Feb. 15, 1938. K. V. RUDIN 2,108,596

CALCULATING MACHINE

Filed Feb. 27, 1930 12 Sheets-Sheet 1

Fig. 1.

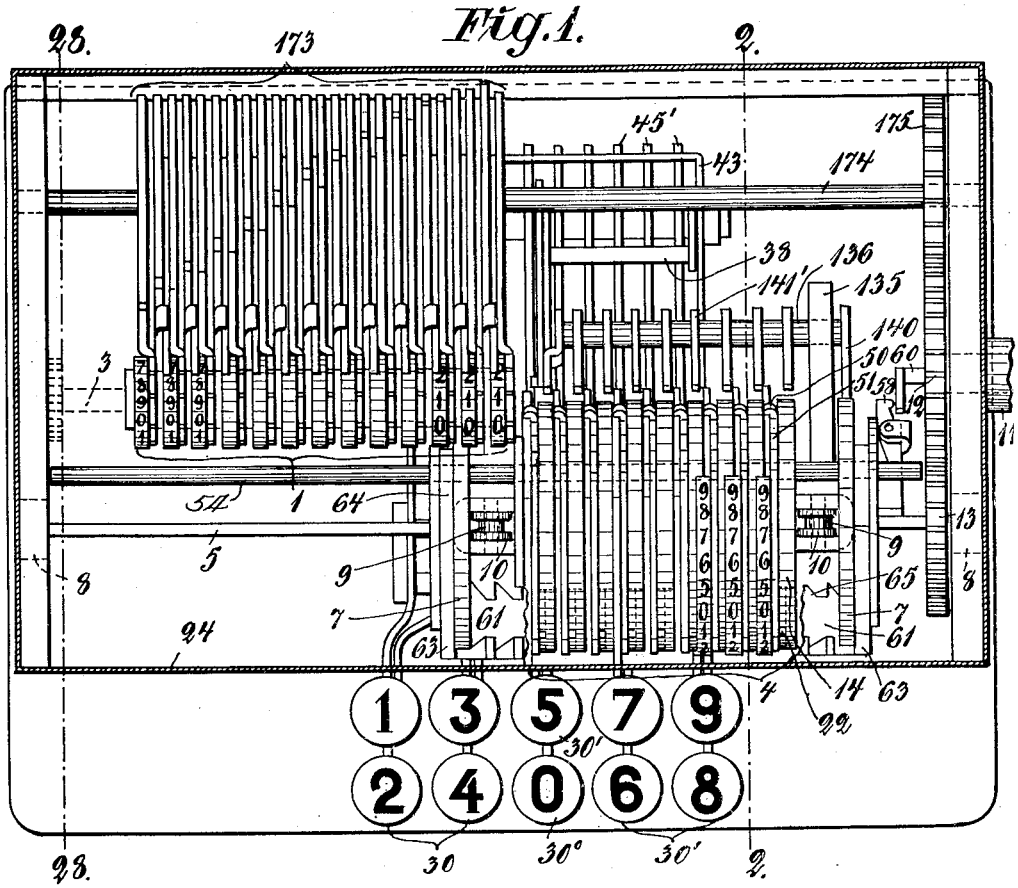
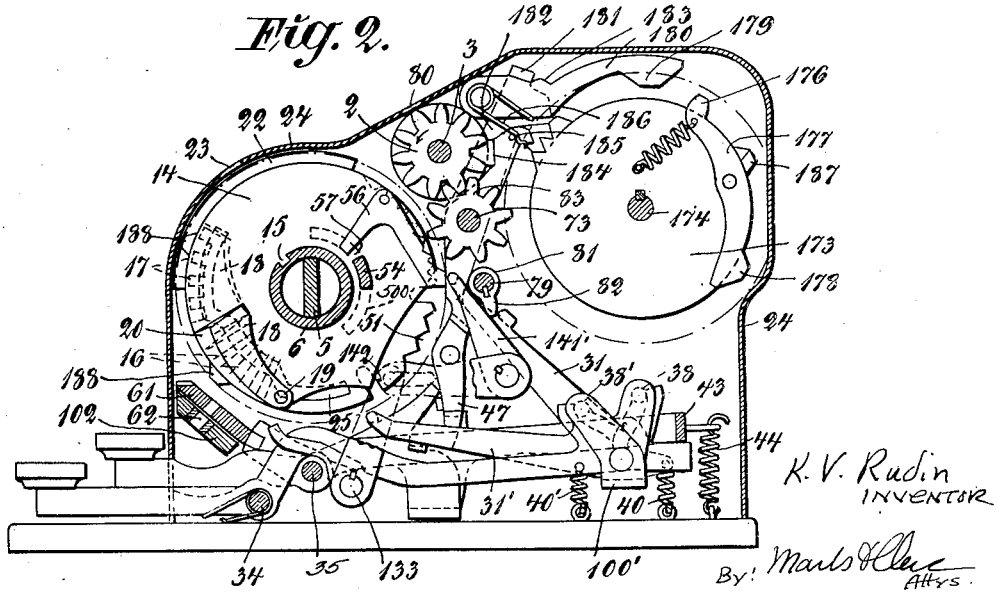


Fig. 2.



Feb. 15, 1938. K. V. RUDIN 2,108,596

CALCULATING MACHINE

Filed Feb. 27, 1930 12 Sheets-Sheet 2

Fig. 3.

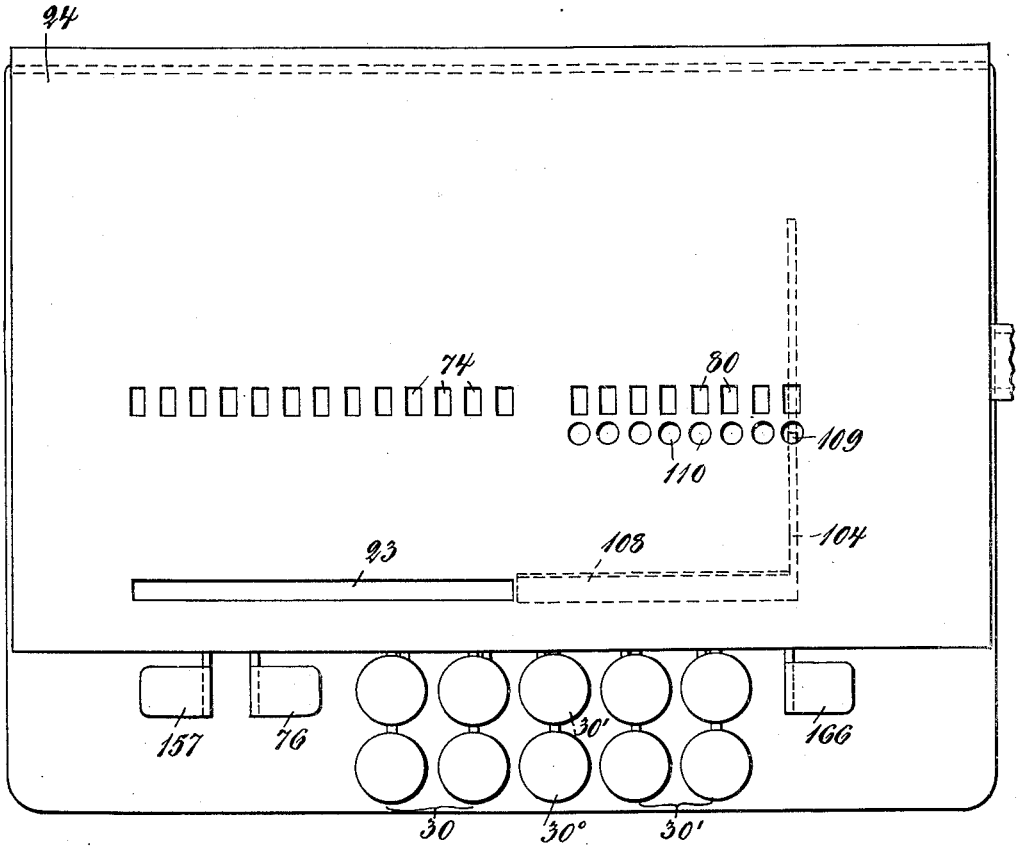
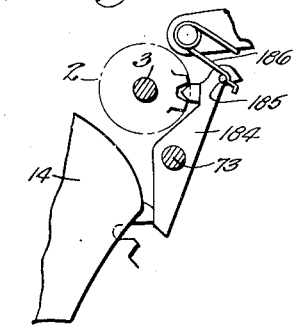


Fig. 2a



K. V. Rudin
INVENTOR

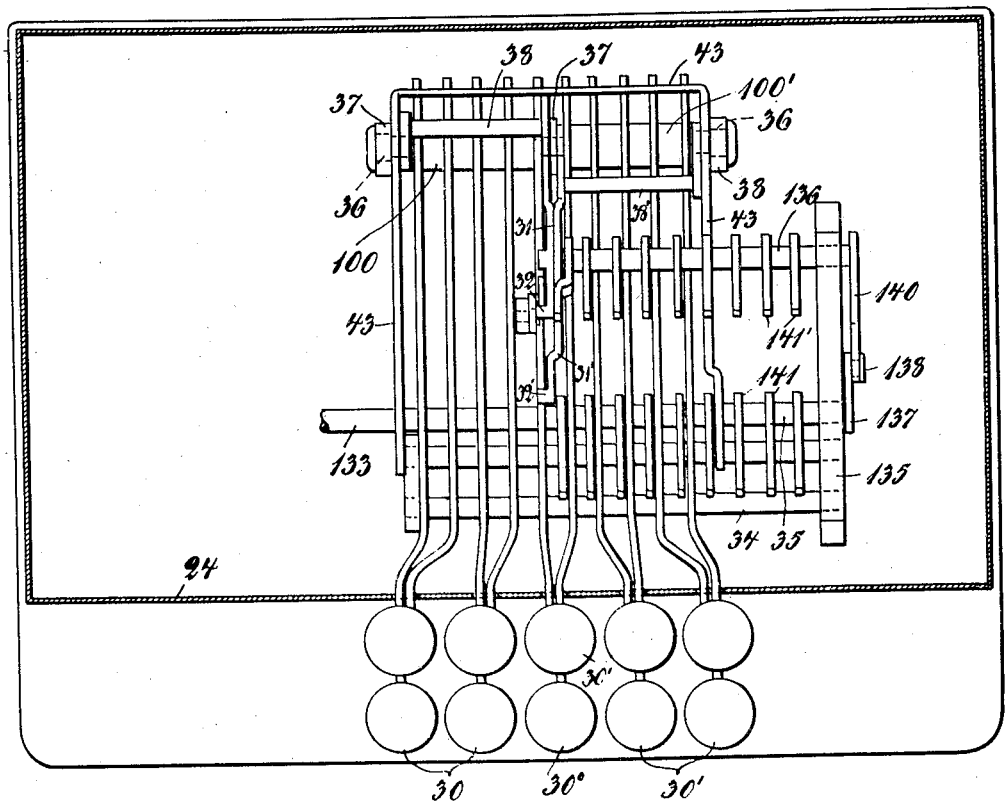
By: Marks & Clark
Attys.

Feb. 15, 1938. K. V. RUDIN 2,108,596

CALCULATING MACHINE

Filed Feb. 27, 1930 12 Sheets-Sheet 3

Fig. 4.



K. V. Rudin
INVENTOR

By: Marks & Clark
Attys.

Feb. 15, 1938. K. V. RUDIN 2,108,596

CALCULATING MACHINE

Filed Feb. 27, 1930 12 Sheets-Sheet 4

Fig. 5.

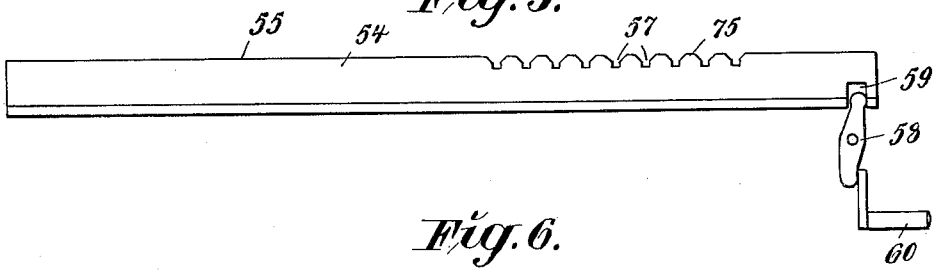


Fig. 6.

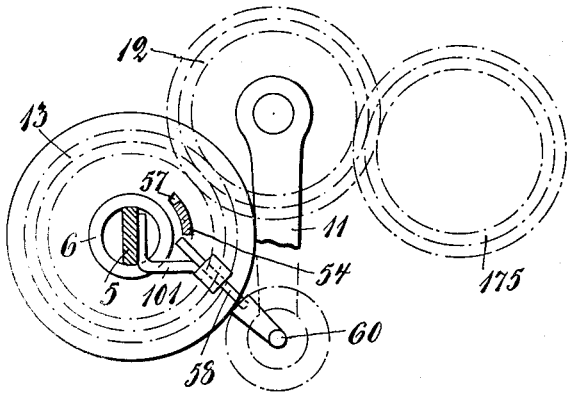
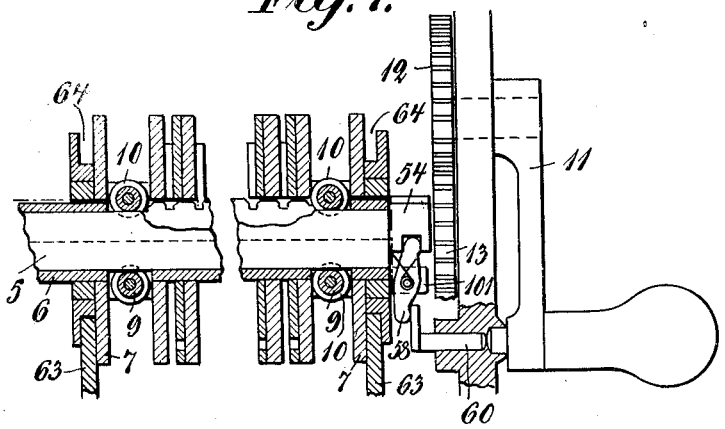


Fig. 7.



