Helsinki, Finland

Application February 14, 1933, Serial No. 656,735
In Finland January 25, 1933

12 Claims. (Cl. 235—60)

This invention is directed to an improvement in ten key adding machines wherein, through an improved key control of the mechanism, a material saving of time and labor in the ordinary use of the machine is effected.

In the usual ten key adding machine, particularly in setting up a number requiring a series of naughts, it has been necessary to utilize the naught keys as operatively independent in the control of the setting up mechanism, thus requiring the time and labor of operating the machine through the depression of a digit key, followed by subsequent depressions of the naught key for successively setting up the naughts for printing.

The primary object of the present invention is to provide for the simultaneous operation of the desired digit key and the required number of naught key or keys simultaneously with the utilization of such key operation as a means for compelling a proper setting up of the digit followed by the required number of naughts when the keys are released.

A further object of the invention is the provision of naught keys directed for independently controlling the setting up of a single naught, two naughts, three naughts, and so on, to the desired limit, each of the naught keys or any two or more of them being simultaneously operated with a required digit key to control the setting up mechanism in accordance with the digit key and number of naughts indicated on the selected naught key or keys.

A further object of the invention is the provision of means whereby the operation of the digit key or selected naught key or keys sets the mechanism to permit a subsequent automatic setting up, with the initial operation of any of the selected keys locking the setting up mechanism against operation until all the operated keys have been released, whereby the selected digit and naught or naughts will appear in proper sequence in the setting up operation regardless of the order in which the digit key and naught key or keys are depressed, provided that any operated key is maintained in operated position until the setting up has been completed.

For the purpose of fully explaning my invention the same will now be described in the way of example as applied to and inserted in an adding machine of the well known "Dalton" type.

In the accompanying drawings:

Fig. 1 is a side view of the essential portion of my device,

Fig. 2 is a top plan view of the same,

Fig. 3 illustrates the shaft upon which the ratchets and bevel gears shown in Figs. 1 and 2 are journalled,

Fig. 4 shows the wheel **11** the top portion of which is shaped to form a bevel gear while its lower portion is shaped to form a ratchet, in a side view,

Fig. 4A is a top plan view of the wheel **11**,

Fig. 5 is a sectional view of the wheel **10** along the line A—B in Fig. 5A,

Fig. 5A is a top plan view of the bevel gear **10** and the second bevel gear **10***c* journalled therein.

Fig. 6 shows a double bevel gear **12** (or **13**), the left half being a side view and the right half a sectional view of the same,

Fig. 7 is a sectional view of the ratchet **2** and the bevel gear **3** both being shaped from the same block,

Fig. 8 is a perspective view of the pawl **16—19**,

Fig. 9 is a plan view of the same pawl, from below,

Figs. 10 and 10*a* are respectively elevations and transverse sections through a ratchet controlling pawl in one position.

Figs. 11 and 11*a* are respectively elevations and transverse sections of the pawl in the second operating position.

Figs. 12 and 12*a* are respectively elevations and transverse sections of the pawl in the third position.

Figs. 13 and 13*a* are respectively elevations and transverse sections of the pawl in the fourth position.

Fig. 14 shows a bar forming part of the safety locking device that makes it certain that the digit will always appear in front of the naught or naughts,

Fig. 15 shows the rack connecting the naught mechanism of my invention with the pin carriage.

Fig. 16 is a sectional side view showing certain interior parts of the adding machine with the naught mechanism according to my invention mounted therein, such portions that are not required for this description being omitted.

Fig. 17 is a top view of the interior of the same adding machine.

Fig. 18 is a perspective view showing the connection between the pin-carriage rack and certain parts of the mechanism.

On the shaft **1** (Figs. 1, 2 and 3) ratchet **2** hereinafter termed the main ratchet is journalled. The teeth of this ratchet **2** are bevelled and mesh with the rack **20** (Figs. 1 and 2). The ratchet **2**

and the bevel gear 3 form one single block (see Fig. 7). Below the bevel gear 3 there is journalled on the shaft 1 a ratchet 8, below this a double bevel gear 12, then a ratchet 9, a double bevel gear 13, a ratchet 10 and lastly a wheel 11, the top portion of which is shaped to form a bevel gear while its lower portion to form a ratchet.

