

J. L. LEVIN.
CALCULATING MACHINE.
APPLICATION FILED DEC. 1, 1904.

3 SHEETS—SHEET 1.

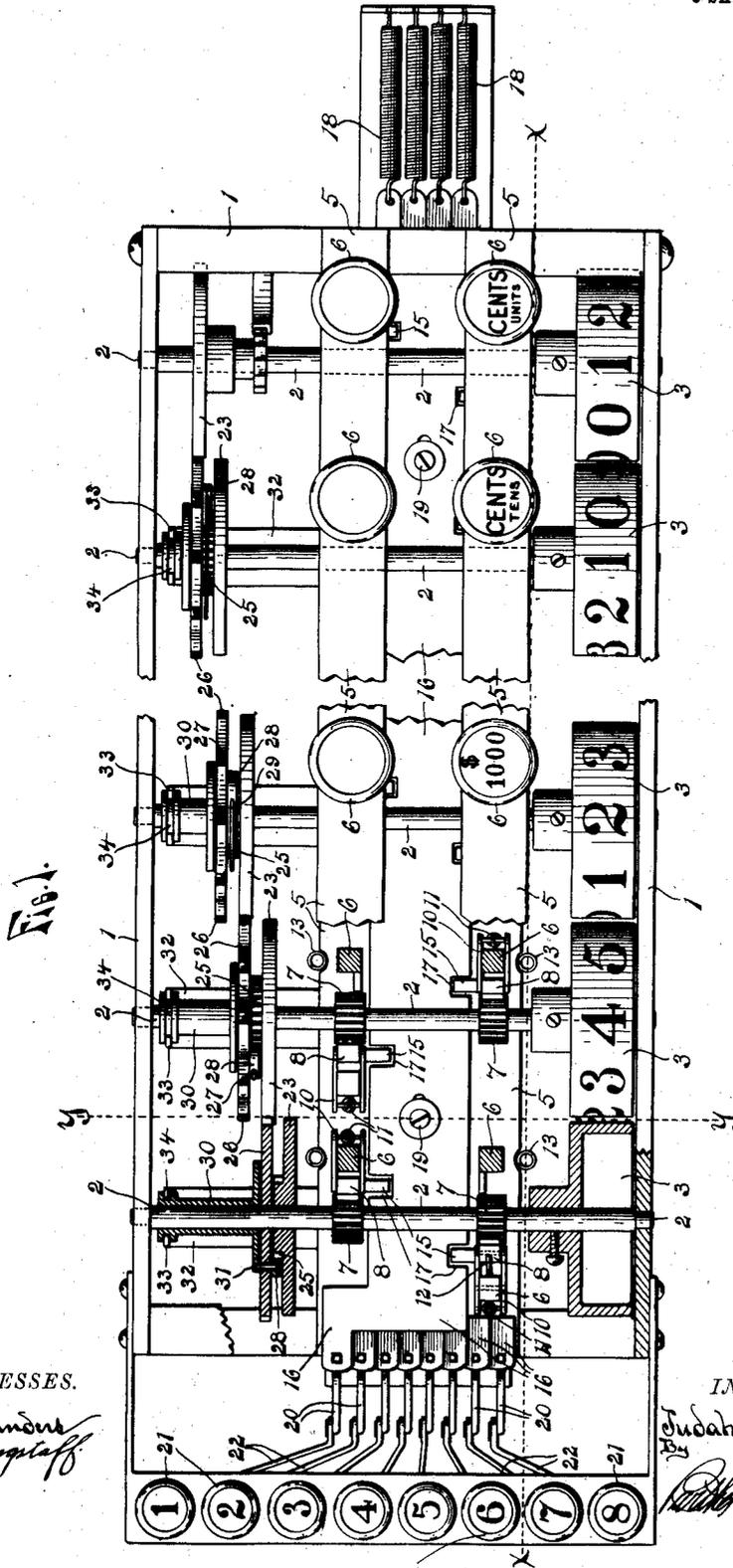


Fig. 1.