K. V. Rudin INVENTOR

By: Marks & Clark Attys.

Feb. 15, 1938. K. V. RUDIN 2,108,596

CALCULATING MACHINE

Filed Feb. 27, 1930 12 Sheets-Sheet 5

Fig. 8.

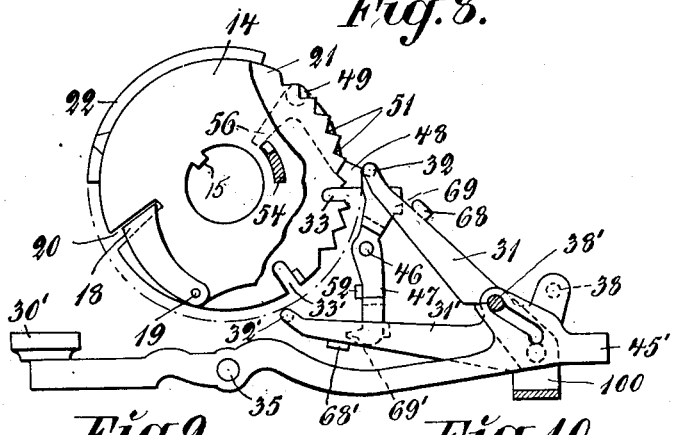


Fig. 9.

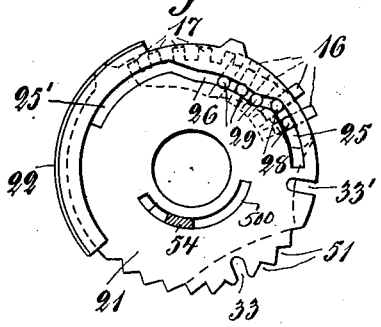


Fig. 10.

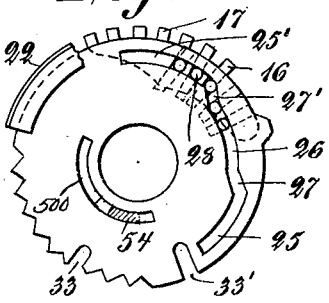
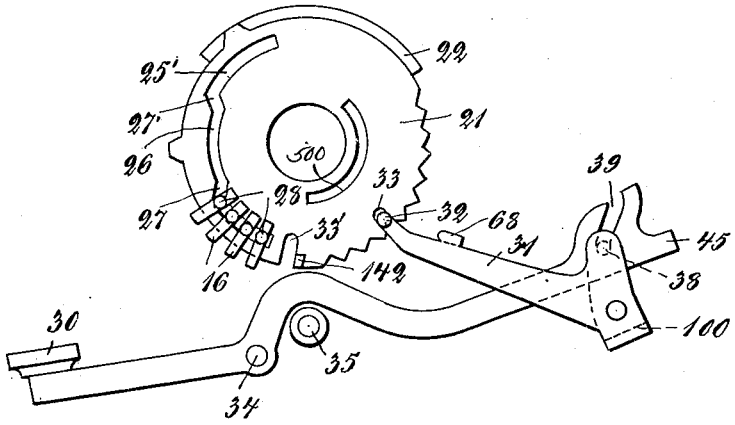


Fig. 11.



K. V. Rudin
INVENTOR

By: Marks & Clark
Attys.

Feb. 15, 1938. K. V. RUDIN 2,108,596

CALCULATING MACHINE

Filed Feb. 27, 1930 12 Sheets-Sheet 6

Fig. 14.

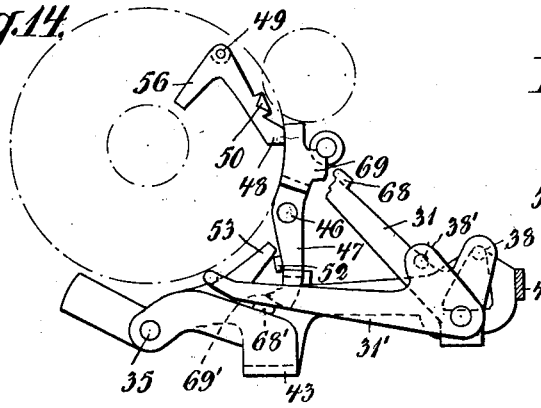
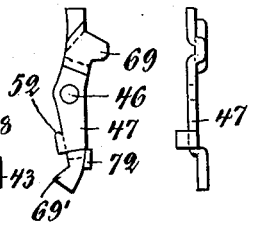


Fig. 15 Fig. 16.



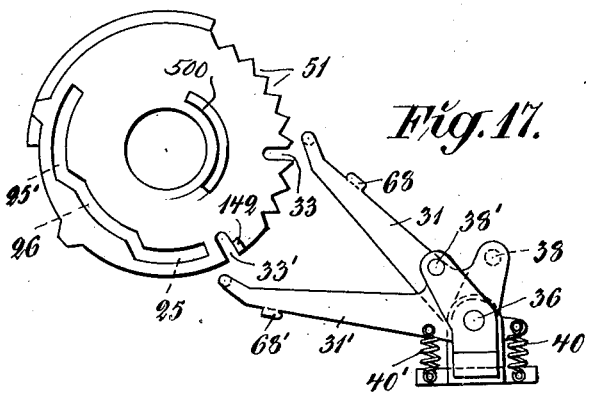


Fig. 17.

Fig. 18.

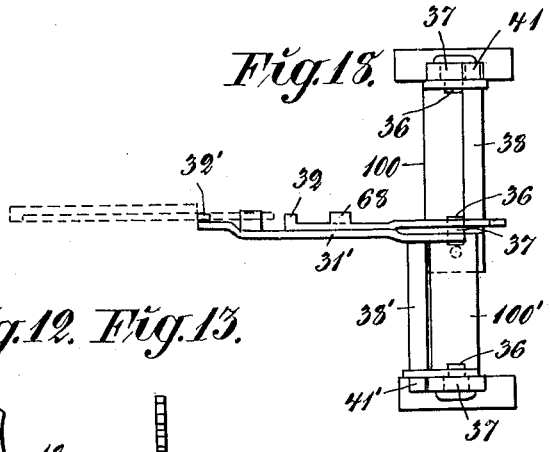
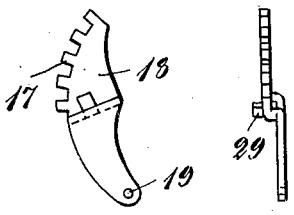


Fig. 12. Fig. 13.



R. V. Rudin
INVENTOR

By: Marks Allen
Attys.

Feb. 15, 1938. K. V. RUDIN 2,108,596

CALCULATING MACHINE

Filed Feb. 27, 1930 12 Sheets-Sheet 7

Fig. 19.

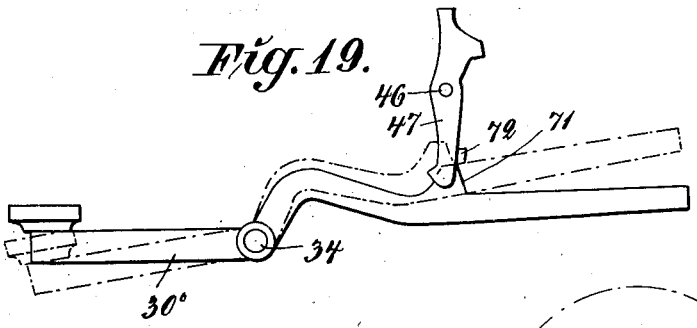


Fig. 22.

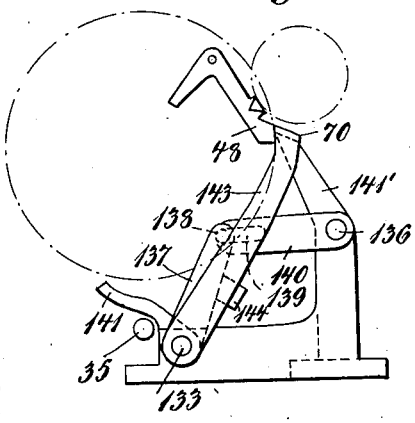


Fig. 21.

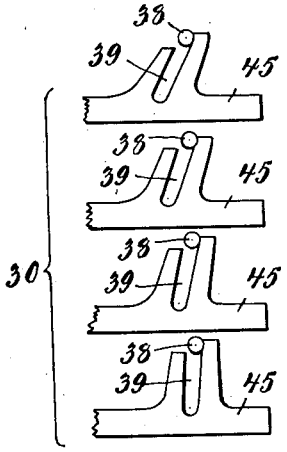


Fig. 20.

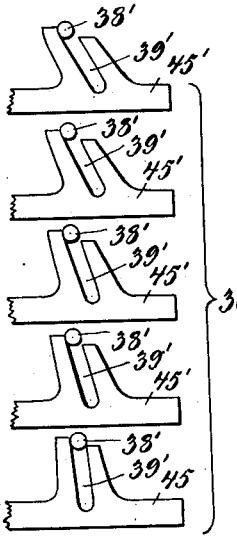
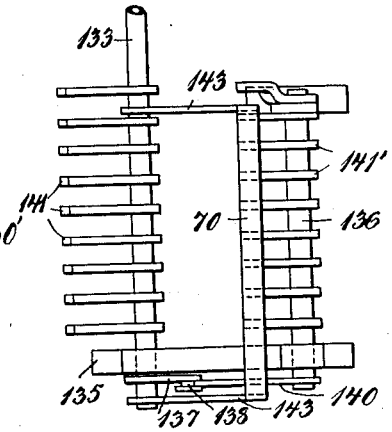


Fig. 23.



K. V. Rudin INVENTOR

BY: Marks & Clark ATTYS.

Feb. 15, 1938. K. V. RUDIN 2,108,596

CALCULATING MACHINE

Filed Feb. 27, 1930 12 Sheets-Sheet 8

Fig. 24.

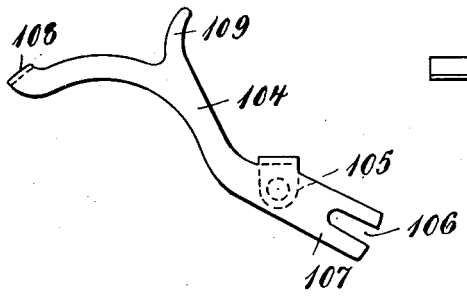


Fig. 25.

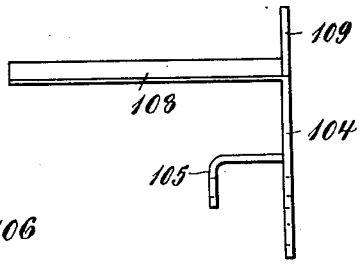


Fig. 26.

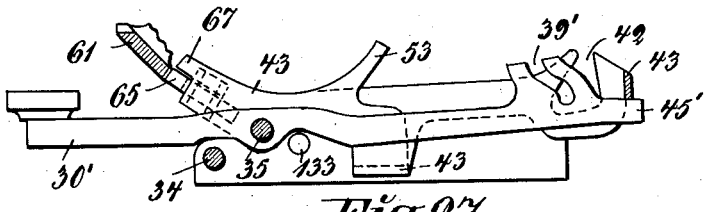
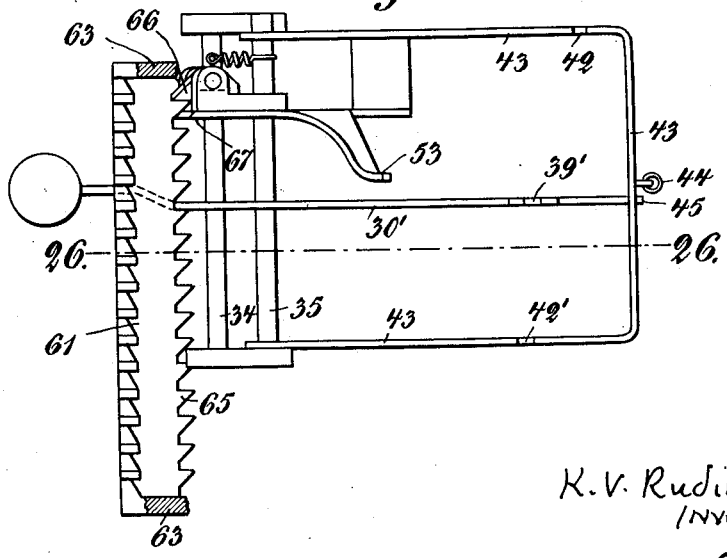


Fig. 27.



K. V. Rudin
INVENTOR

By: Marks & Clerk
Attys.

Feb. 15, 1938. K. V. RUDIN 2,108,596

CALCULATING MACHINE

Filed Feb. 27, 1930 12 Sheets-Sheet 9

Fig. 28.