The bevel gears 3 and 12 mesh with the bevel gear 5 mounted between them in the ratchet 8. In the same manner the double bevel gears 12 and 13 mesh with the bevel gear 6 and the bevel gears 13 and 11 mesh with the bevel gear 7. The number of teeth of the bevel gears is fixed solely according to the size of the teeth that is considered appropriate in each instance. The bevel gears 3, 12, 13 and 11 should have the same number of teeth this number being in the example shown 40. The bevel gears 5, 6 and 7 should likewise have the same number of teeth the number of which in the drawings is 15.

The pin carriage under the influence of the spring 20a tends, when free to move, to travel from the position shown in Figure 17 toward the left as viewed from the front of the machine, but the cooperation of the rack 20 and ratchet 2 determines a step by step movement of the pin carriage for setting up purposes, so that obviously the number of steps imparted to the pin carriage may be controlled by governing the cooperative movement of the rack 20 and ratchet 2.

The object of the escapement device is to allow the pin carriage to move the desired number of steps. By a step the space between two consecutive rows of pins in the pin carriage is meant, this being equal to the pitch of the rack and the same as the pitch of the ratchet 2. Thus, if it is desired to record simultaneously a digit and four naughts, the escapement device is to be adjusted so that it releases the ratchet 2 by five teeth, whereby the rack and the pin carriage attached to the same will likewise move five steps.

As explained above the spring 20a draws the pin carriage to the left (Fig. 17), but the rack 20 attached to the pin carriage 21 meshes with the ratchet 2 (Figs. 17 and 2) and tends thus to rotate the ratchet 2 in the direction shown by the arrow in Fig. 1. This rotation and thus the movement of the pin carriage is, however, prevented by the pawls 16, 17, 18, and 19 (Fig. 1) engaging the ratchets 8, 9, 10, and 11, because, as they prevent the ratchets 8, 9, 10, and 11 from turning, the ratchet 2 will not be able to turn.

The ratchet 2 has in these drawings been shown with 18 teeth (Fig. 2) and when this ratchet rotates by one tooth the pin carriage will move one step to the left. The ratchet 8 has 36 teeth. When now the pawl 16 is actuated as will be more accurately described in the following, the ratchet 8 will rotate by one tooth. In the ratchet 8 the shaft of the bevel gear 5 is journalled. This shaft turns together with the ratchet 8 by an angle comprising 1/36th of the circle circumference or by 10°. The bevel gear 5 meshes both with the bevel gear 12 below and with the bevel gear 3 above. If the bevel gear 5 had not meshed with the bevel gears 12 and 3, it would have been moved without rotating a space corresponding to 1/36th of the circumference of the bevel gears 12 and 3. As, however, the bevel gear 5 meshes with the bevel gear 12, but the pawls 17, 18 and 19 (that have not been released) prevent the bevel gears 11, 7, 13, 6 and 12 from rotation (Fig. 1), the bevel gear 5 is compelled to roll on the bevel gear 12. As also the bevel gear 3 meshes with the bevel gear 5, the bevel gear 3 will be rotated by a space corresponding to both the turning movement of the bevel gear 5 by 1/36th of the circumference or 10° and to the rolling movement of bevel gear 5 on the bevel gear 12 that likewise corresponds to 1/36th of the circumference or 10°, so that the bevel gear 3 will rotate by 2/36th of the circumference or by 20°. As seen in Fig. 7 the ratchet 2 forms one single block with the bevel gear 3 and will thus likewise rotate by 2/36th or 1/18th of its circumference, i. e. by one tooth and thus allow the pin carriage to move one step.