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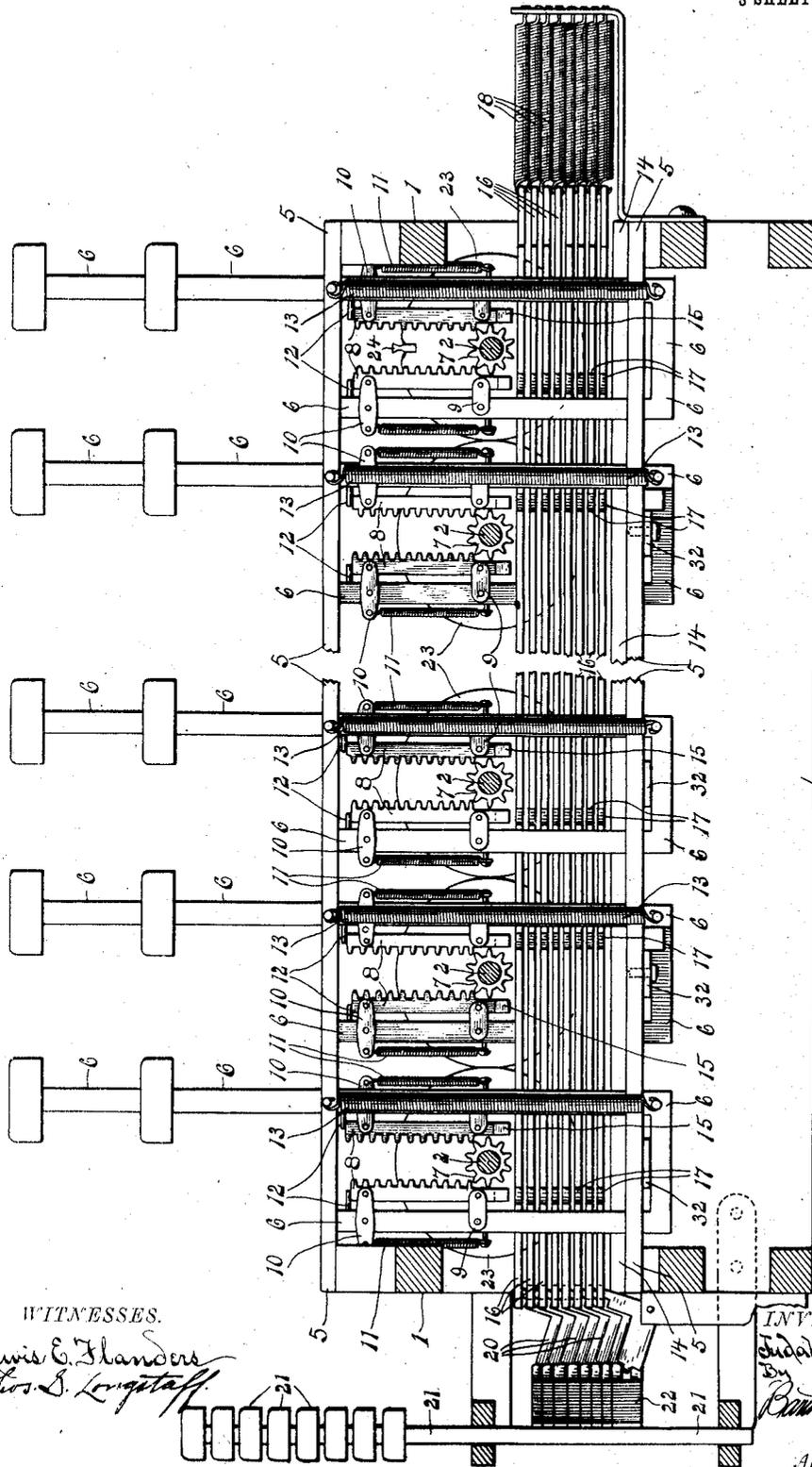


Fig. 2.

