B. C. M. BEHR.

THOMAS CALCULATING MACHINE WITH DEVICE FOR MOVING THE KEYS.

APPLICATION FILED APR. 30, 1910.

1,034,756.

Patented Aug. 6, 1912.

3 SHEETS—SHEET 1.

Fig. 1.

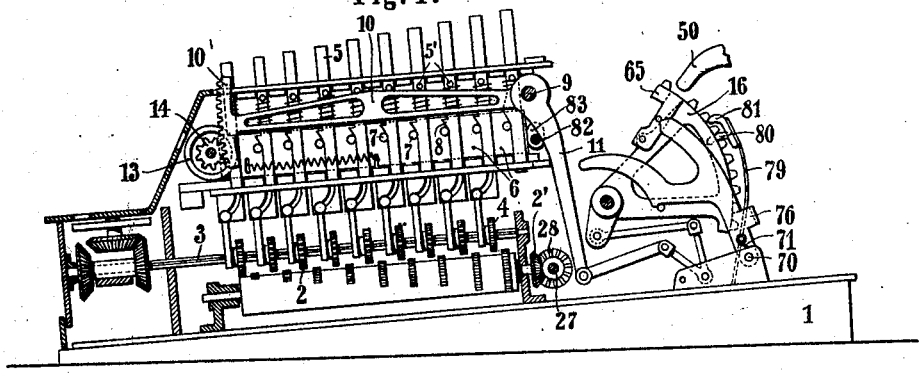
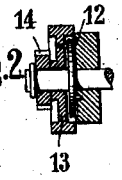


Fig. 2.



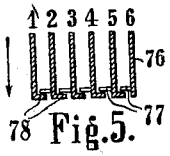
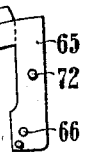


Fig. 5.

Fig. 6.



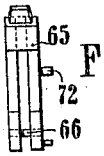


Fig. 7.

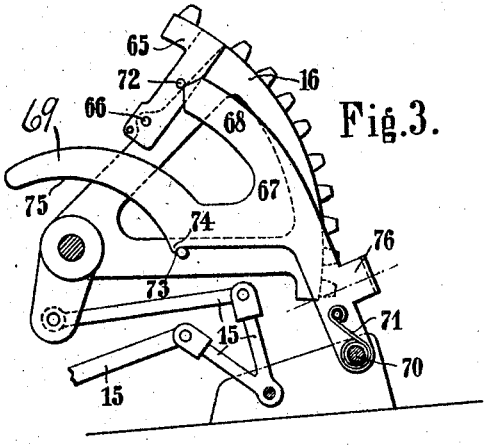


Fig. 3.

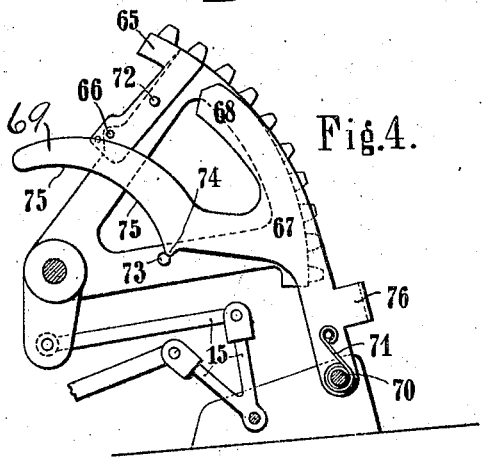


Fig. 4.

Fig. 8.

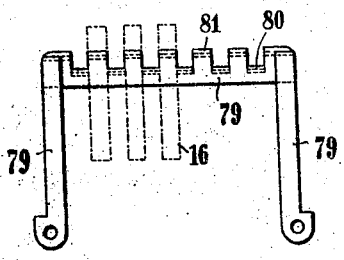
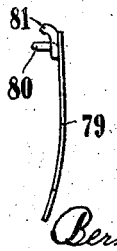


Fig. 9.