The ratchet 9 has 18 teeth. If now the pawl 17 is released, while the pawls 16, 18 and 19 are in holding positions, and the ratchet 9 is allowed to rotate by 1/18th of its circumference, the shaft of the bevel gear 6 will turn by 1/18th of the circumference relatively to the bevel gear 13 and in addition thereto roll upon the latter likewise by 1/18th on the circumference or in all by 2/18ths of the circumference, which movement is transferred to the bevel gear 12 in the same manner as the movement of the bevel gear 5 was transferred to the bevel gear 3. The bevel gear 5 will again transfer this movement to the bevel gear 3 and the number of teeth being the same on the bevel gears 13, 12 and 3, the bevel gear 3 will rotate just as much as the bevel gear 12 or by 2/18ths of its circumference. Here the ratchet 2 will rotate by 2/18ths of its circumference or by two teeth and allow the pin carriage to move two steps.

The ratchet 10 has 12 teeth. On releasing the pawl 18 while the pawls 16, 17 and 19 are closed, the bevel gear 13 will rotate and by the aid of the bevel gears 6, 12, 5 also the bevel gear 3 will rotate by 2/12ths or 6/36ths or 3/18ths of the circumference corresponding to three teeth of the ratchet 2 so that the pin carriage will move three steps to the left.

If it is desired to add a further ratchet that would release the pin carriage by six steps, a ratchet having six teeth together with its corresponding bevel gears should be mounted on the shaft 1 so that the bevel gear 3 and the ratchet 2 would rotate by 2/6ths or 6/18ths of the circumference or by 6 teeth causing the pin carriage to move six steps.

The ratchet 11 has 18 teeth. On releasing the pawl 19 while the pawls 16, 17 and 18 are closed, the ratchet 11 will rotate by 1/18th of its circumference. As seen in Fig. 4 the ratchet 11 forms one block with the bevel gear 11. The bevel gear 7 will thus rotate in the direction of the arrow shown thereon in Fig. 1, but the shaft of the bevel gear 7 will not be turned, because the pawl 18 prevents the ratchet 10 and thus the shaft of the bevel gear 7 from moving. The movement of the ratchet-bevel gear 11 is transferred by the aid of the bevel gears 7, 13, 6, 12, 5 to the bevel gear 3 and the ratchet 2 without any ratio of gearing and the latter will rotate by 1/18th of its circumference or by one tooth corresponding to one step of the pin carriage.

The specified number of teeth on the respective ratchets, as above outlined, are to be understood as setting forth merely an operative example, as the number of teeth on the respective ratchets may be varied from that above stated so long as the ratio of the number of teeth on any one ratchet in relation to the number of teeth on the other ratchets corresponds specifi-

cally to the relative number of teeth on the ratchets in the above example.

In the practical use of adding machines generally six naughts will be sufficient and this is obtained with additional naught keys for two and three naughts. As, however, three naughts may be obtained by depressing simultaneously the keys for one and two naughts, it may be more desirable to provide the machine with a four naughts key in which case the machine may record any number of naughts up to seven naughts. This change is made by cutting only 9 teeth instead of 12 as above into the ratchet 10 (Figs. 1 and 16).

If a still larger number of naughts is desired, it would be advisable to add an additional naught key for eight naughts, in which case the machine may register simultaneously any number of naughts up to fifteen. In this case the above-mentioned number of teeth should be changed as follows: Ratchet 2—12 teeth, ratchet 8—24 teeth (for digit keys 1 to 9), ratchet 9—12 teeth (for two naughts), ratchet 10—6 teeth (for four naughts) the new ratchet 3 teeth (for eight naughts) and ratchet 11—12 teeth (for one naught). This is mentioned only as an example as to how the number of naughts obtained with each key and the number of teeth of the ratchets may be changed to suit various purposes.

It has been described above how the release of one tooth of the various ratchets always causes a predetermined rotation of the ratchet 2 and in consequence a movement of the pin carriage by the corresponding number of steps. The construction of the escapement device is such that two or more pawls 16, 17, 18, 19 may be released simultaneously, in which case the corresponding ratchets 8, 9, 10, 11 will rotate simultaneously and actuate the ratchet 2 that will then rotate as many teeth as corresponds to the added influence of all the released ratchets, so that on releasing, for instance, all four ratchets, the pin carriage will move seven steps and register six naughts in addition to the digit depressed, for instance the figure 3,000,000.