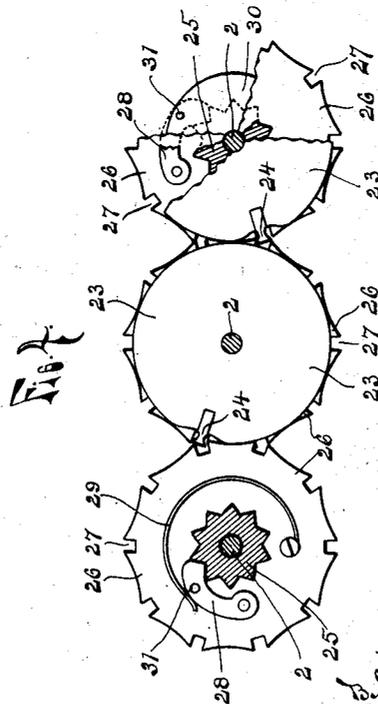
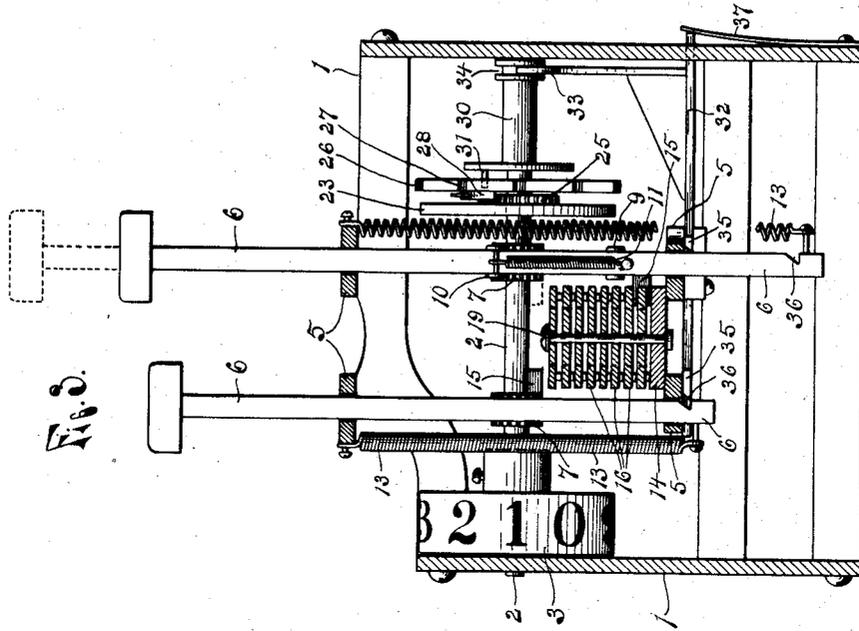
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

JUDAH L. LEVIN, OF DETROIT, MICHIGAN.

CALCULATING-MACHINE.

No. 815,542.

Specification of Letters Patent.

Patented March 20, 1906.

Application filed December 1, 1904. Serial No. 235,033.

To all whom it may concern:

Be it known that I, JUDAH L. LEVIN, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Calculating-Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to new and useful improvements in adding or calculating machines; and its object is to provide a machine having the mechanism and keys so arranged as to greatly facilitate the operation of the machine and so that the liability of making mistakes is reduced to the minimum, the parts being so constructed as to make a very simple, compact, and efficient device capable of performing both addition and subtraction.

It is also an object of the invention to provide a positive lock to prevent error due to the slipping of the parts in transmitting motion, and which lock is operated by the movement of the operating-key to permit independent movement of the parts and to provide means for locking the parts, so that the operation of any key will turn the indicator of that key and those of the keys representing a higher denomination only.

A further object of the invention is to provide the same with the advantages of the particular construction, arrangement, and combination of parts and certain other new and useful features, all as hereinafter more fully described, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of a machine embodying the invention; Fig. 2, a longitudinal vertical section of the same on the line $x x$ of Fig. 1; Fig. 3, a transverse vertical section on the line $y y$ of Fig. 1; and Fig. 4 is a detail showing a portion of the motion-transmitting mechanism in elevation with parts broken away.

As shown in the drawings, 1 is any suitable supporting-casing across which extends a series of shafts 2, supported at their ends in openings in the side plates of the frame to turn freely, and secured to each shaft adjacent to the forward side of the casing is an indicator wheel or drum 3, provided with numbers or digits from "0" to "9" inclusive, on its periphery. Guide-bars 5 extend longitudinally of the casing at the top and near the bottom thereof, and each is provided

with a series of squared openings to receive vertically-extending squared rods having buttons or heads on their upper ends and forming the operating-keys 6. Secured on each shaft 2 opposite each key is a pinion 7, and to engage the pinion to turn the shaft in one direction upon the downward movement of the key a rack-bar 8 is provided, said rack-bar being attached at its lower end to the key by links 9, which are pivotally attached at their ends to the sides of the key-rod and rack-bar, and at its upper end is pivotally attached thereto by the links 10, which are pivoted to the rack-bar at one end and intermediate their ends to the sides of the key-rod, the opposite ends of said links projecting beyond the key-rod, where they are connected by a pin to which one end of a coiled spring 11 is attached, the opposite end of said spring being secured to the key-rod some distance below. Projecting outward from each key-rod is a pin 12 in such a position that when the links are in a horizontal position holding the racks away from the keys the upper ends of the rack-bars will engage the pins, which thus form stops for the racks against which said racks are normally held by the springs 11. When a key is depressed to turn the adjacent shaft and its indicator-wheel, the rack-bar being held away from the key and in engagement with the stop-pin will engage the pinion and turn the same; but when said key is released and raised by the coiled spring 13, attached at one end to the guide-bar 5 and at its opposite end to the lower end of the key-bar, the rack will be swung on its links by its engagement with the pinion downward and toward the key against the action of the spring 11 sufficiently to slip by the pinion and not turn the same.