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3 SHEETS—SHEET 2.

Fig.10

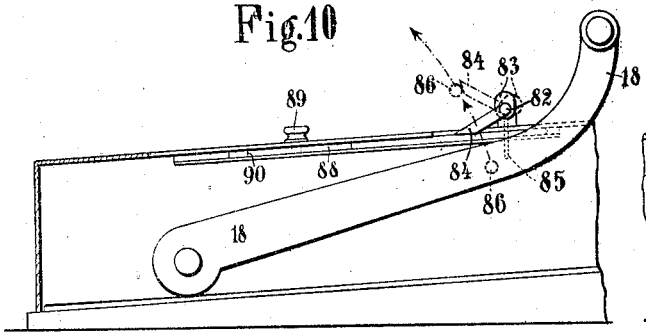


Fig.11

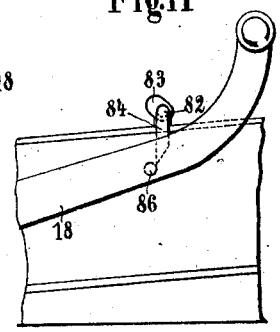
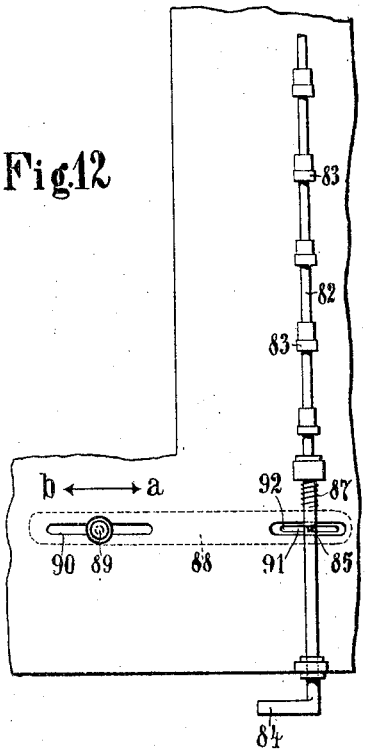


Fig.12



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3 SHEETS—SHEET 3.

Fig.13.

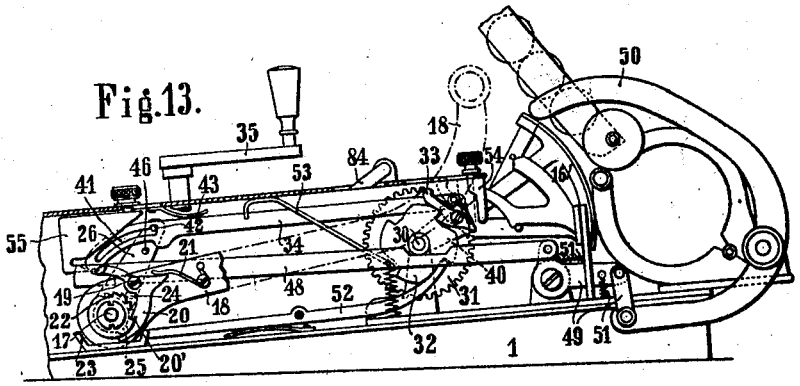


Fig.14.