The ratchet 8 will step the pin carriage on registering the digits 1 to 9. The digit key levers, which are all shown in Figure 17 and only one in Figure 18, are all pivotally supported by the shaft 25a', Figure 18. On the same shaft 25a' is likewise pivotally arranged a support 25 to which there is attached a rod 25c, Figure 18, that reaches over all digit key levers 27. To the end of the rod 25c there is pivotally attached a crank 25a. To the pawl 16 there is attached a rod 16d, and the other end of this rod 16d is inserted into a hole in the crank 25a at its lower end. On depressing any of the digit keys 1 to 9, the key lever 27 will lift the rod 25c, Figure 18, and together with the rod 25c also the crank 25a, together with the rod 16d attached thereto will be raised. This will turn the pawl 16 so that the latter releases the ratchet 8. On releasing the depressed digit, the rod 25c and thus also the pawl 16 will return into their original position and the pawl will again engage the ratchet 8 that has revolved by one tooth, in consequence of which the pin carriage has also stepped one step forward. The exact operation of the pawl 16 and the similar pawls 17, 18, 19 will be more particularly described later.

The ratchet 9 is arranged for two naughts. Its pawl 17 is by the lever 17a' attached to the two naughts (00) key 17b' (Figs. 16 and 17). The pawl 17 is connected to the key lever 17a' by a rod 17d attached to the pawl arm, Figure 18, and this rod 17d is pivotally connected to the key lever 17a' by the eye 17f, Figure 18.

The ratchet 10 is arranged for three naughts and its pawl 18 is by the lever 18a' attached to the three naughts (000) key 18b' (Figures 16 and 17). The connection between the pawl 18 and the key lever 18a' is similar to that already described for the pawl 17.

The ratchet 11 is arranged for one naught and its pawl 19 is by lever 19a' attached to the one naught (0) key 19b' (Figs. 16 and 17). The connection between the pawl 19 and the key lever 19a' is similar to that of the two preceding ones.

The use of the digit and naught keys in an adding machine provided with the devices of my invention has already been described.

Figure 18 shows the pawl 16 completely but only part of the arms of pawls 17 and 18, while pawl 19 is not shown. All pawls are similar and operate as will be described below. The pawl 16 is by the screw 16e (Figure 18) pivotally attached to the rigid frame 1a (Figure 1). Similar screws are provided for the pawls 17, 18, 19. To the arm of each pawl there is attached a rod 16d, 17d, 18d, 19d establishing the connection between the pawls and the key levers for operation of the pawls on depressing the keys.

The pawls 16, 17, 18, 19 are made so that the portion of the same that engages the teeth of the ratchet has two parts or jaws of which one jaw 16a—19a (Fig. 8) is rigid while the other jaw 16—19b (Figs. 8 and 9) is movable. The working of the pawls 16b—19 is schematically illustrated in Figs. 10 and 10a to 13 and 13a. In Fig. 10 to the left the pawl is shown in its closed or rest position, i. e. in the position in which it is when the corresponding key is up. In Figure 10a the jaws 16a—19a and 16b—19b of the pawl are shown as seen from the side of the ratchet together with two teeth 10a and 10b of the ratchet tending to escape past the jaws of the pawl in the direction of the arrow, the tooth 10a pressing against the movable jaw 16b—19b of the pawl. When the corresponding key has been depressed the pawl will move into the position shown in Fig. 11 and as seen in Figure 11a the teeth 10a and 10b of the ratchet are in the same position as in Fig. 10a, but in front of the tooth 10a the rigid jaw 16a—19a of the pawl has stepped while the movable jaw 16b—19b has been pushed by the spring 19c to one side. On releasing then the key the movable jaw of the pawl will rise between the teeth 10a and 10b on the other side of the tooth 10a (Fig. 12a) and the tooth 10b presses the movable jaw 16b—19b into its original position and steps against the same (Fig. 13a). The tooth 10b is now in the same position as was the tooth 10a in Fig. 10a.