There are two rows of operating-keys, each shaft having two keys, one to turn the shaft in one direction to perform the operation of addition and the other to turn the same in the opposite direction to subtract. In order to so turn the shaft in opposite directions and in order that the keys may be placed in line with each other, one of the key-rods is bent twice at right angles extending across beneath the lower guide-bar and vertically upward at the opposite side of the shaft to support its rack in engagement with its pinion at the side of the shaft opposite that at which the other rack is supported.

Secured to and resting upon the lower

guide-bars 5, between the two rows of keys, is a stop-plate 14, and projecting inward over this plate from the lower end of each rack-bar is a lug 15 to engage the plate and limit the downward movement of the rack and key, the parts being so proportioned that the full movement of the key will turn the indicator-wheel nine spaces or figures. Supported upon this stop-plate are eight superimposed longitudinally-movable stop-plates 16, each provided with a notch 17 opposite each lug 15 on the rack-bars to permit the lug to pass and normally held with their notches in the paths of the lugs by springs 18, attached to one end of the plates. The plates are limited in their movement by being slotted longitudinally to receive bolts 19, extending vertically upward from the stop-plate 14, and to move said plates longitudinally against the action of said springs 18 bell-crank levers 20 are pivoted on the frame and attached to the ends of the plates opposite those to which the springs are secured. A series of vertically-movable keys 21 (eight in number) are guided in openings in suitable brackets secured to the end of the frame, and on these keys are rigid arms 22, pivotally attached to the outwardly-extending arms of the bell-crank levers. In adding a certain number the digits of that number are indicated by pressing the keys 21 and the value of each digit or its position in the number by pressing the operating-keys. As, for instance, suppose the number is fifteen dollars and twenty-five cents. The operator would first press the digit-key marked "1." This would by means of the bell-crank connection move the first stop-plate 16 longitudinally, throwing its notches out of the path of the lugs 15 on the rack-bars, and thus limiting the movement of the rack-bars, so that the indicating-wheels could be turned but one space or number by the operating-keys. The fourth operating-key from the right-hand end of the machine, or the key representing the tens place of the whole number or dollars, would then be pressed, turning its indicating-wheel one space, and when released said key would be raised by its spring, the stop-plate also being moved to its normal position by the spring 18 upon the release of the digit-key. The operator next would press the digit-key marked "5" and then the operating-key representing units place, turning the indicating-wheel of said operating-key five spaces. The cents of the number would then be added in a like manner by pressing the key marked "2," then the second or "tens" operating-key marked "Cents," and the last digit of the number would be added by pressing key "5" and the first operating-key.

To transmit motion from one shaft to another, so that one revolution of one indicator-wheel representing digits of a certain value will turn the wheel representing those of the

next highest value one space, a driving-disk 23, having one tooth 24 on its periphery, is secured on each shaft to turn therewith, and a ratchet-wheel 25, having ten teeth, is formed integral with said disk or secured to the shaft at one side of the same. A driven disk 26, having ten scallops or concaves in its periphery to fit the periphery of the disk 23 on the next adjacent shaft, is also mounted upon each shaft to turn freely thereon, and cut in the edge of said disk at each meeting-point of the scallops is a notch 27, adapted to be engaged by the tooth 24 of the said adjacent disk, said disk being cut away slightly at each side of the tooth to permit the shoulders at each side of each notch to pass as said scalloped disk is turned. Motion thus received from the adjacent shaft is transmitted by the scalloped disk to its shaft by a pawl 28, pivoted on said disk and normally held in engagement with the ratchet 25 by a spring 29, said pawl also serving to center the fixed disk 23 relative to the scalloped disk when the fixed disk is turned by its shaft, the scalloped disk being prevented from turning by the engagement of one of its scallops with the periphery of the fixed or driving disk on the adjacent shaft. While the driving-disk may always turn the scalloped disk which it engages, said scalloped disk is always prevented from turning the driving-disk by the engagement of one of its scallops with the periphery of the driving-disk and also by the engagement of the shoulder at one side of its notch with the end of the tooth of the driving-disk when said disk is stopped with said tooth engaging one of the notches, as shown in Fig. 4.