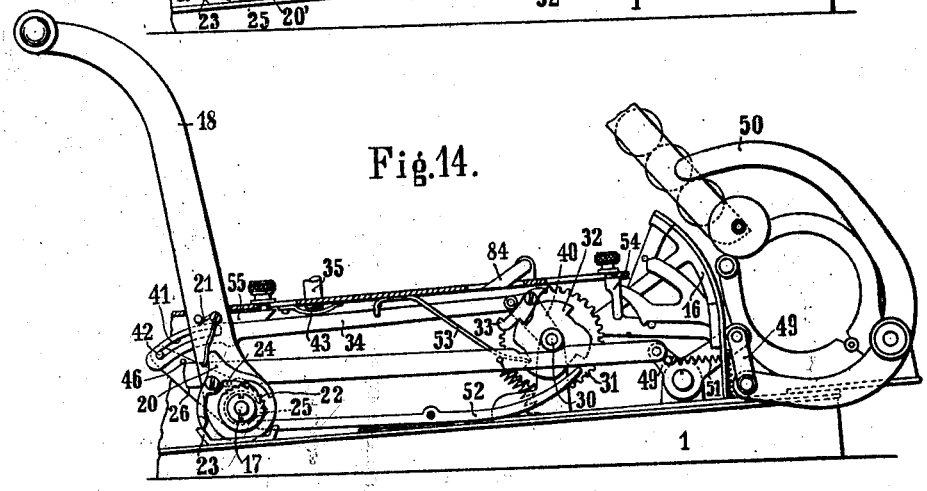


Fig.15.

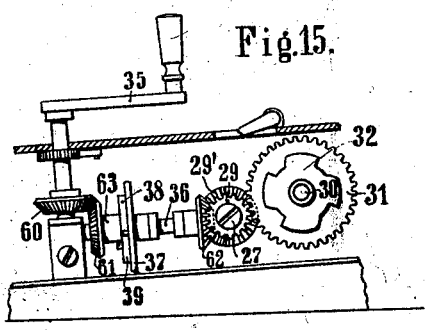


Fig.16.

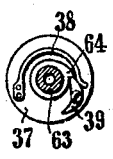
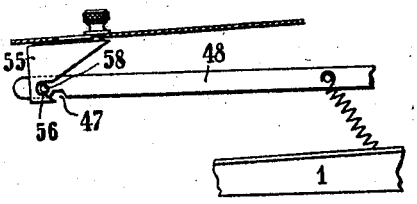


Fig.17.



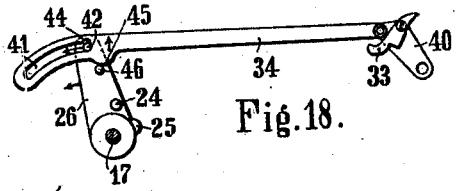


Fig.18.

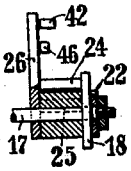


Fig.19.

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THOMAS CALCULATING-MACHINE WITH DEVICE FOR MOVING THE KEYS.

1,034,756. Specification of Letters Patent. Patented Aug. 6, 1912.

Application filed April 30, 1910. Serial No. 558,715.

To all whom it may concern:

Be it known that I, BERNHARD CARL M. BEHR, a subject of the German Emperor, and resident of Dresden, Germany, have invented certain new and useful Improvements in Thomas Calculating-Machines with Devices for Moving the Keys, of which the following is a specification.

This invention relates to a Thomas calculating machine having a keyboard and a printing mechanism, the calculating mechanism being actuated by a crank and the printing mechanism being actuated by means of a special printing lever, said last-named mechanism serving for printing the amounts to which the machine has been adjusted. In this calculating machine the printing lever is actuated with the calculating mechanism and this connection is releasable as well as the connection of the printing mechanism with the printing lever. Furthermore, a coupling device is inserted in the connection between the crank and the calculating mechanism, said coupling device preventing the crank from being influenced or controlled by the printing lever when the calculating mechanism is operated, so that after releasing the connection between the printing lever and calculating mechanism, the calculating mechanism may be actuated by the crank, independently of the printing mechanism, and the printing mechanism may be actuated by the printing lever, independently of the calculating mechanism. Therefore, the calculating and printing mechanisms may be actuated together, by means of the printing lever, or after the connection between printing lever and printing mechanism is interrupted, the calculating mechanism alone may be actuated.