The rack 20 (Figs. 1 2, 15, 16, 17 and 18) and its connection with the gears has already been described above. This rack 20 is fully shown in Figs. 15 and 17 and partly in Figs. 2 and 18, i. e. only the end engaging the ratchet 2. The beveled teeth of this rack 20 are in Fig. 18 designated 20c, and the operation of the same has already been described. On the other side, the rack 20 has rectangular grooves or teeth 20b (Figure 18). A pawl 15 (Figs. 1, 2, 16, 17, and 18) engages these grooves. The pawl 15 is by the screw 15a pivotally attached to the frame 1a (Fig. 1) and the other arm of the pawl 15 is by a screw 15b pivotally attached to a bar 14 (Fig. 18). This bar 14 is provided with a number of oblong or rectangular openings or slots, through which the

rods 16d, 17d, 18d, 19d pass. The opening at the lower end of the bar 14 is shown narrower than the other openings for the purpose of preventing a sidewise movement of the bar 14. It has already been described that on depressing any key, the key lever will lift the corresponding rod 16d, 17d, 18d or 19d. The bar 14 rests upon these rods, and when any of the rods, for instance 16d, is raised, the bar 14 will also rise. Because the openings in the bar 14 are oblong, the other rods 17d, 18d, 19d do not follow the upward movement of the bar 14 but they remain in their lowest position. On the other hand, the oblong slots in the bar 14 allow the simultaneous depression of several keys, the movement of the bar 14 being exactly the same regardless of the fact whether one or several keys are depressed. The purpose of the bar 14 is to actuate the pawl 15.

The purpose of the pawl 15 is to lock the rack 20 and the pin carriage connected to this rack as well as the gearing on depressing any key. As has been explained, on depressing any key, the bar 14 will rise and turn the pawl 15 so that its end 15c (Figure 18) engages one of the groove 20b of the rack 20.

It has earlier been explained that on depressing any key, the corresponding pawl releases its ratchet, but its rigid jaw 19a, (Fig. 3) still stops the ratchet and thus also the pin carriage, permitting them to move only when the key has been released, Thus, on depressing the keys one at a time, the rigid jaws 19a of the pawls 16, 17, 18 and 19 fulfil the same action as the pawl 15, the latter being, in this case, superfluous. The pawl 15 becomes necessary only when several keys are depressed simultaneously. If, for instance, one digit key and the one naught (0) key are depressed simultaneously, the pin carriage is locked against movement until one of the two keys has been released. Now, on releasing the two keys, it might happen that the one naught (0) key is released before the digit key, with the result that the pin carriage would move before the pins of the pin carriage have been pressed up, as will be more particularly described in the following. The pins would hit against the parts actuating the pins, with the result that the whole machine would be locked. This unfortunate occurrence is completely prevented by the bar 14 and the pawl 15.

If the operator wishes to obtain the figure 100, this figure is obtained by depressing and releasing simultaneously the key 1 and the two naught key (00). Even if he releases the two naught key before the key 1, the digit key will nevertheless by the aid of the bar 14 and the pawl 15 keep the pin carriage immovable and the pin carriage is free to step three steps only when also the digit key has been released and the machine will register quite correctly the figure 100. The operator may even depress firstly the two naught key and then the digit key 1, then release the two naught key and only at last release the digit key 1, and even if proceeding thus irregularly, the machine will properly register the figure 100 and not 001, as the order of depressing and releasing of the keys would presuppose. This is, as explained above, due to the locking operation of pawl 15 that locks the pin carriage immediately on depressing the two naught key and releases the pin carriage only after the digit key 1 has been released, because the bar 14 is kept in its upraised position all the time until both keys have been released. Thus on releasing the two naught key, the pawl 15 still keeps the pin carriage immobile because the digit key 1 keeps the bar 14 in its uplifted position. First when both keys have been released, the bar 14 falls down and the pawl 15 releases the pin carriage, allowing it to make three steps.