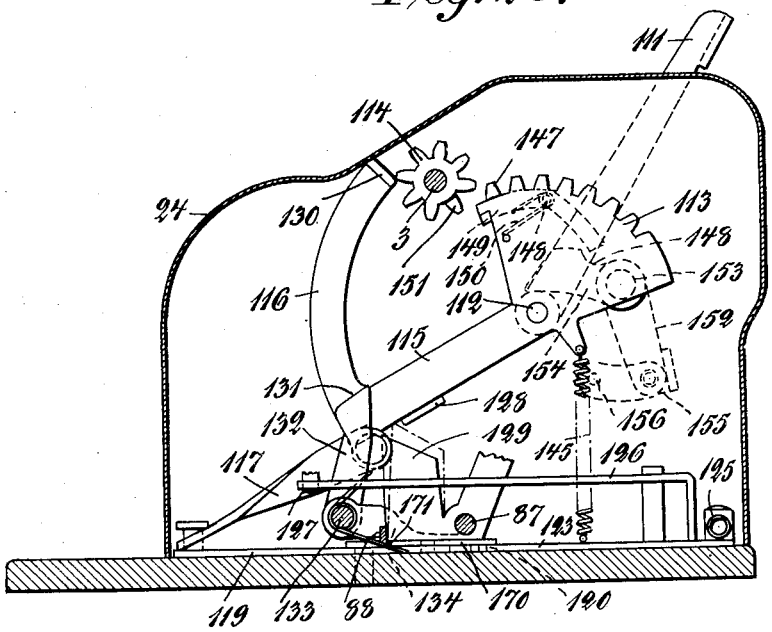
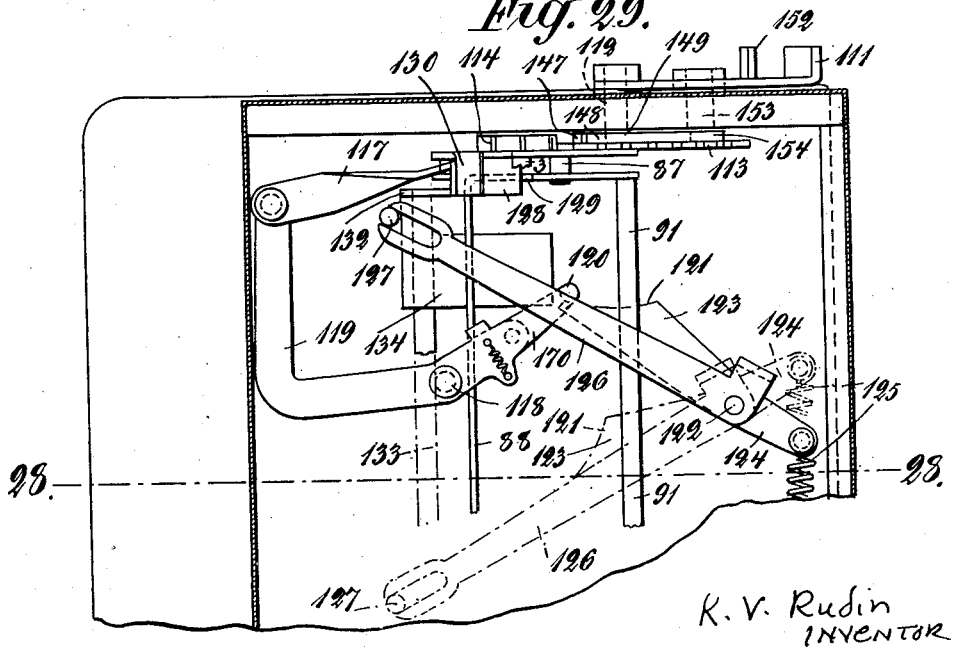


Fig. 29.



K. V. Rudin
INVENTOR

BY: Marks & Clerk
ATTYS.

Feb. 15, 1938. K. V. RUDIN 2,108,596

CALCULATING MACHINE

Filed Feb. 27, 1930 12 Sheets-Sheet 10

Fig. 31.

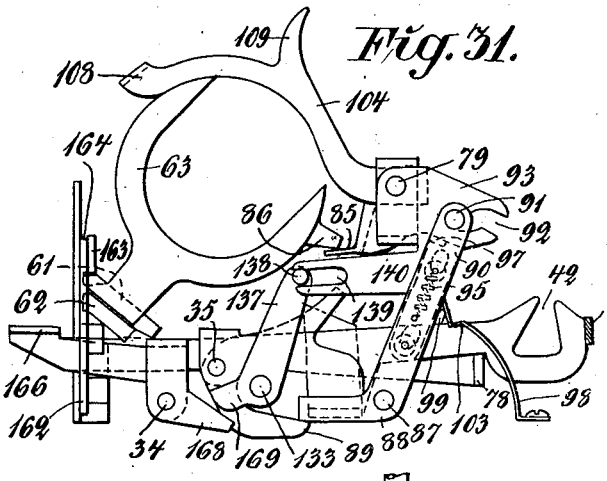


Fig. 32.

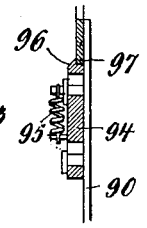


Fig. 30.

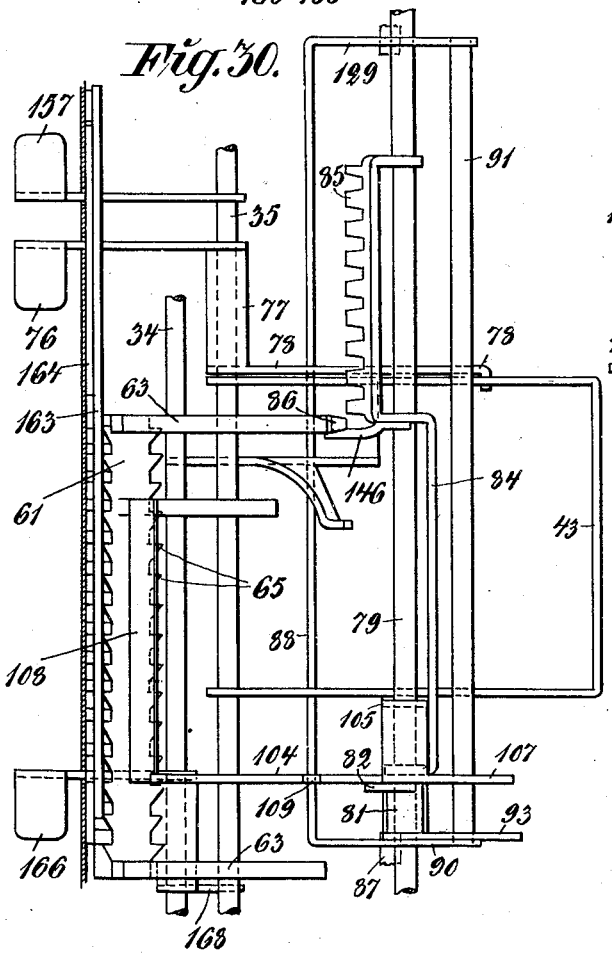
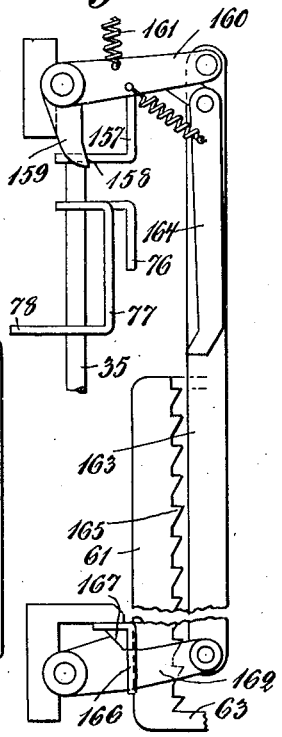


Fig. 33.



K. V. Rudin
INVENTOR

By: Marks & Clark
Attys.

Feb. 15, 1938. K. V. RUDIN 2,108,596

CALCULATING MACHINE

Filed Feb. 27, 1930 12 Sheets-Sheet 11

Fig. 34.

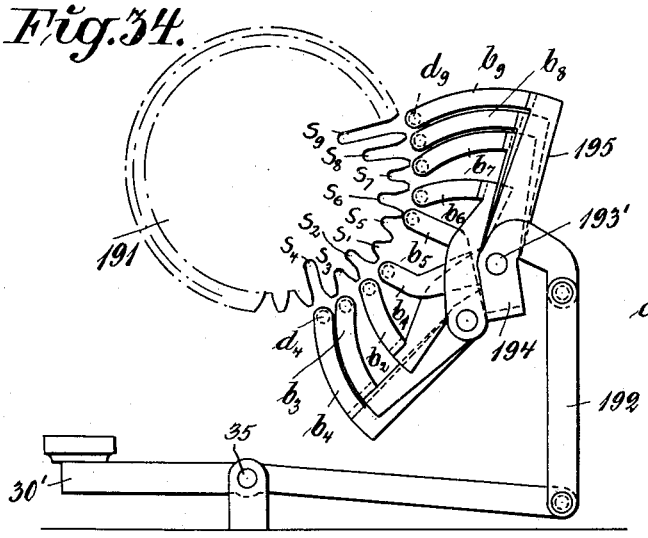


Fig. 36.

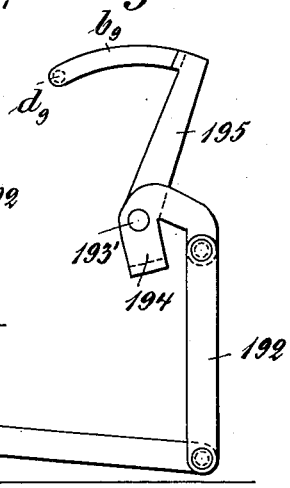


Fig. 35.

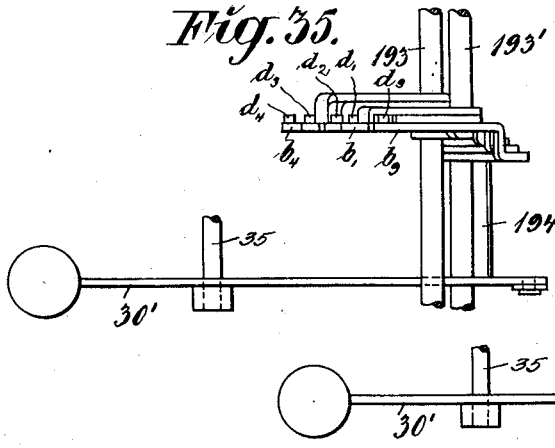
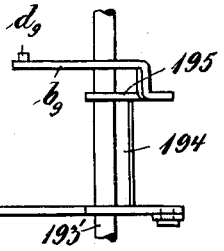


Fig. 37.



R. V. Rudin
INVENTOR

By: Marks & Clerk
ATTYS.

Feb. 15, 1938. K. V. RUDIN 2,108,596

CALCULATING MACHINE

Filed Feb. 27, 1930 12 Sheets-Sheet 12

Fig. 38.

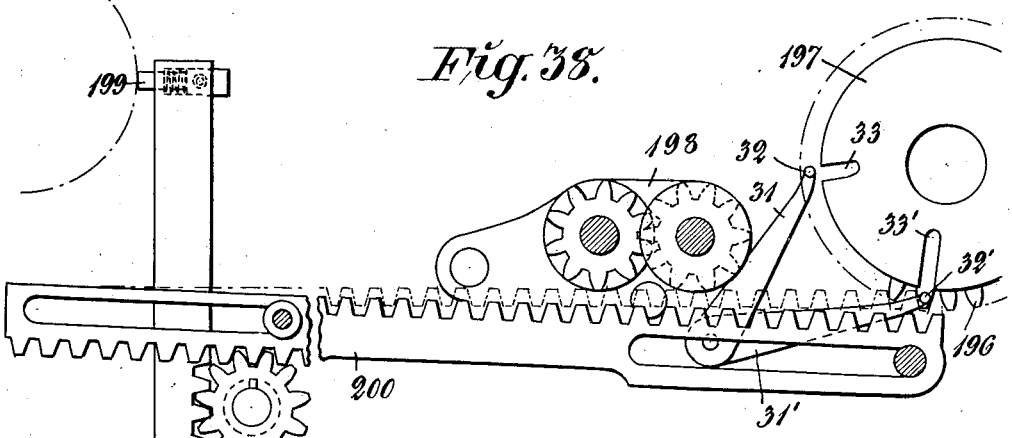


Fig. 39.

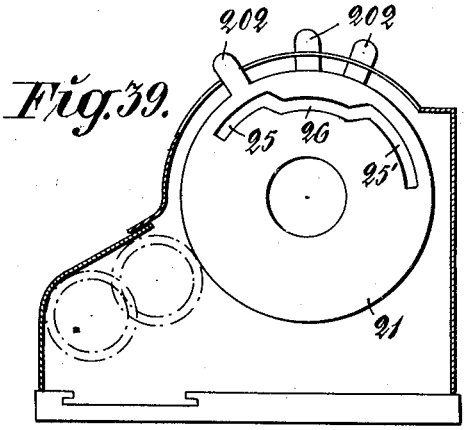
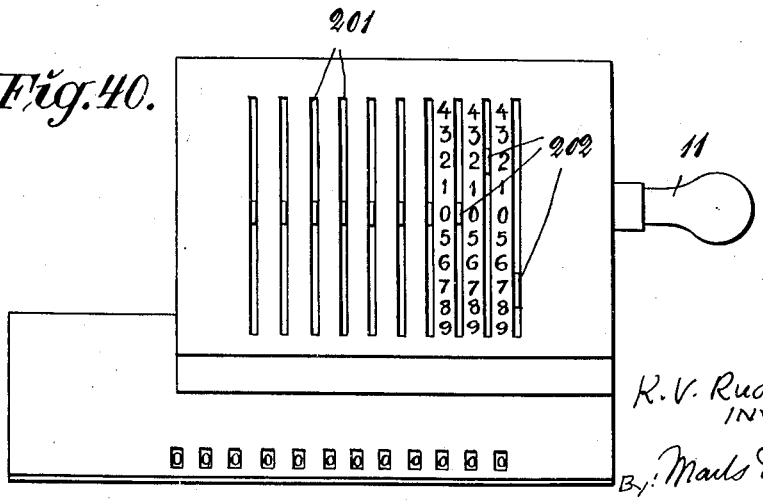


Fig. 40.



K. V. Rudin
INVENTOR

By: Marks & Clark
Attys.