The printing mechanism comprises a plurality of sectors, which are provided with printing type, said sectors being connected by means of levers and links with the lower ends of the bell crank lever arms which are actuated by depression of the keys. The zero types are disposed on separate sectors, so that they are lifted off from the type carriers when the type carriers are in inoperative positions. When these segments for the zero types are adjusted, the type are positioned in the writing line. This is effected by means of coupling claws which are attached to the various sectors, said claws being tilted by means of the lever segments so that the zero sectors lose their hold. The arrangement of coupling claws in connection with the single type carriers or sectors, has the advantage that the force required for depression of the keys is uniform, no matter whether zeros or other type characters are positioned. The immovability of the zero type sectors permits of printing a zero at the right hand side of a cipher which is to be printed without requiring special adjustment of the zero. The zeros at the left hand side of a cipher are left inoperative. If for instance in the one thousand digits of a machine having 9 digit rows a "1" is to be printed, the printed result must show "1000" or should not show 000001 and 000.

The restoration of figures required in the machine is effected by means of a releasing device which frees the locking bars holding the keys in depressed positions. The release is effected by means of a shaft disposed transversely in the rear of the keys, said shaft being provided with cams which shift the locking bar backwardly when the shaft is rotated. The rotation of the shaft is effected by means of the printing lever in the period preceding the final depression of the same, a lug being provided near the free end thereof and which engages a set-off portion of the shaft. A repeating device comprising a slide is provided in the machine and by means of which the set-off portion of the shaft may be lifted manually so that it is beyond the path in which the lug of the printing lever moves, so that said lug cannot engage the shaft. The release of the shaft may also be effected by means of the slide when the machine is operated by the crank to multiply or subtract. As the disconnection of said shaft is possible even after the operation of the lever and the printing operation has taken place, errors can be corrected at the last moment of the operation. The device permits of restoration of single figures as well as of the entire figure when the repeating slide is pulled out by hand. By this means material advantages over known constructions are ob-

tained. For instance when repetition of various groups of figures follow each other, it is not necessary to release the repeating device, but the new group of figures can be printed and the old group of figures can be returned to original position, and furthermore it is possible to reset all of the groups to zero position when the repeating slide is pulled out. This is frequently necessary for example when the amounts of weights are to be added which differ only slightly from each other and wherein only the last digits or fractions thereof vary. The possibility of actuating the repeating slide after the printing has taken place and when the lever of addition has been lifted, affords the advantage of immediate correction of an error without requiring a new adjustment of the slide. In these cases the repeating slide is pulled out and the adding lever is lowered, the machine is switched over to subtracting operation printed in red and the lever is operated again so that the error is corrected almost automatically. If the error would have to be printed first and then be corrected by resetting of the keys, time would be lost together with liability of other mistakes.

Figure 1 is a cross section through the machine; Fig. 2 is a section through the cipher plate; Figs. 3 and 4 are elevations of the printing mechanism and of the type segments, respectively, in various operative positions; Figs. 5, 6 and 7 are details of the printing mechanism; Figs. 8 and 9 are front and side elevations respectively of a device for fixing the adjusted type segments; Figs. 10, 11 and 12 show the device for restoring to zero the amounts to which the machine was adjusted, this restoration being accomplished by means of the printing lever; Figs. 13 and 14 are side elevations of a certain part of the machine showing the same in various positions; Figs. 15 to 19 are other details.

As shown switching drums are mounted in juxtaposition on the base plate 1 and are provided with gear teeth. Setting gears 4 are mounted on the setting shafts 3. The setting gears are displaced on their shaft 3 in a well known way, by depressing the spring controlled keys 5, and are thereby thrown into engagement with the respective gear of the switch or step drums 2. A slide plate 6, is disposed adjacent each bank of keys, said plate being under the control of a spring and having pins 7 for holding the depressed key, said pins projecting over the shoulder 8 of the depressed key.