To take still a second example, the figure 1,000,000 is obtained by depressing simultaneously the digit key 1, the one naught key (0), the two naught key (00), and the three naught key (000). As has been explained above, the order in which the keys are depressed is of no consequence. In whatever order they are depressed and released, the machine will always with absolute safety register the figure 1,000,000 and nothing else. The only condition for this is that at least one key always keeps the bar 14 uplifted and the bar is allowed to fall down only after all keys have been depressed. The pawl 15 is thus an important safety device in consideration of the fact that, in practical work, there may always occur some time difference in the depression of the keys, although they are, nominally, depressed simultaneously.

In most of the known ten key adding machines, such as "Dalton" and "Sundstrand" the naught pins of the pin carriage are normally down so that to register a naught the naught pins must be pressed up. The device according to this invention requires that the naught pins be normally, i. e. on registering a figure in the machine, up and that, when a digit is to be registered the naught pin of the same row is to be pressed down. The machine is therefore as far as the naughts are concerned to be altered so that it operates in a similar manner to that of the adding machines with full keyboard.

On depressing any digit key this will actuate the pawl 16 to cause the pin carriage to move one step forward. This movement is realized by the aid of the support 25 (Figs. 16 and 17). A portion of this support 25 forms a downwardly extending crank 25b (Fig. 16) and to this crank a rod 26 is attached which rod pushes the crank 26a rearward, and clockwise as seen in Figure 16 with the result that a second crank 26b mounted on the same shaft 26c pulls the hook 24 down and this hook presses down the naught pin 23 (Fig. 17) to an ineffective position.

For the return movement of the pin carriage the ratchet 2 and the rack 20 (Figs. 1, 2 and 17) are provided with such bevelled teeth that they engage each other when the carriage moves forward. On returning the carriage, the teeth of the rack 20 will disengage the teeth of the ratchet 2 so that the rack, on returning the pin carriage, will glide over the teeth of the ratchet 2 while the ratchet 2 and the entire escapement device remains immovable. The movement of the ratchet 2 in the direction of the arrow (Fig. 1) is prevented by the pawls 16, 17, 18, 19 and in the opposite direction by the pawl 4 (Figs. 1, 2 and 16). The rack 20 is articulated on a pin 20b attached to the pin carriage and a spring 20c pulls the rack against the ratchet 2 (Fig. 17). To prevent the rack 20 from pressing against the ratchet 2 more than is necessary for the engagement of their teeth there is on the rack 20 a tail 20d (Figs. 15 and 17) that presses against the side of the pin carriage.

The naught keys may be arranged in any convenient manner in the machine, but for practical reasons they are generally placed as near to each other as possible. The accompanying drawings illustrate the arrangement of the devices accord-

ing to my invention in a "Dalton" adding machine, the one naught key 19b' being in its original place. In front of this key the two and three naught keys 17b' and 18b' (Figs. 16 and 17) are placed. The two naught key 17b' and the three naught key 18b' are made slightly lower than the one naught key 19b' and the latter is provided with a shoulder 19c on the level of the keys 17b' and 18b' and as near as possible to the latter ones enabling the operator to press by one finger simultaneously the keys 17b', 18b' and, by the shoulder 19c, the key 19b', whereby six naughts are obtained.

In this description I have used the words "adding machines" by which name this type of machines are generally called, although several of the machines now on the market are also adapted for subtraction. The parts of the mechanism required for subtraction are, however, connected to the tabulating wheels and are not brought into contact with the naught mechanism of my invention so that no changes of the latter are required on this account.

I claim:

1. In a ten key adding machine, a shiftable pin carriage, shifting mechanism therefor, a normally ineffective lock for said carriage, numeral keys for controlling a one step shift of said carriage, naught keys for controlling a variable shifting of the carriage, means operated by any of said keys for shifting into and holding said lock in effective position, said means being formed to permit concurrent depression of a numeral key and a naught key or a plurality of naught keys, and an escapement for said carriage under the conjoint control of both the numeral keys and the naught keys, whereby the shifting means is operated to control the shifting of the carriage an amount equal to the sum of the amounts controlled by the depressed keys after the locking means releases the carriage for movement.