UNITED STATES PATENT OFFICE

2,108,596

CALCULATING MACHINE

Karl Viktor Rudin, Stockholm, Sweden

Application February 27, 1930, Serial No. 431,872
In Sweden July 17, 1929

55 Claims. (Cl. 235—61)

The present invention relates primarily to so called Odhner machines, that is, calculating machines in which the setting mechanism consists of setting disks carrying adjustable teeth which are shifted by means of rotatable cam disks. In such machines, however, the setting motions are transferred circumferentially of the cam disks which have a comparatively large diameter and wherein the angles described in the setting motions for different numerical values cannot be reduced to any considerable extent. Thus, the distances of movement of the setting mechanism parts in such machines are comparatively great as regards the numerical values corresponding to the larger turning angles and the work connected with the setting operation varies within wide limits for the different numerical values whereby, in particular, the use of keys for the setting is very difficult. The invention has for its object to facilitate the setting in general and to render possible an easy setting by means of keys. For said purpose the cam disks are, according to the invention, rotatable in both directions from the normal position, the turning in the one direction bringing about the setting of certain, by way of example the four lowermost, numerical values, whereas the setting of the other unit values takes place by means of rotation in the opposite direction. By this arrangement the largest rotations of the cam disks are reduced to about one half of the ordinary turning angle and the setting work is more even with respect to the different numerals from one to nine.

The invention will be more fully described with reference to the accompanying drawings. Figs. 1 to 33 relate to one and the same embodiment of the invention. Fig. 1 is a plan view of the machine, the casing being in section. Fig. 2 is a section on the line 2—2 in Fig. 1. Fig. 2*a* shows more in detail a portion of the device shown in Fig. 2. Fig. 3 is a plan view of the machine, the casing being in position. Fig. 4 is a plan view of the key system and a part of the zeroizing device. Fig. 5 is a detail of Fig. 7. Fig. 6 is a diagrammatic view of the crank gearing. Fig. 7 is an axial section through the setting mechanism with the appertaining carriage, the middle portion being broken away. Fig. 8 shows a setting disk with the appertaining cam disk viewed from the right, part of the setting disk being broken away. Figs. 9 and 10 show a cam disk, together with the displaceable teeth, set in two different setting positions and viewed from the left. Fig. 11 is a view corresponding to Fig. 8 of the cam disk during the setting motion. Figs. 12 and 13 show a detail of the setting disk in side elevation from the left hand side and in front view respectively. Fig. 14 shows a part of the locking device for the cam disks viewed from the right. Figs. 15 and 16 show a detail of Fig. 14 viewed from the right and from the front respectively. Fig. 17 is a detail of the setting device viewed from the right hand side. Fig. 18 is a plan view of the setting device in Fig. 17. Fig. 19 is a side elevation, viewed from the right hand side, of the zero key and a part of the locking device for the cam disk being in setting position. Figs. 20 and 21 show the shape of the rear ends of the keys. Fig. 22 shows a part of the zeroizing device of the setting mechanism viewed from the right. Fig. 23 is a plan view of the zeroizing device in Fig. 22. Figs. 24 and 25 show a detail of Fig. 31 viewed from the right hand side and the front, respectively. Figs. 26 and 27 show the carriage motion mechanism viewed from the right hand side and from above, respectively. Fig. 28 is a section on the line 28—28 in Figs. 1 and 29. Fig. 29 is a plan view of the parts appearing in Fig. 28. Figs. 30 and 31 show the device for the stepwise motion of the carriage during multiplication and division, respectively, as viewed from above and from the right hand side, respectively. Fig. 32 is a section of a detail in Fig. 31. Fig. 33 shows parts of Fig. 30 in front view. Figs. 34 and 35 show a modified embodiment of the setting device in side elevation and top view, respectively. Figs. 36 and 37 show a detail of Figs. 34 and 35 in side elevation and top view, respectively. Fig. 38 shows a modification of the setting mechanism shown in Figs. 17 and 18 especially intended to be used in setting toothed wheels having fixed teeth. Figs. 39 and 40 illustrate the application of the invention in Odhner machines not provided with a key-board.

In contradistinction to ordinary Odhner machines the product calculating mechanism 1 (Fig. 1) as well as the revolutions counting mechanism 2 (Fig. 2) are stationary in the machine. Both of said calculating mechanisms are carried by a common shaft 3. On the other hand, the setting mechanism 4 is axially displaceable in front of the two calculating mechanisms. The setting mechanism is journalled in a carriage displaceable along the supporting shaft 5 and consisting of a tubular sleeve 6 (Figs. 1, 2, 7) enclosing the shaft and carrying end pieces 7 at its ends. The shaft 5 consists of a flat bar which at its ends is formed with cylindrical studs 8 by means of which said bar is journalled in the

frame. In cavities on the top and bottom sides of the sleeve 6 four small wheels 9 are journalled which run on the bar 5 and by means of flanges 10 grip around the edges of the bar. On account of the engagement of said wheels with the shaft 5 the carriage 6 will, upon the shaft rotating, participate in the rotation. The rotation of the shaft 5 is brought about by means of the crank 11 through the medium of toothed wheels 12, 13.

The setting disks 14 carrying the adjustable teeth are nine in number and are mounted on the sleeve 6. Each of the disks is provided with a tooth 15 projecting inwardly into a corresponding slot in the sleeve 6 so as to fix the disks 14 in definite angular positions on the sleeve.

Each setting disk 14 carries nine adjustable teeth of which, however, only four are arranged in usual manner, that is, in the shape of short pins 16 which are displaceable individually in radial slots or channels in the setting disks (Figs. 2 and 9). The five other teeth 17 are, on the other hand, rigidly interconnected and formed in the circumference of a rack or sector 18 which is pivotally mounted on the setting disk at 19. The toothed sector 18 is normally swung inwards so that the teeth 17, as well as the teeth 16, are positioned inside the circumference of the setting disk. As seen from Figs. 8, 12, and 13 the toothed sector is bent approximately at the middle in such a manner that its free end carrying the teeth 17 and its pivoted end are positioned in different planes on opposite sides of the setting disk, the bent middle portion extending through a slot 20 in the setting disk. It will be seen that the actuating rack 18 is pivoted to the rotatable disk 12 by a pivot arm of fixed length.

Each setting disk 14 is in usual manner provided with a cam disk 21 (Figs. 8–11) rotatable in relation to the setting disk and disposed coaxially and close thereto. The edge of the cam disk adjacent to the casing 24 of the machine is provided with a numeral arc 22 carrying the numerals 0–9 of which the numeral set for the time being is visible through a slot 23 (Fig. 3) disposed in the casing.

The cam disk 21 is provided with a slot, the two ends of which form arcs 25, 25' coaxial with the cam disk and having equal radii while the intermediate portion of the slot forms an arc 26 also coaxial with the cam disk but having a somewhat smaller radius than the arcs 25 and 25'. The three portions of the slot are interconnected by means of oblique slot portions 27, 27'. Studs or pins 28 on the individually displaceable teeth 16 and also a corresponding stud 29 (Figs. 9, 13) on the toothed sector 18 engage the slot. The studs 28, 29 normally engage the middle arc 26 of the slot, the teeth 16 then being retracted into their grooves or channels and the toothed arc 18 being held in retracted position. The teeth 17 are then positioned inside the circumference of the setting disk.

The cam disks are adapted to be successively set by means of a key board comprising four keys 30, five keys 30' and one key 30° disposed on the front side of the machine. The setting takes place in connection with a successive displacement of the carriage 6 on the shaft 5. The carriage normally is in the extreme right hand position shown in Fig. 1. The cam disk appertaining to the first setting disk reckoned from the left hand side then is in a position in alignment with two setting arms 31, 31' the first of which is adapted to be swung downwards by the actuation of some of the keys of the key board, while the other arm 31' is adapted to be swung upwards by the actuation of other keys of the key board. The two arms 31, 31' are pivoted coaxially with one another and are provided at their free ends each with a stud 32 and 32', respectively. Upon actuation of one of the arms the corresponding stud will engage a radial slot 33 or 33', respectively, in the edge of the cam disk and thereby turn said disk. During the setting operation the cam disks appertaining to the following setting disks will be brought successively into the setting position and will accordingly in turn be operated in similar manner.

The keys in the key system are disposed in two parallel rows and divided into two groups, one of which 30 consists of the keys corresponding to the numerals 1, 2, 3, 4 and is arranged for cooperation with the upper setting arm 31. The second group comprising the keys corresponding to the numerals 5 to 9 is arranged for cooperation with the lower setting arm 31'. By the downward motion of the arm 31 caused by the depression of one of the keys by which this arm is actuated, the cam disk appertaining to the setting disk, which at the moment is in the setting position, will be turned in a clockwise direction, while the disk would be turned in a counterclockwise direction if the arm 31' were actuated instead. The zero key 30° upon being pressed down, leaves both setting arms unactuated. The keys in each key row are journalled on common shafts 34 and 35, respectively.

The two setting arms 31, 31' constitute extensions from yokes 100 and 100' (Fig. 18) respectively, which by means of studs 36 are coaxially journalled beside each other in fixed standards 37, said two extensions being swingable in parallel planes close to each other. The two yokes carry between their legs rods 38 and 38', respectively, parallel with the bearing shaft. Each of said rods is adapted to be caught by the rear end of a pressed down key in a corresponding key group.

The rear ends of the numeral keys 30, 30' which ends normally are positioned beneath the rods 38, 38', respectively, are for this purpose flattened and provided with sloping slots 39, 39', respectively, opening upwards. The mouths of said slots are normally positioned directly beneath the rods. The slots 39 which are adapted to cooperate with the rod 38 to actuate the setting arm 31, slope in such a manner as to cause the arm to rotate in a counterclockwise direction upon depression of a corresponding key, while the slots 39' which are adapted to cooperate with the rod 38' to actuate the setting arm 31', slope in opposite manner. Figs. 20, 21 show diagrammatically the rear ends of the different keys viewed from the left, Fig. 20 representing the key group 30', that is, the keys for the numerals 5, 6, 7, 8, 9 counted from below. Fig. 21 shows in a corresponding manner the ends of the keys for the numerals 1, 2, 3, 4 counted from below. The slots 39 and 39' disposed most obliquely (the upper key shanks in Figs. 20, 21) are somewhat arcuate close to the mouth and extend nearly tangentially in relation to the rods 38, 38'. They thus only gradually attain their full sloping whereby the striking of the key becomes softer.

The setting arms 31, 31' are acted upon by helical springs 40, 40' tending to pull the arms towards their starting positions in which posi-

tions extensions 41, 41' of the rods 38, 38' are engaged each in the contracted upturned mouths of the lateral cuts 42 and 42' (Figs. 26 and 27) in a swingable yoke-shaped bridge or rocking frame 43 pivoted on the shaft 35 and adapted to bring about the stepwise movement of the carriage upon a key being actuated. The free end of the bridge is normally held by a spring 44 so as to bear against extensions 45 and 45' respectively on the rear ends of the keys.

In its normal position the bridge 43 also blocks the cam disk 21 on that setting disk which is in the setting position. This locking is brought about through the intermedium of a locking lever 47, Figures 8, 14 to 16, pivoted on a stud 46 directly opposite the setting position. The upper end of the locking lever 47 bears against the one end of an angular pawl 48 projecting outside the circumference of the cam disk and pivoted at 49 on that side of the setting disk which is remote from the cam disk. Said pawl is provided with a pointed projection 50 bent over the edge of the setting disk and engaging one of ten locking notches 51 in the edge of the cam disk. Before the cam disk has been set the point 50 engages one of the two locking notches at the middle of the row of notches. The locking lever 47 is, close to its lower end, provided with an abutment 52. Against the front side of said abutment bears normally the upper end of a locking finger 53 projecting in a sloping direction rearwards and upwards from the bridge 43, on which it is supported.

All the cam disks are normally held locked in relation to the setting disks by the engagement of the appertaining locking projections 50 with the notches 51 in the edge of the cam disk. The pawls 48 of the cam disks which have not yet been set are held in locking engagement by a longitudinal locking bar 70, Figs. 22, 23, against which bear the projecting ends of the pawls on said setting disks and along which said ends slide during the stepwise motion of the carriage. Said locking bar terminates close to the setting position, where the locking lever 47, as above mentioned, takes over the locking of the cam disk which is in said position. In those setting disks which already have passed the setting position the pawls 48 are held in locking position by a locking bar 54 (Figs. 5 through 10) passing through the entire series of cam disks and setting disks in axial direction, the upper edge 55 of said bar, Fig. 5, being in locking engagement with arms 56 projecting radially inwards from the pawls. Bar 54 is supported directly by the setting discs 14 and cam discs 21 are provided with slots 500 of sufficient extent to permit the necessary rotation of the cam discs relative to the setting discs and hence relative to bar 54. Right opposite each of the pawls 47 for the disks not yet set, including the disk in setting position, the locking bar 54 is provided with a recess 57 which allows the arm 56 of the corresponding pawl 48 to swing inwards when the same is released from the circumferential locking.

The locking bar 54 is somewhat displaceable in its longitudinal direction and is normally held in its right hand extreme position by a lever 58 (Figs. 5, 7) pivoted on an arm 101 projecting from the shaft 5. The one end of said lever engages a recess 59 in the locking bar 54 whereas its opposite end is normally held in retracted position, against the action of a spring acting thereon, by means of a pin 60 displaceably mounted in the lateral wall of the machine which pin, in turn, is held in retracted position by an abutment on the crank 11 so long as said crank is in its position of rest.

The carriage 7 supporting the setting mechanism is embraced by a yoke 61 (Figs. 1, 26, 27) cooperating with the stepping mechanism which yoke is guided by pins 62 engaging a longitudinal slot in a fixed guiding bar 102 (Fig. 2). The two fork-shaped legs 63 of the yoke projecting in a sloping direction rearwards and outwards engage annular slots 64 in the end pieces 7 of the carriage, Fig. 7, so that the carriage is caused to follow the axial displacement of the yoke 61 but is free to turn in the fork-shaped legs 63. The middle portion of the yoke 61 is provided with a row of locking teeth 65 along the rear edge, the pitch of said teeth being equal to the length of the stepwise motion of the carriage. In each setting position of the carriage one of the teeth 65 is in engagement with a spring actuated pawl 66 rotatably journalled in the front portion of the bridge 43. The pawl 66 is so disposed on the bridge 43 that it, upon the shifting of the bridge by means of the actuation of a key, is lowered and brought out of engagement with the opposing locking tooth 65, the carriage being then displaced half a step to the left by spring power acting thereon. The carriage is then again stopped by the engagement of the next locking tooth with a locking finger 67 rigidly disposed on the bridge which finger meanwhile has been brought into the path of the teeth. When the key is dropped and the bridge returns to normal position under the influence of the spring 44 the locking finger 67 releases its engagement with the latter locking tooth 65 which now instead is brought to engage the pawl 66 while at the same time the carriage is displaced half a step to the left.