A bell crank lever 10—11 is located adjacent each bank of keys, the pivotal shaft of said bell crank lever being indicated at 9, a pin 12 attached to each key lever 5, acting upon the horizontal arm 10 of said bell crank lever, so that the gear segment 10′, attached to the free end of said lever, and the end of the arm 11 of the same, are oscillated in accordance with the numerical value of the depressed key. For this purpose the upper operating surface of the lever arm 10 is inclined in opposite directions for the purpose of bringing the amplitude of throw off the lever 10—11 exactly into accordance with said numerical values, even if the keys are depressed simultaneously. The front end of the arm 10 engages the checking gear 13 indirectly, the segment being directly in mesh with a gear 14, mounted on the shaft of the gear 13. The gear 14 is under control of a spiral spring 12, (Fig. 2), which returns the gear 13 to zero position and also returns therefore the lever 10—11 to an elevated position.

The rear arm 11, of the bell crank lever, is connected by means of a system of levers 15, with the printing mechanism, comprising rotary type segments 16, so that in accordance with the numerical value of the key depressed, the respective type segments of the printing mechanism and the type, are adjusted to operative position. On the right hand side of the machine, (Figs. 13 and 14) a printing lever 18 is rotatably mounted on the shaft 17, said lever serving to actuate the printing mechanism for solving problems of addition and subtraction. On the printing lever, a double arm pawl 20 is pivotally mounted by means of the pin 19, said pawl being under the influence of a spring 21 supported by the lever 18. A ratchet tooth 20′ connected with the double pawl 20 prevents the return movement of the printing lever 18 before the stroke of the same is completed, said tooth engaging a gap of the stationary gear 22. Below the ratchet gear 22, a bell shaped member 23 is disposed which acts upon the pawl 20 at the end of each stroke of the printing lever. The mounting of said lever near the pivot 17 carries an extension 26 having the lugs 24 and 25 (Figs. 13, 18 and 19). The rotatory shaft of the switching drum 2 is provided with a bevel gear 2′ engaging a second bevel gear 28 carried on the shaft 27. (Fig. 1). Another gear 29, mounted on the last named shaft 27 and shown in Fig. 15, is in engagement with a gear 31 which is rotated by means of a printing lever, the cam wheel 32 being rigidly connected with the gear 31 and being advanced step by step by means of pawl 33 carried by a bar 34 which is mounted on the arm 26. The operation of the cam wheel 32 takes place with each stroke of the printing lever. (Figs. 13, 14 and 18).

Gear 31 is four times as large as gear 29 of the drive shaft 27, so that each partial rotation of the switching disk coincides with a complete rotation of the drive shaft 27.

It is advantageous to make the connection between the crank 35 of the calculating mechanism, releasable as soon as the printing lever 18 is operated exclusively, for the purpose of preventing simultaneous rotation of the crank, and also for the purpose of making the connection between printing lever and calculating mechanism releasable, so that in multiplying and dividing the crank 35 may be used exclusively, which is better adapted for these calculating operations. The printing lever 18 also is releasably connected with the printing mechanism 16 for the purpose of being able to add or subtract by means of said lever without printing at the same time.

The transmitting shaft 36 communicates the movement of the crank 35 to the driving shaft 27 of the switch drum 2, by means of the couples of bevel gears 60—61 and 62—29'. The bevel gear 62 is rigidly mounted on the shaft 36 while the bevel gear 61 is loosely carried thereon, said last named bevel gear being coupled with the shaft 36, when the crank 35 is connected by said shaft, a sleeve 63 of gear 61 being provided with a cam disk 64 and being rotated by means of a pawl 39 which is disposed on a disk 37 of shaft 36, and which engages said cam disk 64 on account of the pressure exerted by spring 38 upon the pawl 39.

If the machine is actuated with the printing lever 18, and in which actuation the gear 29 of the driving shaft 27 is rotated by means of gear 31 on the cam wheel 32, the connection between disk 37 and cam disk 64 is interrupted and the crank 35 remains stationary.