2. In a ten key adding machine, number keys, naught keys, a shiftable pin carriage, shifting mechanism therefor, a normally ineffective lock acting when effective to prevent shifting of the carriage, a plurality of carriage shifting control means, each of said control means having an independent and predetermined control of the shifting of the carriage, one of said control means being responsive to the operation of any number key, each of the remaining control means being governed by the operation of a naught key, and means whereby concurrent operation of any two or more keys tending to influence the control means will operate the lock for preventing shifting movement of the carriage, the release of all such operated keys serving to release the lock and thereby release the carriage for a shifting movement determined by the sum of the amounts of carriage movement permitted by the control means of the individual actuated keys.

3. In a ten key adding machine, number keys, naught keys, a shiftable pin carriage, shifting means for the carriage, a normally ineffective lock serving when effective to prevent carriage shifting, a control means for governing the shifting of the carriage and responsive for control purposes to the actuation of a number key, a plurality of carriage shifting control means each responsive to the actuation of a naught key, each of said control means being set for operation on the depression of the correlated key and serving to control carriage shifting following release of the correlated key, and means responsive to the concurrent operation of any two or more keys for setting the lock to prevent carriage shifting and simultaneously setting that control means with which each operated key is correlated, the lock being maintained and the control means prevented from control influence while any one key remains in operated position, the release of the operated keys releasing the lock and permitting the carriage to move to the extent defined by the sum of permissible shiftings indicated by the operated control means.

4. In a ten key adding machine, number keys, naught keys, a shiftable pin carriage, means for shifting the carriage, a normally ineffective lock serving when effective to lock the carriage against shifting, a control means for carriage shifting set for operation in response to actuation of any number key, a plurality of additional control means for carriage shifting set for operation by the actuation of selected naught keys, and means responsive to concurrent actuation of any two or more keys to set the lock to prevent carriage shifting and thereby prevent movement of the carriage in accordance with any set control means, the lock remaining effective and the set control means held against control of carriage shifting while any one of the operated keys remains in operated position, the release of all operated keys serving to release the lock and surrender the carriage to the shifting control influence of the sum of all previously set control means.

5. A ten key adding machine having number keys and naught keys, the naught keys representing the setting up of one naught, two naughts and three naughts respectively, a pin carriage, shifting means therefor, a normally ineffective locking means serving when effective to prevent shifting movement of the carriage, a carriage shifting control means responsive to the operation of a number key and serving to control the shifting of the carriage a single space, a second carriage shifting control means responsive to the operation of the single naught key and serving to limit carriage shifting to one space, a third carriage shifting control means responsive to the operation of the double naught key and serving to permit a shifting of the carriage two spaces, a fourth carriage shifting control means responsive to the operation of the triple naught key and serving to permit a shifting of the carriage for three spaces, and means responsive to the concurrent actuation of any two or more keys for moving the lock to prevent carriage shifting and simultaneously setting for operation the control means governed by each of such actuated keys, the release of all actuated keys relieving the carriage of the lock and surrendering the carriage for shifting purposes to the sum of the spaces determined by the set control means.

6. A naught mechanism for ten key adding machines permitting simultaneous setting of a pin carriage for one digit and one or more naughts by the use of numeral and naught keys, comprising in combination a main ratchet engaging a rack on said pin carriage and additional ratchets cooperating with said main ratchet through a differential gearing, and pawls engaging the additional ratchets and operated one by depression of any one digit key and the others by depression of naught keys to release said ratchets for a rotation to permit actuation of the main ratchet to release the pin carriage for a number of step

by step movements corresponding to the total number of digits and naughts depressed.