To explain more clearly the operation of the setting mechanism, assume that one of the keys in the key group 30, by way of example the key corresponding to the numerical value two, is pressed down while the carriage is in its starting position on the right hand side in the machine. The cam disk on the extreme setting disk to the left thus takes up the setting position directly opposite the setting arms 31, 31'. When said key is pressed down the rear end of the bridge 43 is raised by the rear extension 45 of the key. The locking finger 53 is then brought out of locking engagement with the locking abutment 52 of the locking lever 47 but simultaneously the setting arm 31 is swung down by the engagement of the key slot 39 with the rod 38, an abutment 68 disposed on the setting arm being then initially brought into the path of an abutment 69 at the upper end of the locking lever 47 whereby said lever still is held locked, up to the moment when the stud 32 on the setting arm enters the slot 33 in the cam disk. At this moment the lever 47 is released and then also the pawl 48, the inwardly projecting arm 56 of which, upon the turning of the cam disk during the continued actuation of the key, enters the corresponding recess 57 in the locking bar 54. The slot 39 in the rear end of the two-key is so shaped that the cam disk upon a complete depression of said key is rotated two steps in clockwise direction, as viewed from the right hand side, two of the rod-shaped teeth 16 being then brought into operative position by the engagement of the corresponding studs 28 with the end portion 25 of the slot, (see Fig. 9 where the cam disk, however, is viewed from the left). When the key is completely pressed down the carriage

is moved in above described manner half a step to the left whereby the stud 32 is brought out of engagement with the slot 33 in the cam disk and simultaneously the arm 56 of the pawl 48 slides onto the locking edge 55 of the locking bar 54, the locking projection 50 then engaging that locking notch 51 on the cam disk which corresponds to the number set up. During the return of the key the setting arm 31 is brought back to the starting position at the same time as the carriage in above described manner is brought a further half-step to the left, whereby the next setting disk is brought to setting position, its pawl 48 being then brought out of engagement with the longitudinal locking bar 70 (Figs. 22, 23) against which it has previously been bearing and being locked instead by the locking lever 47, the locking abutment 52 of which has again been engaged by the locking finger 53. The numeral two has now appeared on the extreme right hand side in the elongated slot-shaped window 23 on the front side of the machine.

If now one of the keys in the key group 30', by way of example the 7-key, is actuated, the rear end of the bridge 43 is raised in similar manner as before by the rear extension 45' of the key, and the locking finger 53 is, as before, brought away from the locking lever 47, but on account of an abutment 68' on the setting arm 31' being brought into the path of an abutment 69' on the lower end of the lever 47, said lever together with the pawl 48 is maintained locked until the stud 32' on the setting arm 31' is inserted into the slot 33' in the cam disk. The cam disk is then released and said disk is turned, upon the continued actuation of the key, three steps in the direction opposite to the first setting movement, that is, counter-clockwise in Figure 8 and clockwise in Figure 10 which, as well as Figure 9, shows the cam disk as viewed from the left in the machine. By this turning of the cam disk the stud 29 together with two of the pins 28 are brought outward by engagement with the outer arc 25' of the slot. The toothed sector 18 is thus swung out and its five teeth 17 are brought into operative position, and two of the rod shaped teeth 16 are brought out in operative position. Altogether seven teeth are now positioned outside the circumference of the setting disk. The carriage has now been brought still another step to the left and the numeral 7 is now visible to the extreme right in the slot 23 on the front side of the machine, whereas the numeral 2 is moved one step to the left in the slot. The number 27 appears thus at the right hand end of the slot 23. If a key, by way of example in the key group 30, be actuated in an incomplete manner and restored without any carriage displacement taking place, the cam disk is restored to zero position by the pin 32, throwing over being, however, prevented because the locking abutment 68, immediately upon the release of the engagement between the pin 32 and the slot 33, strikes the abutment 69 of the locking lever 47 which thereby immediately brings the pawl 48 into locking engagement with the locking tooth space 51 corresponding to the zero position of the cam disk.

As is readily understood by the above description, one, two, three or four of the rod-shaped teeth 16 are set for each of the numerals 1 to 4 respectively. For the numeral 5 the 5-teeth 17 are set by the swinging out of the toothed segment 18. For each one of the numerals 6 to 9 the toothed segment 18 and also one, two, three or four, respectively, of the rod-shaped teeth 16 are set.

Upon actuation of the zero key 30° neither of the setting arms 31 nor 31' is actuated but, on the other hand, the bridge 43 is raised in the same manner as upon the actuation of one of the other numeral keys and brings about a displacement of the carriage in two half-steps in above described manner. To prevent the locking lever 47 from being released during said stepwise motion during which the locking finger 53, as mentioned above, is brought away from the locking abutment 52 of the lever 47, the zero key (Fig. 19) is on its upper side provided with an upturned projection 71 (Fig. 19) which normally is positioned closely beneath a locking projection 72 on the lower end of the locking lever 47. Said projection 71, however, upon the actuation of the zero key, is moved up against the projection 72 and thereby the locking lever 47 is held in locking position during the entire key motion.

After the item has been set in the setting mechanism a multiplication may be carried out by repeated turning of the crank 11. In connection therewith a successive displacement of the carriage of the setting mechanism in relation to the results calculating mechanism 1 may take place. By each rotation of the setting discs the teeth set up are caused to engage in usual manner the intermediate wheels in the calculating mechanism which are rotatably disposed on the shaft 73. The result will then be visible in check openings 74 on the front side of the machine casing 24.

In order to rotate the crank it must first in ordinary manner be axially pulled out from its locking position, the pin 60 being then released. The lever 58 is then thrown over under the influence of spring power acting thereon and pushes the locking bar 54 to the left a distance equal to the length of a halfstep displacement of the carriage. The recesses 57 in the locking bar each of which previously has been positioned directly opposite one of the arms 56 of the disks not yet set, are thus displaced in relation to said arms so that the arms will be positioned directly opposite the tooth-shaped portion 75 between the recesses 57. As the pawls 48 of the adjusted setting disks still are held locked by the locking edge 55 of the locking bar all pawls 48 are now locked by the bar 54 during the rotation of the crank, said bar then participating in the rotation of the setting mechanism.

Successive displacement of the carriage of the setting mechanism in relation to the product calculating mechanism, during the multiplication, is brought about by pressing down the tabulating key 76 on the front side of the machine (Fig. 30). This key is rotatably disposed on the shaft 35 by a sleeve 77 and grips underneath the bridge 43 by a rearwardly extending arm 78. Upon the depression and subsequent release of the key 76 a displacement of the carriage in two half-steps is thus brought about in above described manner. The registration of the multiplier in the revolutions counting mechanism 2, that is the registration of the number of crank revolutions in the different multiplication positions of the setting mechanism is brought about through the medium of a shaft 79 operated from the crank 11 and a sleeve 81 displaceable on the shaft and carrying a projecting tooth 82 which normally is positioned directly opposite the extreme intermediate wheel

83 (Fig. 2) on the right hand side in the revolutions counting mechanism. For each revolution of the crank shaft, the shaft 79 is turned together with the sleeve 81 also one revolution, the tooth 82 then engaging the opposing intermediate wheel 83 and thereby bringing forward a corresponding numeral wheel 2 in the revolutions counting mechanism one step for each turn. The number of crank revolutions is registered in the check openings 80.

The tooth 82 must remain in its starting position during the stepwise motion of the carriage, which motion is carried out in connection with the setting of the multiplicand, but must, on the other hand, participate in the successive displacement of the carriage during the multiplication and division. For this purpose the sleeve 81 is adapted to be connected together with the carriage during the multiplication and division through the intermedium of a yoke 84, Fig. 30, bent in an S-shape and swingably mounted on the shaft 79, said yoke carrying a toothed rack 85 which by the turning of the yoke is brought into engagement with a tooth 86 projecting from the fork 63 engaging the left hand side of the carriage. The shifting of the toothed rack 85 is effected by actuation of the tabulating key 76 through the medium of a yoke 88 (Figs. 30, 31) journalled on pins 87 against which yoke an arm 89 projecting downward from the key 76 bears from below. The legs 90 of the yoke 88 extend slopingly upwards and carry a rod 91 extending parallel with the shaft 79. The rod 91 extends through a slot 92 open on the rear side and disposed in a flattened arm 93 projecting from the yoke 84 backwards. The right hand leg 90 of the yoke 88 carries on the inside a spring detent comprising a plate 94 displaceable in the longitudinal direction of the leg (Figures 31, 32) which plate by means of a helical spring 95 is held in the shown up-turned position, the plate by means of a locking edge 96 then gripping around a projection 97 projecting downwards from the arm 93, whereby the entire S-shaped yoke 84 is normally held in the starting position shown in Figure 30. The yoke 88 is normally held in the position shown in the drawings by a locking spring 98 the free end of which bears against a bent-over projection 99 of the right hand leg 90. When the tabulating key 76 is depressed the legs 90 of the yoke 88 together with the rod 91 are swung backwards, the S-shaped yoke 84 being then turned by the engagement of the rod in the sloping slot 92 so that the toothed rack 85 is brought into engagement with the tooth 86 projecting from the carriage, which tooth may be assumed to have been brought to the left one or several steps by the carriage movement during the setting of the multiplicand. The yoke 88 is held in the latter position by the projection 99 having snapped into an angular notch 103 of the spring 98. The toothed rack 85 is thereby held in engagement with the tooth 86 during the entire multiplication operation. Upon the turning of the yoke 88 the locking edge 96 of the spring lock 94 slides away from the projection 97 of the arm 93 whereby the S-shaped yoke 84 is now free and may follow the stepwise motion of the carriage.

Freely mounted on the shaft 79 a stamped plate arm 104, Figures 24, 25, 30, 31, projecting obliquely upwards is pivoted between the one end of the S-shaped yoke 84 and the sleeve 81 and guided by a bent-over supporting projection 105 also rotatably pivoted on the shaft 79. As the sleeve 81 is disposed between the arm 104 and the arm 93 extending backwards from the yoke 84, both said sleeve and the yoke 84 will follow the carriage movements during the multiplication. The rod 91 passes through a slot 106 (Fig. 24) in a rearwardly projecting portion 107 of the arm 104, which slot 106 has the shape of a circular arc, the centre of which coincides with the turning axis 87 of the yoke 88 whereby the arm 104 is steadily held in a constant angular position independent of the swinging of the yoke 88. The arm 104 carries at its front end a bar 108 projecting to the left across the numeral arcs 22 of the cam disks under the casing parallel with the slot 23. The free end of said bar is, before the beginning of the multiplication, positioned close to the right hand end of the slot 23 (Figure 3). The arm 104 is also provided with an upwardly projecting finger 109, the end of which during the displacements of the carriage during the multiplication, passes a series of round apertures 110 disposed directly beneath the apertures 80 in the casing. In the starting position the point 109 is visible in the extreme aperture to the right where it remains during the setting of the multiplicand. During the multiplication the bar 108 moves with the carriage and is accordingly moved stepwise to the left so as to cover the ciphers on the cam disks not set so that the set multiplicand, still unaltered, may be read off in the slot 23.

The stepwise motion during the multiplication may, of course, also be carried out by means of the zero key 30°, registration in the revolution calculating mechanism being then, however, not obtained as the depression of key 30° does not cause the tooth 82 to be coupled to the carriage.

The restoration of the different parts after completed calculating operation is brought about by means of an arm 111 Figs. 28, 29 disposed externally on the left hand side of the machine. Said arm is keyed on the outer end of a journal 112 disposed in the left hand endplate of the machine. On the inner side of the journal 112 a toothed segment 113 is keyed and adapted to cooperate with a toothed wheel 114 keyed to the calculating mechanism shaft 3. From the center of the toothed segment 113 extends an arm 115 provided with a circular arcuate extension 116 concentric with the journal 112. The outer end of the arm 115 is connected by means of a link 117, to the one end of an angular lever 119 pivoted on the bottom of the machine at 118. The opposite end of said lever carries a stud 120 bearing against a circular arcuate cam surface 121 on an arm 123 pivoted on the bottom of the machine at 122. The rear extension 124 of the latter arm is engaged by a strong helical spring 125. An arm 126 rigidly connected to the arm 123 extends nearly parallel therewith but somewhat above the same. The forkshaped end of the arm 126 is in engagement with a stud 127 secured to the left hand end of the carriage.

The arm 115 is provided with a bent over projection 128 adapted to cooperate with an upturned oblique cam 129 on the left hand end piece of the yoke 88 to restore the yoke into normal angular position after completed multiplication. The arcuate extension 116 of the arm 115 is at its free end provided with a bent over extension 130 adapted to cooperate with a sloping surface 131 on an upturned arm 132 which is keyed onto the left hand end of a shaft 133 for the zeroizing of the setting mechanism. Said shaft extends parallel with the carriage path.

The shaft 133 is journalled in a bearing 134 to the left in the machine and also in a bearing plate 135 to the right. Opposite the right hand portion of the shaft 133, (Figs. 22, 23) and on the opposite side of the path of the setting mechanism a shaft 136 is journalled to which the former shaft is connected by means of an arm 137 keyed thereon, which arm by a stud 138 engages in a slot 139 at the end of an arm 140 keyed on the shaft 136. The shafts 133, 136 each carries a number of zeroizing arms 141 and 141', respectively. The arms in the two groups are so disposed that they are positioned in pairs directly opposite the cam disks of the different setting disks in the starting position of the carriage. Normally the two groups of zeroizing arms are held swung out from the setting mechanism by means of a spring 171 (Fig. 28) acting on the shaft 133 but are swung inwards at the zeroizing, one of the arms in each pair, that is, either an arm in the group 141 or the opposing arm in the group 141', then engaging a projection 142 (Figs. 2, 17) disposed on the corresponding cam disk. If the cam disk is set on any of the numerals 1 to 4 the zeroizing arm 141 becomes operative. If the disk, on the other hand, is set on any of the numerals 5 to 9 it is zeroized by the opposite arm 141'. On the shaft 133 two arms 143 are freely mounted, said arms serving as supports for the above mentioned locking bar 70 which normally is held in engagement with the pawls 48 of the setting disks not set by means of a projection 144 extending from the arm 137 and gripping around the one of the arms 143.