The connecting rod 34 is connected with one end of an arm 40 (Figs. 13, 14 and 18), which is rotatable about shaft 30 of cam wheel 32. The other end of the connecting rod 34 is provided with an arcuated slot 41 into which a pin 42 on arm 26 projects. The right hand end of the slot is enlarged in an upward direction, as shown at 44, in Fig. 18. A spring 43 (Figs. 13 and 14) normally presses the connecting rod 34 downwardly. The lower edge of the rod 34 is provided with a cam-like projection 45 against which a pin 46 of the arm 26 projects when the printing lever 18 is lifted. The pin 42 rests in the enlargement 44, of slot 41, as long as the printing lever is in an inoperative position and the pawl 33 projects into one of the recesses of the cam wheel 32, as shown in Fig. 13. When the printing lever is lifted to swing from the position shown in Fig. 13, to the position shown in Fig. 14, the connecting rod 34 is pulled to the left as long as pin 42 remains in the enlargement 44 of slot 41, and the cam wheel 32 is therefore rotated by coaction of the pawl 33 until one quarter rotation has been made, the drive shaft 27 making at the same time one complete revolution. During this movement of the printing lever 18, pin 46 of the arm 26 engages the cam-like projection 45 of the connecting rod 34 and raises said rod, thereby freeing the pin 42 from the enlargement 44 in slot 41. (Fig. 18). During the continued movement of the printing lever, pin 42 slides in the slot 41 without moving the rod 34. The lug 24, fastened to the pivotal head of the printing lever 18, enters a recess 47 of a bar 48, displaces said bar to the left and places the printing hammer 50 under tension by means of suitable transmitting elements 49, counteracting the tension of the springs 51. (Fig. 14). When the printing lever is returned to the position shown in Fig. 13, lug 24 leaves the notch 47, of bar 48, and the printing hammer 50 strikes against the types of the segment 16, resuming the original position, (Fig. 14), under the action of the springs 51. At the same time pin 46 passes the cam-like projection 45, of the rod 34, and said rod is pressed downwardly again by the spring 43, so that pin 42, of lever 26, again enters the enlargement 44, in the slot of the rod 34, and displaces said rod 34 toward the right, when the movement of the lever 18 to the right, is continued. In this continued movement, the pawl 33 leaves the recess of cam wheel 32, slides on the circumference of said wheel, and drops into the next recess, shortly before the return movement of the lever is entirely completed.

The zero sectors 65, which are pivotally connected with the type sectors 16, are raised from the other types as long as they are in an inoperative position. Each of the type segments is provided with a clutch finger 67 having projections 68 and 69. These projections are rotatable about the axis 70 and are pressed into the space between the type sectors as long as they are in an inoperative position. The end of finger 68, is tapered or inclined in opposite directions. When the segment is in an idle position, pins 72, on zero type sectors 65, are in engagement with the apex of said finger 68, so that said zero types are spaced from the balance of the printing types of the segments (Fig. 3).

Each of the type segments 16 is provided with a pin 73, serving as a purchase for the lug 74 of the finger 69. When one of the type segments is raised, pin 73 lifts the clutch finger 67, overcoming the tension of spring 71. Pin 72 of the zero sector is released from the apex of finger 68 and recedes, together with the zero type, into the printing line, Fig. 4. When the type segment continues its rotation, pin 73 slowly slides on the edge 75, of the finger 69, and

retains the clutch 67 in a raised position, so that the zero type remains in the printing line.

When the key lever is released, type segment 16 returns to an inoperative position, and pin 73, in its return movement, causes spring 71 to return the clutch 67 into the position shown in Fig. 3. The pins 72 slide upwardly on the inclined edge of finger 68 and the zero sector 65, with its type, is again raised with respect to the type segment. The clutches 67 are provided with lugs 76 (Figs. 3, 4 and 5) said lugs having bent or angle portions 78 which overlap pin 77. (Fig. 5). If a key is depressed, for instance a key in the third row counting from the right hand end, the respective clutch 67 is raised by the key lever and said clutch rocks the end clutch 67, on account of the engagement of the lug 76, with the lug of the end clutch, and said end clutch rocks the first clutch. Therefore all of the zero types, located at the right hand side of the set cipher, will drop into the printing line, while those located at the left hand side of the actuated key remain outside of the printing line. Therefore the zeros to the right of the set cipher will be printed and the zeros at the left hand of the set cipher will not be printed. If the key in the third row is released, not only clutch 67, of the third row of ciphers, but also all of those which are at the right hand side thereof will return to zero position, the respective zero types are raised again.