7. A construction as defined in claim 6, wherein the main ratchet carries a relatively fixed bevel gear and wherein an additional ratchet responsive to depression of a digit key carries a second bevel gear meshing with the first mentioned bevel gear, with said digit ratchet having twice the number of teeth of the main ratchet, with the bevel gear of such digit ratchet mounted for bodily movement with such ratchet and independent rotative movement with respect thereto, and wherein another of the additional ratchets is controlled by the one naught key and provided with the same number of teeth as the main ratchet, said one naught ratchet having a relatively fixed bevel gear and wherein the remaining additional ratchets are respectively controlled by the two naught key and the three naught key, each of the two naught and three naught ratchets carrying bevel gears bodily movable with such ratchets and freely rotatable with respect thereto, the bevel gear of the three naught ratchet cooperating with the bevel gear of the one naught ratchet, and bevel gears intermediate the bevel gears of the digit ratchet and the respective naught ratchets, and a pawl cooperating with each of said ratchets other than the main ratchet and controlled by the key for which the particular ratchet is designed, the movement of the ratchets permitted by the actuation of the cooperating pawl being translated through the gearing described to the main ratchet to control the movement of the pin carriage in accordance with the movement permitted by the ratchet or ratchets whose pawls have been actuated by corresponding key depression.

8. A naught mechanism according to claim 6, wherein each ratchet engaging pawl has two jaws opening on depression of a key controlling said pawl, the lower jaw releasing a tooth of the cooperating ratchet with the top jaw moving in front of the tooth to release the tooth only when the lower jaw, after release of the actuated key, has been moved in advance of the succeeding tooth, the ratchet rotating until the succeeding tooth of the same is moved into the plane of the raised lower jaw of the pawl.

9. A construction as described in claim 6, including a locking device comprising a pawl engaging a supplemental set of teeth of the rack of the pin carriage, a bar controlled by the digit keys to hold the pawl in engaging position when a digit key is depressed, and connections between the naught keys and said pawl to hold the latter in engaging position when a naught key is depressed, whereby any of said keys may be depressed in any desired order so long as any one key is held depressed, the release of all of the depressed keys causing the pawl to disengage said teeth of said pin carriage rack.

10. A naught mechanism for ten key adding machines permitting the simultaneous setting of a pin carriage for one digit and one or more naughts by the use of a numeral key and one or more naught keys, comprising in combination ratchets cooperating through a differential gearing with a main ratchet engaging a rack on said pin carriage, the pin carriage being normally under tension, pawls normally engaging the first mentioned ratchets and operated one by depression of any one digit key and the others by depression of naught keys to release the ratchets for a rotation which, translated by the differential gear to the main ratchet, releases the pin carriage for a number of steps corresponding to the total escapement determined by the digit and the naught keys depressed, and a pin carriage locking device which prevents the movement of the pin carriage until the release of all depressed keys.

11. A naught mechanism according to claim 10, wherein the main ratchet engaging the pin carriage rack forms one block with a bevel gear which cooperates with a second bevel gear mounted for bodily movement with and free rotation with respect to a second ratchet having twice as many teeth as the main ratchet and held against rotation by a pawl controlled by any digit key, a one naught ratchet having the same number of teeth as the main ratchet and carrying a relatively fixed bevel gear, a pawl connected to the one naught lever and controlled by the movement of the one naught key, the ratchets for plural naught setting of the pin carriage being arranged between the digit ratchet and the one naught ratchet and interconnected with said digit ratchet and one naught ratchets through differential gearing, the said plural naught ratchets each having that number of teeth required to rotate the main ratchet through the bevel gearing, a multiple of the rotation caused by the one naught ratchet, pawls engaging said several naught ratchets and controlled respectively by the several naught keys, the movement of the digit ratchet and the naught or several naught ratchets being translated through the differential gearing to the main ratchet to permit a movement of the pin carriage corresponding with the total number of digit and naught keys depressed.

12. In a naught mechanism according to claim 10, wherein the locking device comprises a pawl engaging a second rack of the pin carriage and moved into engagement with the rack by a bar controlled by the digit keys when any one of said digit keys is depressed, and intermediate connections between the naught keys and said pawl whereby the latter is moved into engagement with said rack when any one of the naught keys is depressed, with the result that a digit key and one or more naught keys may be depressed in any desired order so long as any one of the several keys to be depressed is held down, and with the further result that the selected digit value will appear in the proper position on the carriage relative to the naught values.

HANNES SATUKANGAS.