Opposite each pair of zeroizing arms 141, 141' the corresponding setting disk 14 is provided with two arcuate recesses (Fig. 2) which allow the arms to pass freely during the zeroizing. Also in other respects the setting disk need not be circular but may be provided with suitably disposed recesses to reduce the weight.

The arm 111, by means of which the parts are restored after the calculating operation, is normally held in the position shown in Fig. 28 by a helical spring 145 engaging the toothed segment 113. When the arm 111 is brought forward the projection 128 on the arm 115 of the toothed segment first touches the cam 129 on the yoke 83 which, at the beginning of the multiplication, was swung over so that the cam 129 was swung up towards the projection 128. The cam is now pressed down, the yoke 83 being then swung back to the starting position shown in Figs. 30, 31. The locking projection 99 (Fig. 31) on the right hand leg of the yoke then snaps out of the locking notch 103 on the spring 98 and enters instead into engagement with the outer end of the spring.

At the same time the toothed segment 113 is brought into engagement with the toothed wheel 114 on the calculating mechanism shaft whereby the results calculating mechanism and the revolutions counting mechanism are now zeroized during the continued pull of the handle 111. At the same time the angular lever 119 is swung over by the link connection to the arm 115 and brings with it the arms 123, 126 on account of the pressure of the catching stud 120 against the cam 121. By the engagement of the arm 126 with the stud 127 secured to the carriage, the carriage is then restored to the starting position. The arms 123, 126 are brought along until the circular arcuate curve 121 has reached the position shown in Fig. 29 with dashed and dotted lines in which position said curve is concentric in relation to the journal 118 of the lever 119. In said position of the arm 123 the carriage has been brought somewhat past the starting position. During the continued motion, during which the zeroizing of the setting mechanism has to be performed, the stud 120 slides on the cam 121 and snaps, at the end of the forward motion of the arm 111, past the point of the arm 123, the carriage then being pulled back by the spring 125 that small distance, which it has been brought past its normal starting position. During the restoration of the carriage the yoke 84 has been brought to its starting position by the tooth 86 on the carriage having engaged a short arm or abutment 146 (Fig. 30) projecting from the yoke. When the yoke 84 reaches its starting position the locking projection 97 on the arm 93 again snaps in behind the locking edge 96 on the spring lock 94, the yoke being locked anew in starting position (Fig. 32).

To enable the free end of the lever 119 (Fig. 29) to pass the point of the arm 123 after completed zeroizing of the setting mechanism said end is jointed and pivotable clockwise from the position shown in Fig. 29. The zeroizing of the setting mechanism is started when the abutment 130 at the end of the arc 116 reaches the cam surface 131 on the arm 132. Said arm is now swung back and turns the shaft 133, both groups of zeroizing arms 141, 141' (Figs. 22, 23) then, on account of the interconnection of the shafts 133, 136, being swung inward toward the setting mechanism and the zeroizing of the setting mechanism taking place in above described manner.

In certain cases, by way of example in division, it is desirable that the results calculating mechanism and the revolutions counting mechanism are not zeroized at the restoration of the carriage to starting position and the zeroizing of the setting mechanism. To avoid the zeroizing of the calculating mechanism in such cases, upon the restoration of the carriage by means of the arm 111, the front tooth 147 on the toothed segment 113 is adjustable and carried by a lever 149 pivoted on the left hand side of the toothed segment at 148. The tooth 147 is normally held in the shown projecting position by a spring 150 acting on the lever 149 but, when desired, may be swung inwardly out of the path of the opposing tooth 151 on the toothed wheel 114. The half of the tooth 151 projecting inwardly is milled out so that the tooth has only half the tooth length in comparison with the other teeth on the toothed wheel 114. For this reason the tooth 151 is continuously out of the path of the fixed teeth on the toothed segment 113 which, as seen from Fig. 29, has only about half the thickness of the toothed wheel 114. The tooth 151 is, on the other hand, positioned in the same plane as the adjustable tooth 147. The shifting of the latter is brought about by means of an arm 152 disposed on the outside on the left hand side of the machine. Said arm is keyed onto a journal 153 rotatably mounted in the left hand end piece of the machine which journal carries on its inside a cam disk 154.

In the normal position shown in Fig. 28 the arm 152 is held locked by a spring detent snapped into a hole 155 in the end plate and the cam disk 154 is in the lower position. If zeroizing of the calculating mechanism is not intended to take place upon the restoration of the carriage and zeroizing of the setting mechanism, the arm 152 is swung forward until the spring detent snaps into a hole 156, whereby the lever 149, by means of the cam disk 154, is swung over against

the action of the spring 150 and the tooth 147 is brought out of operative position. When the arm 111 is now brought forward the fixed teeth of the toothed segment 113 will pass idle between the two whole teeth on both sides of the tooth 151 on the toothed wheel 114. The carriage together with the yoke 84 is now restored without any zeroizing of the results calculating mechanism and the revolutions counting mechanism taking place.

If the carriage during the calculating operation has to be brought to the right one or several steps a tabulating key 157, Figs. 30, 33, disposed to the left of the tabulating key 76 is pressed down. The key 157 is also pivoted on the shaft 35. The key 157 is provided with a shoulder 158 gripping over and, upon depression of the key, catching an arm 159 journalled close to the front side of the machine. To the arm 159 an upturned arm 160 is connected which is acted upon by a spring 161, whereby the arms 159, 160 are normally held in the position shown in Fig. 33 and the key 157 is held in its upper position. Close to the right hand end of the machine an arm 162 corresponding to the arm 160 is journalled. Both arms carry in common a horizontal flattened bar 163 pivotally connected to said arms. Said bar is displaced to the right and simultaneously somewhat lowered upon the pressing of the key 157. The bar 163 carries a spring actuated pawl 164, the free end of which, upon the pressing of the tabulating key 157, is brought to the right and is lowered into engagement with a row of teeth 165 along the upper edge of the toothed rack 61 connected to the carriage. The motion of the pawl 164 is so adjusted that the carriage is then brought one step to the right.

If the last set numeral in the setting mechanism by a mistake has been erroneously set and has to be altered a tabulating key 166 pivoted on the shaft 34 and disposed to the right in the machine is actuated (Figs. 30 and 31). Said key on its bottom side is provided with a sloping cam surface 167 (Fig. 33) cooperating with a corresponding shoulder on the arm 162. The key 166 further carries an arm 168 projecting rearward, the end of which is positioned beneath a projecting short arm 169 which is keyed onto the zeroizing shaft 133. When the key 166 is pressed down the arm 162 is swung to the right and the carriage is brought by the pawl 164, in above described manner, one step to the right where it is held on account of the right hand edge of the shoulder 167, upon the continued pressing of the key, sliding on the lower portion of the left hand edge of the arm 162. Upon the continued pressing of the key 166 the arm 168 enters into engagement with the arm 169 on the zeroizing shaft 133 and this shaft is turned, the zeroizing arms 141, 141' being then swung in towards the setting mechanism in above described manner to zeroize the last set cam disk.

The reason why the arms 141, 141' are prevented from restoring all of the set disks upon operation of the tabulating key 166 may be understood from Figs. 1 and 4, from which it will appear that all of the resetting arms 141, 141', with exception of the two arms at the left hand end of the resetting device, are positioned opposite to cam disks which have not yet been set. The two arms at the left are positioned opposite to the cam disk which has just been set and will therefore be operative upon depression of the tabulating key while all of the other resetting arms will perform idle motion. It should be observed, that the zeroizing operation is normally to be performed after the carriage has been returned to its normal position.

In order not to load the carriage with a number of disks which only become operative upon tens transferring and which, besides, should considerably increase the length of the carriage and the machine, a special stationary tens transferring rotor comprising a number of disks 173, Figs. 1, 2, is disposed behind the results calculating mechanism 1. Said tens transferring rotor is keyed onto a shaft 174 journalled in the frame which shaft is operated from the crank by means of a toothed wheel 175 (Fig. 6) engaging the toothed wheel 12. Each of the tens transferring disks 173 is provided with two tens transferring teeth 176 each disposed at the one end of a lever 177 pivoted on the disk. Only one of said levers is shown on the drawings. The other end of the lever 177 is provided with a cam 178 adapted to be actuated, upon a tens transfer, by a cam surface 179 on a pivoted arm 180. The latter is in turn adapted to be actuated by an abutment 181 on a tens transfer hook 182 which in turn, in known manner, is actuated by the corresponding calculating mechanism wheel during the tens transfer operation, the tens transfer hook being then swung in towards the opposing disk 173 and then sliding up on a cam 183 on the corresponding arm 180, which then is swung in towards the disk and also locked in swung in position by the abutment 181. The restoration of the tens transferring member after completed tens transferring is brought about in a manner known per se by means of cam surfaces or the like at the circumferences of the tens transferring disks 173.

Both the numeral wheels of the results calculating mechanism and also the numeral wheels 2 of the revolutions counting mechanism are held locked by pawls 184 provided with pins or abutments 185 normally resting in angular locking notches in locking springs 186. At the release of the pawls upon rotation of the numeral wheels the pins or abutments 185 slide up beneath the free ends of the locking springs 186, whereby the pawls 184 are held out of locking engagement during the rotation of the numeral wheels. The restoration of the pawls 184 into locking engagement with the numeral wheels is brought about by abutments 187 on the disks 173 or by abutments 188 on the cam disks 21, respectively, which latter abutments cooperate with the lower ends of the detents 184.

In the embodiment according to Figs. 34 to 37 the numeral keys 30 and 30' respectively for the different numerals one to nine are each permanently connected to one appertaining shifting arm b_1, b_2 . . . b_9 and each of the cam disks is along the edge facing the setting arms provided with a row of slots s_1, s_2 . . . s_9 the lengths of which correspond to the setting motion for the appertaining numerical value and which are adapted to cooperate with setting studs d_1, d_2 . . . d_9 on each one of the setting arms b_1, b_2 . . . b_9. Said arms are all positioned in the same plane, the setting studs d_1, d_2 . . . d_9 being then distributed along an arcuate line each in front of the mouth of one of the slots s_1, s_2 . . . s_9 on the cam disk 191 which is in its setting position. Figs. 36, 37 show the key corresponding to the numeral nine together with the appertaining setting arm b_9, in side elevation and in top view respectively. Each of the keys 30 and 30' respectively is by a link 192 jointedly

connected to the one leg of a yoke 194 pivoted on the shafts 193 and 193' respectively the opposite leg of said yoke being provided with an arm 195 from the free end of which the appertaining setting arm b_1, b_2 . . . b_9 extends forward in the shape of an arcuate projection. The different yokes 194 grip over each other in such a manner that the different setting arms upon the actuation of the key may move freely independent of each other.

Fig. 38 shows an application of the setting arrangement described in connection with the embodiment according to Figs. 1 to 33 in an adding machine having a setting mechanism disposed in a carriage and comprising a number of toothed wheels 196. The setting studs 32, 32' on the setting arms 31, 31', which latter may be adapted to be actuated by means of keys, in above described manner cooperate with radial slots 33, 33' in the edge of disks 197 which are coaxially and rigidly connected to the appertaining setting toothed wheel. In certain cases the slots may be disposed in the toothed wheels proper then each forming internal extensions of one tooth space. The set number is transferred in known manner (the Swedish Patent No. 61,735) to a swingably disposed calculating mechanism 198 and also to a typing mechanism 199 by means of a number of parallel toothed racks 200 which are adapted to be shifted out of and into engagement with the setting mechanism or the calculating mechanism, respectively. The setting arrangement having two setting arms 31, 31' may of course also in such adding machines be replaced by the setting arrangement shown in Figs. 34 to 37 having a plurality of setting arms cooperating with a corresponding number of slots in the toothed wheels.

Figs. 39, 40 show an application of the invention in an Odhner machine in which the cam disks in usual manner are adjustable by means of arms or levers 202 projecting through slots 201. Before the setting, all levers 202 are positioned in an intermediate position nearly at the middle of the slots 201. Evidently the manual movements required in the setting operation will only be about one half of those required in the ordinary arrangement. By the shown embodiment the further advantage is gained that two of the setting positions, that is, those corresponding to the numerals 4 and 9, constitute stop positions for the levers 202 whereby the setting is further facilitated. The cam disks may otherwise be designed in similar manner as above described. The slot in each cam disk is thus in the shown embodiment constituted by an intermediate arc 26 having a smaller radius and extending on both sides into end portions 25, 25' having larger and mutually equal radii. The adjustable teeth may also be disposed in the same manner as above described in that, by way of example, four of the teeth may be adapted to be set individually whereas five teeth may be adapted to be shifted in common and formed at the circumference of a toothed sector pivotally mounted on the setting disk.

The invention is, of course, not restricted to the shown embodiment but may be modified in different manners. By way of example, the tens keyboard may be replaced by a complete keyboard having ten teeth for each setting disk, in which case the setting mechanism evidently need not be displaced during the setting.

Instead of forming the setting members 31, 31' in the shape of levers they may be formed also in other manners, by way of example as toothed arcs or toothed racks.

The invention may, of course, also be applied in so called cash-registers or other similar apparatus provided with calculating mechanisms.

I claim:

1. In a calculating machine, in combination, a setting disc, a number of adjustable teeth mounted thereon, a cam disc mounted rotatably in coaxial relation to the setting disc, and means cooperating with said cam disc for setting some of the teeth in common upon rotation of the cam disc in one direction from a normal position and for setting the other teeth individually in succession upon rotation of the cam disc in the other direction from the normal position.