A resilient comb-shaped element 79 (Fig. 8) provided with teeth 80 and 81, serves for exact setting of the printing type, said element entering with its teeth 80, between the type segments, and with its teeth 81, between the printing types, this entrance being produced by the printing lever a short time before the hammer strikes, and effecting a vertical and horizontal adjustment of the types. When the printing lever is returned, comb 79 releases the type segments. The restoration is effected by the common shaft 82 (Figs. 1, 10, 11 and 12). This shaft is provided with eccentric disks 83 arranged in opposition to the rear edges of the bars 6, which serve for locking the key levers. One end of shaft 82 is bent at 84 and carries a pin 85 which extends downwardly. The bent portion 84 projects into the path of a pin 86 disposed on the printing lever 18. When the printing lever 18 is raised, pin 86 raises the bent portion 84 of the shaft and passes underneath the same without causing a displacement of the transverse bar 6 by the eccentrics 83, which oscillate to the rear. Shaft 82 is controlled by a spring 87 (Fig. 12) which tends to return the shaft toward an inoperative position. When lever 18 is depressed, pin 86 engages the bent portion 84 of shaft 82, and rocks the same with its eccentric disks 83 toward the locking rods or bars 6. These bars are therefore displaced and the pins 7 release the shoulders 8, of the keys 5, so that all of the keys return to zero position. When it is necessary in a calculating operation to repeat the printing of one amount several times in succession, it is necessary to prevent the actuation of the automatic restoring device. For this purpose the shaft 82 is adjusted manually so that restoration of the set parts does not take place when the machine is rotated several times by means of the crank, for multiplying or dividing. For this purpose a slide 88, having a knob 89, which projects outwardly from the machine, is disposed underneath the top plate of the machine. The knob 89 slides in a slot 90, of the plate, and normally occupies a central position in said slot. The slide 88 is provided with a slot 91 at its rear end; a pin 85 on shaft 82 projects into said slot 91, said last-named pin also occupies a central position with respect to said slot as long as it is inoperative. In the inoperative position slide 88 does not control the restoring shaft 82. When the adjusting knob 89 is moved in the direction of the arrow *a*, the left hand end of slot 91 engages the pin 85 and rocks the same toward the right. By this means the eccentric disks 83 are pressed against the locking bars 6 and the locking mechanism is released. The adjusting knob 89 may be mounted resiliently so that it will also return to an inoperative position automatically.

When the machine is to be adjusted for repetition, the adjusting knob 89 is moved in direction of the arrow *b*. It remains in said position on account of frictional engagement. The right hand end 93 of the slot 91, rocks the pin 85 to the left so that the bent portion 84 (Fig. 10) is lifted out of the path of pin 86, on lever 18, and a release of the locking device cannot occur when the printing lever is lowered. When the knob 89 is returning to a central position the repeating device is rendered operative.

When it is desired to disconnect the printing lever 18 from the printing mechanism, a slide 55 (617) may be shifted to bring a notch 56 thereof into engagement with a pin 53 on the bar 48. This lifts the bar 48, and its notch 47, out of the path of the pin 24.

52 is a spring controlled detent engaging the notches in the cam wheel 32 for preventing movement thereof in a clockwise direction beyond a predetermined extent.

53 is a spring detent engaging the cam wheel 32 for preventing movement thereof in a contra-clockwise direction.

In order to disconnect the printing lever from the calculating mechanism so that the

printing lever can be operated for any desired number of times for duplicating the printing operation, I provide a slide 54 adapted for engagement with the pawl 33 so as to prevent the latter from engaging the teeth of the cam wheel 32. As shown in Figs. 13 and 14, the slide 54 is in an inoperative position but it will be understood that when the slide 54 is moved to the left, then, it will engage the right hand end of the pawl 33 and prevent the same from engaging the notches of the wheel 32.