2. In a calculating machine in combination, a setting disc, a number of adjustable teeth mounted thereon, a cam disc mounted rotatably in coaxial relation to the setting disc, and means cooperating with said cam disc for setting some of the teeth in common upon rotation of the cam disc in one direction from a normal position and for setting the other teeth individually in succession upon rotation of the cam disc in either direction from the normal position.

3. In a calculating machine in combination, a setting disc, a number of adjustable teeth rigidly connected together so as to form a toothed sector mounted thereon, a number of other teeth mounted on the setting disc in such a manner as to be adjustable individually, a cam disc mounted rotatably in coaxial relation to the setting disc, means cooperating with the cam disc for setting said toothed sector into operative position upon rotation of the cam disc in one direction from a normal position, and means cooperating with the cam disc for setting the other teeth in succession upon rotation of the cam disc in opposite direction from its normal position.

4. In a calculating machine in combination, a setting disc, a toothed sector comprising five teeth adjustably mounted in the setting disc, four teeth mounted on the setting disc in such manner as to be adjustable individually, a cam disc mounted rotatably in coaxial relation to the setting disc, means cooperating with the cam disc for setting the toothed sector into operative position upon rotation of the cam disc in one direction from normal position and for setting the four other teeth in succession upon further rotation in the same direction, and means cooperating with the cam disc for setting the teeth last mentioned in succession upon rotation of the cam disc in opposite direction from the normal position.

5. In a calculating machine in combination, a setting disc, a number of adjustable teeth mounted thereon, a cam disc mounted rotatably in coaxial relation to the setting disc, a setting device adapted upon operation to engage the cam disc at the circumference, a key board comprising different groups of keys, means under the control of one of said groups of keys for rotating the cam disc through the medium of said setting device in one direction from a normal position, and means under the control of another of said groups of keys for rotating the cam disc through the medium of the setting device in the opposite direction from the normal position.

6. In a calculating machine, the combination of accumulating mechanism comprising a toothed wheel, differential actuating means therefor comprising a rotatable member having an actuating rack pivoted thereto by a pivot arm of fixed

length, and means for oscillating said rack in the plane of said wheel by moving it about said pivot.

7. In a calculating machine, in combination, a setting disc, a number of adjustable teeth mounted thereon, a cam disc mounted rotatably in coaxial relation to the setting disc, and means cooperating with said cam disc operative to set only some of the teeth upon relative rotation of the cam disc with respect to the setting disc in one direction from the normal position of the cam disc relative to the setting disc and to set all of the teeth upon relative rotation of the cam disc with respect to the setting disc in the opposite direction from said normal position.

8. In a calculating machine, in combination, a setting disc, a number of adjustable teeth mounted thereon, a cam disc having slots in the edge thereof and mounted rotatably in coaxial relation to the setting disc, a setting device comprising two swingable arms operative to engage said slots in the cam disc, a key board comprising different groups of keys, means operative by one of said groups of keys for swinging one of said arms to rotate said cam disc in one direction from a normal position, and means operative by another of said groups of keys for swinging the other of said arms to rotate said cam disc in the opposite direction from the normal position.

9. In a calculating machine, item setting mechanism including a movable carriage, a plurality of disc units mounted in said carriage, said disc units including discs having adjustable teeth, a key board, set up means under control of said key board adapted to act on the disc units to move said teeth, means for moving the carriage in a given direction step by step to align the disc units successively with the set up means, a shaft arranged parallel with said given direction of carriage movement, a revolutions counter actuator mounted on and axially movable on said shaft, a rack member swingably mounted on said shaft and movable axially thereon with said revolutions counter actuator, a projection on said carriage adapted for engagement with said rack member, a slotted arm attached to said rack member, a rod passing through said slot, and means to move said rod to swing said slotted arm so as to swing said rack member into engagement with the projection on the carriage.

10. In a calculating machine, in combination, a setting disc having adjustable digit-representing elements, a rotatably mounted member associated with said disc, means for rotating said member in one direction to set up certain digit-representing elements in said disc and for rotating said member in the opposite direction to set up other digit-representing elements in said disc, two resetting arms rotatably mounted on opposite sides of the axis of said member, an abutment on said member, and means for rotating said arms simultaneously toward said abutment to restore said member to its initial position regardless of the direction in which it was rotated.

11. In a calculating machine, in combination, a plurality of setting discs having adjustable digit-representing elements, a plurality of rotatably mounted members each appertaining to one of said discs, a movable carriage supporting said discs and members, means for rotating said members in one direction to set up certain digit-representing elements in the appertaining discs and for rotating said members in the opposite direction to set up other digit-representing elements in the appertaining discs, means for moving said carriage step by step in given direction to bring said members successively into operative position in relation to the rotating means, two resetting arms for each of said members rotatably mounted on opposite sides of the axis of said members, a resetting abutment on each of said members, and means for rotating said arms simultaneously towards said abutments to restore said members to their initial positions regardless of the directions in which they were rotated.

12. In a calculating machine, in combination, a plurality of setting discs having adjustable digit-representing elements, a plurality of rotatably mounted members each appertaining to one of said discs, a movable carriage supporting said discs and members, means for rotating said members in one direction to set up certain digit-representing elements in the appertaining discs and for rotating said members in the opposite direction to set up other digit-representing elements in the appertaining discs, means for moving said carriage step by step in given direction to bring said members successively into operative position in relation to the rotating means, a pair of parallel shafts disposed on opposite sides of the axis of said members, means connecting said shafts so that rotation of one causes rotation of the other in the opposite direction, a resetting arm for each of said members mounted on each of said shafts, a resetting abutment on each of said members, and means for rotating one of said shafts so that said arms are rotated simultaneously towards said abutments to restore said members to their initial positions regardless of the direction in which they were rotated.

13. In a calculating machine, in combination, a plurality of setting discs having adjustable digit-representing elements, a plurality of rotatably mounted members each appertaining to one of said discs, a movable carriage supporting said discs and members, means for rotating said members in one direction to set up certain digit-representing elements in the appertaining discs and for rotating said members in the opposite direction to set up other digit-representing elements in the appertaining discs, means for moving said carriage step by step in given direction to bring said members successively into operative position in relation to said means for rotating said members, a revolutions counter actuator displaceable parallel to said given direction, shiftable means for connecting said actuator with said movable carriage at the end of the setting operation, zeroizing means for said disc units, means operable by said zeroizing means for disengaging the connection between said actuator and said carriage, and means operable upon return of the carriage for restoring said actuator to initial position.

14. In a calculating machine, in combination, a plurality of setting discs having adjustable digit-representing elements, a plurality of rotatably mounted members each appertaining to one of said discs, a movable carriage supporting said discs and members, means for rotating said members in one direction to set up certain digit-representing elements in the appertaining discs and for rotating said members in the opposite direction to set up other digit-representing elements in the appertaining discs, means for moving said carriage step by step in given direction to bring said member successively into operative position in relation to said means for rotating said members, a revolutions counter actuator displaceable parallel to said given direction, shift-

able means for connecting said actuator with said movable carriage at the end of the setting operation, zeroizing means for said disc units, means operable by said zeroizing means for disengaging the connection between said actuator and said carriage, and means operable upon return of the carriage for restoring said actuator to initial position, comprising a projection mounted on said carriage and an abutment connected to said actuator and adapted to be engaged by said projection.

15. In a calculating machine, item setting mechanism including a movable carriage, a plurality of disc units mounted in said carriage, said disc units including discs having adjustable teeth, a key board, set up means under control of said key board adapted to act on the disc units to move said teeth, means for moving the carriage in a given direction step by step to align the disc units successively with the set up means, a shaft arranged parallel with said given direction of carriage movement, a revolutions counter actuator mounted on and axially movable on said shaft, a rack member swingably mounted on said shaft and movable axially thereon with said projection, a projection on said carriage adapted for engagement with said rack member, and means for swinging said rack member around said shaft to bring it into engagement with the projection on said carriage.

16. In a calculating machine, item setting mechanism including a movable carriage, a plurality of disc units mounted in said carriage, said disc units including discs having adjustable teeth, a key board, set up means under control of said key board adapted to act on the disc units to move said teeth, means under control of the keyboard for moving the carriage in a given direction step by step to align the disc units successively with the set up means, a revolutions counting mechanism, an actuator for said mechanism displaceable parallel to said given direction, shiftable means for connecting said actuator with said movable carriage at the end of the setting operation, said shiftable connecting means comprising coupling elements comprising a toothed rack extending parallel to said given direction of movement and an opposing tooth, said coupling elements adapted to be brought into mutual engagement by the shifting of one element perpendicularly to said given direction of movement, means comprising a spring pawl for holding said actuator in starting position, and means for releasing said pawl and for controlling the carriage moving means independently of the key board.

17. In a calculating machine in combination, a setting disk, a number of adjustable teeth mounted thereon, a cam disk mounted rotatably in coaxial relation to the setting disk, and means cooperating with said cam disk operative to render less than all of the teeth effective upon relative rotation of the cam disk with respect to the setting disk in one direction from the normal position of the cam disk relative to the setting disk and to render all of the teeth effective upon relative rotation of the cam disk with respect to the setting disk in the opposite direction from said normal position.

18. In a calculating machine, actuating mechanism comprising individually adjustable teeth and an adjustable group of teeth having fixed relation to each other, and adjusting means comprising a single member provided with cam means for moving said teeth in a single plane.

19. In a calculating machine, actuating mechanism comprising individually adjustable teeth, an adjustable group of teeth having fixed relation to each other, and means movable in one direction to set one or more of the individually adjustable teeth and movable in another direction to set said group of teeth and none or one or more of the individually adjustable teeth.

20. In a calculating machine, actuating mechanism comprising individually adjustable teeth, an adjustable group of teeth having fixed relation to each other, and means rotatable in one direction to set one or more of the individually adjustable teeth and rotatable in the opposite direction to set said group of teeth and none or one or more of the individually adjustable teeth.

21. In a calculating machine, actuating mechanism comprising less than nine and at least four individually adjustable teeth, an adjustable group of teeth having fixed relation to each other, the number of teeth in said group being the difference between nine and the number of individually adjustable teeth, and adjusting means comprising a single member provided with cam means for selectively adjusting said teeth.

22. In a calculating machine, actuating mechanism comprising four individually adjustable teeth, an adjustable group of five teeth having fixed relation to each other, and adjusting means comprising a single member provided with cam means for selectively adjusting said teeth.

23. In a calculating machine, a rotatable setting disk having a slot therein, an arm eccentrically pivoted on one side of said disk and extending through said slot and having a portion on the other side of said disk, and teeth on the portion of said arm on the other side of the disk.

24. In a calculating machine, a rotatable setting disk having a slot therein, an arm eccentrically pivoted on one side of said disk and extending through said slot and having a portion on the other side of said disk, and teeth on the portion of said arm on the other side of the disk, said arm being movable parallel to said disk.

25. In a calculating machine, the combination of accumulating mechanism comprising a toothed wheel mounted to rotate about a first axis, differential actuating means therefor comprising a rotatable member mounted to rotate about a second axis parallel to the first axis, an actuating rack pivotally mounted by an arm of fixed length on said rotatable member about a third axis parallel to the first and second axes and adapted to engage said toothed wheel, and means for oscillating said rack between retracted position and engagement position.

26. In a calculating machine, the combination of accumulating mechanism comprising a toothed wheel mounted to rotate about a first axis, differential actuating means therefor comprising a rotatable member mounted to rotate about a second axis parallel to the first axis, an actuating rack pivotally mounted on said rotatable member about a third axis parallel to the first and second axes and adapted to engage said toothed wheel, means for oscillating said rack between retracted position and engagement position, and additional means carried by said rotatable member and cooperating with said rack for selectively actuating said toothed wheel in increments of from one to nine.

27. In a calculating machine, the combination of accumulating mechanism comprising a toothed wheel mounted to rotate about a first axis, differential actuating means therefor com-

prising a rotatable member mounted to rotate about a second axis parallel to the first axis, an actuating rack pivotally mounted on said rotatable member about a third axis parallel to the first and second axes and adapted to engage said toothed wheel, means for oscillating said rack between retracted position and engagement position, and additional means comprising individually adjustable teeth and cooperating with said rack for selectively actuating said toothed wheel in increments of from one to nine.

28. In a calculating machine, the combination of accumulating mechanism comprising a toothed wheel mounted to rotate about a first axis, differential actuating means therefor comprising a rotatable member mounted to rotate about a second axis parallel to the first axis, an actuating rack having not more than five teeth, said rack being pivotally mounted by an arm of fixed length on said rotatable member about a third axis parallel to the first and second axes and adapted to engage said toothed wheel, and means for oscillating said rack between retracted and engagement position.

29. In a calculating machine, the combination of accumulating mechanism comprising a toothed wheel mounted to rotate about a first axis, differential actuating means therefor comprising a rotatable member mounted to rotate about a second axis parallel to the first axis, an actuating rack having five teeth, said rack being pivotally mounted by an arm of fixed length on said rotatable member about a third axis parallel to the first and second axes and adapted to engage said toothed wheel, and means for oscillating said rack between retracted position and engagement position.

30. In a calculating machine, the combination of accumulating mechanism comprising a toothed wheel mounted to rotate about a first axis, differential actuating means therefor comprising a rotatable member mounted to rotate about a second axis parallel to the first axis, an actuating rack having not more than five teeth, said rack being pivotally mounted on said rotatable member about a third axis parallel to the first and second axes and adapted to engage said toothed wheel, means for oscillating said rack between retarded position and engagement position, and additional means carried by said rotatable member comprising individual adjustable teeth cooperating with said rack for differentially actuating said toothed wheel, the number of said individually adjustable teeth being the difference between nine and the number of teeth on said rack.

31. In a calculating machine, the combination of accumulating mechanism comprising a toothed wheel mounted to rotate about a first axis, differential actuating means therefor comprising a rotatable member mounted to rotate about a second axis parallel to the first axis, an actuating rack having five teeth, said rack being pivotally mounted on said rotatable member about a third axis parallel to the first and second axes and adapted to engage said toothed wheel, means for oscillating said rack between retracted position and engagement position, and additional means carried by said rotatable member and cooperating with said rack for differentially actuating said toothed wheel comprising four individually adjustable teeth.

32. In a calculating machine, the combination of accumulating mechanism comprising a toothed wheel mounted to rotate about a given axis, differential actuating means therefor comprising a rotatable member mounted to rotate about an axis parallel to the first-mentioned axis, said member having an actuating rack pivoted thereto by a pivot arm of fixed length, said rack being adapted to engage said toothed wheel, and means for oscillating said rack in a plane perpendicular to said axes by moving it about said pivot.

33. In a calculating machine, the combination of accumulating mechanism comprising a toothed wheel mounted to rotate about a given axis, differential actuating means therefor comprising a rotatable member mounted to rotate about an axis parallel to the first-mentioned axis, said member having an actuating rack pivoted thereto by a pivot arm of fixed length, a plurality of individually adjustable teeth carried by said member, said rack and said teeth being adapted to differentially actuate said toothed wheel, and means for adjusting said teeth and for oscillating said rack by moving it about said pivot in a plane perpendicular to said axes.

34. In a calculating machine, the combination of accumulating mechanism comprising a toothed wheel mounted to rotate about a given axis, differential actuating means therefor comprising a rotatable member mounted to rotate about an axis parallel to the first-mentioned axis, an actuating rack pivotally mounted on said member by an arm of fixed length, a plurality of individually adjustable teeth carried by said member, said rack and said teeth being adapted to differentially actuate said toothed wheel, a cam disk mounted rotatably in coaxial relation to said member, and means cooperating with said cam disk operative to adjust said teeth and to oscillate said rack by moving it about said pivot in a plane perpendicular to said axes.

35. In a calculating machine, the combination of accumulating mechanism comprising a toothed wheel mounted to rotate about a given axis, differential actuating means therefor comprising a rotatable member mounted to rotate about an axis parallel to the first-mentioned axis, an actuating rack pivotally mounted on said member by an arm of fixed length, a plurality of individually adjustable teeth carried by said member, said rack and said teeth being adapted to differentially actuate said toothed wheel, a cam disk mounted rotatably in coaxial relation to said member, and means cooperating with said cam disk operative to adjust said teeth upon rotation of the cam disk with respect to said member in one direction from normal position of the cam disk relative to said member and to adjust said teeth and to oscillate said rack by moving it about said pivot in a plane perpendicular to said axis upon rotation of the cam disk in the opposite direction from said normal position.

36. In a calculating machine, the combination of accumulating mechanism comprising a toothed wheel mounted to rotate about a given axis, differential actuating means therefor comprising a rotatable member mounted to rotate about an axis parallel to the first-mentioned axis, an actuating rack pivotally mounted on said member by an arm of fixed length, a plurality of individually adjustable teeth carried by said member, said rack and said teeth being adapted to differentially actuate said toothed wheel, a cam disk having slots in the edge thereof and mounted rotatably in coaxial relation to said member, a setting device comprising two swingable arms operative to engage said slots in the cam disk, a keyboard comprising different groups of keys,

means operable by one of said groups of keys for swinging one of said arms to rotate said cam disk in one direction from a normal position to adjust said teeth, and means operative by another of said groups of keys for swinging the other of said arms to rotate said cam disk in the opposite direction from the normal position to adjust said teeth and to oscillate said rack by moving it about said pivot in a plane perpendicular to said axes.

37. In a calculating machine of the ten-key type, a stationary results register including numeral wheels, a stationary revolutions counter including numeral wheels, a laterally movable carriage, actuating mechanism for said results register carried by said carriage and including a plurality of discs and radially displaceable members mounted on said discs, laterally movable means for engaging and rotating the wheels of said revolutions counter, and means for selectively coupling said laterally movable means to said carriage for lateral movement therewith.

38. In a calculating machine of the ten-key type, a stationary results register including numeral wheels, a stationary revolutions counter including numeral wheels, a laterally movable carriage, actuating mechanism for said results register carried by said carriage and including a plurality of discs and radially displaceable members mounted on said discs, a laterally movable single tooth for engaging and rotating the wheels of said revolutions counter, and means for selectively coupling said tooth to said carriage for lateral movement therewith to bring said tooth into registry with different wheels of said revolutions counter.

39. In a calculating machine of the ten-key type, a stationary results register including numeral wheels, a stationary revolutions counter including numeral wheels, a laterally movable carriage, actuating mechanism for said results register carried by said carriage and including a plurality of discs and radially displaceable members mounted on said discs, a laterally movable single tooth for engaging and rotating the wheels of said revolutions counter, a projection on said carriage, and a shiftable rack connected for lateral movement with said tooth and engageable with said projection for selectively coupling said tooth with said carriage for lateral movement therewith to bring said tooth into registry with different wheels of said revolutions counter.

40. In a calculating machine of the ten-key type, a stationary results register including numeral wheels, a stationary revolutions counter including numeral wheels, a laterally movable carriage, actuating mechanism for said results register carried by said carriage and including a plurality of discs and radially displaceable members mounted on said discs, a laterally movable single tooth for engaging and rotating the wheels of said revolutions counter, a projection on said carriage, a rack connected for lateral movement with said tooth, and a key for shifting said rack into engagement with said projection for selectively coupling said tooth with said carriage for lateral movement therewith to bring said tooth into registry with different wheels of said revolutions counter.

41. In a calculating machine of the ten-key type, a stationary results register including numeral wheels, a stationary revolutions counter including numeral wheels, a laterally movable carriage, actuating mechanism for said results register carried by said carriage and including a plurality of discs and radially displaceable members mounted on said discs, a stationary key board, means operable by said key board for displacing said members to set up digits, means for moving said carriage laterally as each digit is set up, means for moving said carriage laterally into registry with different wheels of said results register after the digits have been set up, laterally movable means for engaging and rotating the wheels of said revolutions counter, and means for selectively coupling said laterally movable means to said carriage for lateral movement therewith.

42. In a calculating machine, in combination, a movable setting disc, a number of movable teeth mounted thereon, a selecting member associated with said setting disc and mounted for movement in opposite directions, means for selectively moving said member in opposite directions, said member being operative to render less than all of the teeth effective upon movement of said member in one direction and operative to render all the teeth effective upon movement in the opposite direction, and means for restraining movement of said setting disc during movement of said selecting member.

43. In a calculating machine, a setting disc, two groups of adjustable teeth mounted thereon, and a cam disc mounted rotatably in coaxial relation to the setting disc operative to render effective teeth of one group upon rotation of the cam disc with respect to the setting disc in one direction from the normal position of the cam disc relative to the setting disc and to render effective teeth of the other group upon rotation of the cam disc with respect to the setting disc in the opposite direction from said normal position.

44. In a calculating machine, a setting disc, a number of adjustable teeth mounted thereon, and a cam disc mounted rotatably in coaxial relation to the setting disc operative to render effective from one to four teeth upon rotation of the cam disc with respect to the setting disc in one direction from the normal position of the cam disc relative to the setting disc and to render effective from five to nine teeth upon rotation of the cam disc with respect to the setting disc in the opposite direction from said normal position.

45. In a calculating machine, a movable setting disc, two groups of movable teeth mounted thereon, a selecting member associated with said setting disk and mounted for movement in opposite directions, means for selectively moving said member in opposite directions, said member being operative to render effective teeth of one group upon movement of said member in one direction and operative to render effective teeth of the other group upon movement in the opposite direction, and means for restraining movement of said setting disc during movement of said selecting member.

46. In a calculating machine, a movable setting disc, a number of movable teeth mounted thereon, a selecting member associated with said setting disc and mounted for movement in opposite directions, means for selectively moving said member in opposite directions, said member being operative to render effective from one to four teeth upon movement of said member in one direction and operative to render effective from five to nine teeth upon movement in the opposite direction, and means for restraining movement of said setting disc during movement of said selecting member.

47. An arrangement as claimed in claim 17, characterized in that an arcuate indicator member is connected with the cam disc carrying the digits 0 through 9 arranged circumferentially thereon, said digits being so disposed as to form two series of consecutive digits, said series running in numerical order and in opposite directions from an intermediate point on the indicator member.

48. An arrangement as claimed in claim 17, characterized in that an arcuate indicator member is connected with the cam disc carrying the digits 0 through 9 arranged circumferentially thereon, said digits being so disposed as to form two series comprising the digits 0 through 4 and 5 through 9, respectively, said series running in numerical order and in opposite directions from an intermediate point on the indicator member.

49. In a calculating machine, in combination, a movable setting disc, two groups of movable teeth mounted thereon, a selecting member associated with said setting disc and mounted for movement in opposite directions, means for selectively moving said member in opposite directions, said member being operative to move teeth in one of said groups upon movement of said member in one direction and operative to move teeth in both groups in common upon movement in the opposite direction, and means for restraining movement of said setting disc during movement of said selecting member.

50. In a calculating machine, actuating mechanism comprising individually adjustable teeth and an adjustable group of teeth having fixed relation to each other, said teeth having a total of nine, and adjusting means comprising a single member provided with cam means for moving said teeth in a single plane.

51. In a rotatable actuating device for a computing machine, a plurality of setting discs having adjustable teeth, a number of cam discs each appertaining to one of said setting discs for adjusting the teeth thereof, a setting device for operating said cam discs, a carriage supporting said setting discs and said cam discs, means for displacing said carriage stepwise in axial direction so as to bring said cam discs in succession into operative position in relation to said setting device, pawls swingably mounted on the setting discs and engageable with said cam discs to lock each cam disc against rotation with respect to the appertaining setting disc, each of said pawls including an arm extending to the periphery of the setting disc, and a bar extending parallel to the direction of the stepwise motion of the carriage mounted adjacent to said periphery and in position to be contacted by the ends of certain of said arms so as to hold the pawls thereof in locking engagement with the appertaining cam discs, said bar terminating adjacent to said setting device whereby the bar contacts only the arms of the pawls appertaining to the cam discs which have not been operated by said setting device.

52. In a rotatable actuating device for a computing machine, a plurality of setting discs having adjustable teeth, a number of cam discs each appertaining to one of said setting discs for adjusting the teeth thereof, a setting device for operating said cam discs, a carriage supporting said setting discs and said cam discs, means for displacing said carriage stepwise in axial direction so as to bring said cam discs in succession into operative position in relation to said setting device, pawls swingably mounted on the setting discs and engageable with said cam discs to lock each cam disc against rotation with respect to the appertaining setting disc, each of said pawls including an arm extending to the periphery of the setting disc, a pivotally mounted locking lever mounted adjacent to said periphery and in position to be contacted by the end of the arm of the pawl appertaining to the cam disc which is in operative position in relation to said setting device, a plurality of keys for operating said setting device, a member shiftable by depression of any of said keys, and an abutment carried by said member and normally holding said locking lever in contact with said arm and shiftable with said member to release said locking lever.

53. In a rotatable actuating device for a computing machine, a plurality of setting discs having adjustable teeth, a number of cam discs each appertaining to one of said setting discs for adjusting the teeth thereof, a setting device for operating said cam disc, a carriage supporting said setting discs and said cam discs, means for displacing said carriage stepwise in axial direction so as to bring said cam discs in succession into operative position in relation to said setting device, pawls swingably mounted on the setting discs and engageable with said cam discs to lock each cam disc against rotation with respect to the appertaining setting disc, each of said pawls including an arm extending to the periphery of the setting disc, a pivotally mounted locking lever mounted adjacent to said periphery and in position to be contacted by the end of the arm of the pawl appertaining to the cam disc which is in operative position in relation to said setting device, a plurality of keys for operating said setting device, a zero key, a member shiftable by depression of any of said keys, an abutment carried by said member and normally holding said locking lever in contact with said arm and shiftable with said member to release said locking lever, and an abutment carried by said zero key and movable by depression of said zero key to contact said locking lever for holding the locking lever in contact with said arm.

54. In a rotatable actuating device for a computing machine, a plurality of setting discs having adjustable teeth, a number of cam discs each appertaining to one of said setting discs for adjusting the teeth thereof, a setting device for operating said cam discs, a carriage supporting said setting discs and said cam discs, means for displacing said carriage stepwise in axial direction so as to bring said cam discs in succession into operative position in relation to said setting device, pawls swingably mounted on the setting discs and engageable with said cam discs to lock each cam disc against rotation with respect to the appertaining setting disc, each of said pawls including an arm extending to adjacent the center of the setting disc, and a bar passing in axial direction through and supported by said setting discs, said bar being formed with notches normally in alignment with the arms of the pawls appertaining to the cam discs which have not been operated by said setting device, the remainder of said bar being disposed so as to contact the arms of the pawls appertaining to the cam discs which have been operated by said setting device for holding the last mentioned pawls in locking position.

55. In a rotatable actuating device for a computing machine, a plurality of setting discs having adjustable teeth, a number of cam discs each

appertaining to one of said setting discs for adjusting the teeth thereof, a setting device for operating said cam discs, a carriage supporting said setting discs and said cam discs, means for displacing said carriage stepwise in axial direction so as to bring said cam discs in succession into operative position in relation to said setting device, pawls swingably mounted on the setting discs and engageable with said cam discs to lock each cam disc against rotation with respect to the appertaining setting disc, each of said pawls including an arm extending to adjacent the center of the setting disc, a longitudinally shiftable bar passing in axial direction through and supported by said setting discs, said bar being formed with notches normally in alignment with the arms of the pawls appertaining to the cam discs which have not been operated by said setting device, the remainder of said bar being disposed so as to contact the arms of the pawls appertaining to the cam discs which have been operated by said setting device for holding the last mentioned pawls in locking position, a rotatable member for rotating said carriage and the cam and setting discs and said bar as a unit, and means operable by rotation of said member for shifting said bar longitudinally so as to move the notches therein out of alignment with the arms, whereby said bar contacts all of the arms to hold the pawls in locking position during rotation of the carriage.

KARL VIKTOR RUDIN.