I claim—

1. A calculating machine comprising in combination, a plurality of keys, a plurality of type segments operatively connected with said keys and spaced apart from each other, and a resilient comb having teeth projecting into the spaces between said segments to retain the same in proper spaced relation.

2. A calculating machine comprising in combination, a plurality of keys, a main driving shaft, a printing lever adapted to be coupled with the main driving shaft, type segments, and means whereby movement of the printing lever serves to operate said segments.

3. A calculating machine comprising in combination, a plurality of keys, a printing lever provided with a head, a drawing rod, and an attachment whereby the drawing rod may be raised out of the path of the printing lever head, said attachment comprising a shiftable gripper arranged for movement upon a stationary part such as the cover plate of the machine.

4. A calculating machine comprising in combination, a plurality of crank-shafts provided with rollers, a printing lever, a drawing rod operated by said lever, a double-armed pawl, and a disk provided with a wheel operatively connected with the main driving shaft, said disk being operated by said drawing rod, substantially as described.

5. In a calculating machine, the combination with calculating mechanism, printing mechanism therefor, an operating member, means operatively connecting said operating member with said calculating mechanism, a device for disconnecting said means from said calculating mechanism, means connecting said operating member with said printing mechanism, a device for disconnecting said last named means from said printing mechanism, an actuating member for said calculating mechanism, and means for releasing connection between said actuating member and said calculating mechanism when the latter is actuated by said operating member.

6. In a calculating machine, the combination with calculating mechanism, printing mechanism therefor, an actuating member for said calculating mechanism, an operating member, and devices releasably connecting said operating member with said calculating mechanism and operatively connecting said operating member with said printing mechanism whereby the calculating mechanism may be actuated by said actuating member while said operating member is at rest.

7. In a calculating machine, the combination with calculating mechanism, printing mechanism therefor including type segments and a printing hammer, a printing lever, a bar for operating said hammer, means operated by said lever for actuating said bar to operate said hammer, and a slide for disconnecting said bar from said lever.

8. In a calculating machine, the combination with calculating mechanism, a cam wheel connected with said mechanism, a bar and pawl for operating said cam wheel, an operating lever, and means connecting said bar with said lever during a portion of its operating movement.

9. In a calculating machine, the combination with calculating mechanism, a printing mechanism therefor, a cam wheel connected with said calculating mechanism, a bar and pawl for operating said cam wheel, a lever operatively connected with said printing mechanism, means connecting said bar with said lever to operate said cam wheel, and a slide for throwing said pawl out of operative relation with said cam wheel.

10. In a calculating machine, the combination with calculating mechanism, printing mechanism therefor including type segments and zero type elements pivotally mounted between said segments, spring controlled clutch elements for throwing said zero type elements out of printing position and permitting them to assume a printing position, said clutch elements having co-acting pins and lugs whereby operation of one clutch element serves to operate the remaining clutch elements, from the first clutch element operated, to shift the corresponding zero type elements, substantially as described.

11. In a calculating machine, the combination with calculating mechanism and a plurality of keys therefor, slides for maintaining said keys in a depressed position, an operating lever for said calculating mechanism, a cam shaft provided with cams for actuating said slides to release said keys, said shaft having means co-acting with said lever whereby said shaft may be actuated, and a device for throwing said means out of co-acting relation with said lever.

12. A calculating machine comprising in combination, a plurality of keys all having the same length of movement from their starting to their final actuating position, a lever actuated by said keys and having oppositely inclined portions for engagement

by said keys whereby the extent of movement of the lever is proportionate to the value of the key actuated, said lever having a segment, a number disclosing wheel meshing with said segment, and a spring for retaining said wheel in a position of rest, substantially as described.

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

BERNHARD CARL M. BEHR.

Witnesses:

FRITZ WEIDENBEIN,

FRANZ SCHMALER.