A flanged sleeve 30 on each shaft is provided with a flange at one end carrying a pin 31, engaging an opening through the adjacent scalloped disk and adapted to project through said disk into an opening therefor in the pawl 28 on the opposite side of the disk. The pawl is rigidly held by the pin in engagement with a notch of the ratchet, and thus the scalloped disk is locked thereby to the driving-disk on the same shaft. The sleeve by reason of the engagement of its pin with the hole in the disk turns with said disk and to disengage the pin from the pawl to release the same is adapted to move longitudinally of the shaft a short distance, but not far enough to disengage the pin from the disk. To so move the sleeves, operating-bars 32 are supported at one end by the lower guide-bars 5, one adjacent to each pair of operating-keys, and at their opposite ends are provided with bearing ends extending through openings in the rear side wall or plate of the supporting-frame. Upwardly-extending arms having forked ends 33 are fixed on said bars to engage grooves 34 in the sleeves and move the same upon the movement of the bars, and on each operating-bar are laterally-extend-

ing lugs 35, adapted to engage a notch 36 in the lower end of each key-bar, said lugs being normally held in engagement with said key-bars by flat springs 37, secured to the outer side of the plate of the frame and engaging the ends of the operating-bars projecting therethrough, thus forcing the said bars endwise and moving the sleeves longitudinally of their shafts to hold the pins engaged with the pawls. The notches 36 are formed with an inclined side extending inward from the face of the key-bar and downward, so that when the keys are in their normal raised position with the lugs on the operating-bars within said notches and a key is depressed the incline engaging the side of the lug forces the operating-bar longitudinally against the action of the spring 37, and thus withdraws the pin 31 from the pawl, unlocking the scalloped disk from the driving-disk on that shaft and permitting the said driving-disk to be turned by said movement of the key independently of the said scalloped disk. In Fig. 3 one of the keys is shown depressed to illustrate this operation.

By providing two sets of keys, one for determining the digits and the other for determining the value of each digit or its place in the number and also to operate the mechanism, the speed of operation is greatly increased and liability of mistakes lessened, as the keys are operated in the same order in which the person would call or write the number. Thus in writing or speaking "4,000" the digit "4" is expressed first and then its value or place in the number.

Instead of journaling the shafts 2 in the casing it is obvious that they might be made stationary and the operating parts carried by a sleeve on the shaft.

Having thus fully described my invention, what I claim is—

1. In a calculating-machine, the combination of a series of indicators mounted on shafts journaled in the casing and provided with numbered spaces, means carried by the shafts for transmitting motion from one to the other of said indicators, two series of vertically-movable operating-keys to turn the indicators in opposite directions, a series of keys each representing a digit, a series of superposed sliding plates supported in the casing adjacent to the operating-keys and attached to the digit-keys to be moved thereby to correspondingly limit the movement of all of the operating-keys and means for returning said plates.

2. In a calculating-machine, the combination with a casing, of a series of shafts mounted in said casing, an indicator on each shaft, a pinion on each shaft, means for transmitting motion from one to the other of said shafts, a series of operating-keys, rack-bars connected to said keys to engage the pinions and turn the shafts, a series of superimposed longitudi-

nally-movable plates having notches opposite the rack-bars to allow the same to pass there-through, and a series of digit-keys connected to said plates to move the same longitudinally.

3. In a calculating-machine, the combination with a casing, of a series of shafts mounted on said casing, indicators on said shafts, means connecting said shafts to transmit motion from one to the other, pinions on said shafts, rack-bars to engage the pinions, a series of vertically-movable key-bars, links pivoted to said key-bars and to the racks, stops to limit the movement in one direction of the racks relative to the key-bars, and springs to normally hold the racks against the stops.

4. In a calculating-machine, the combination with a casing, of a series of shafts mounted on said casing, a series of indicating-wheels on said shafts, means for transmitting motion from one shaft to another, pinions on said shafts, a series of vertically-movable key-bars, racks extending parallel to the key-bars, links pivoted at one end to the key-bars and at their opposite ends to the racks, stop-pins on the key-bars to engage the ends of the racks when the links are extended at right angles to the key-bar, and springs to normally hold the racks against the stop-pins.

5. In a calculating-machine, the combination with a casing, of a series of shafts supported by the casing, indicator-wheels on said shafts, means for transmitting motion from one shaft to another, pinions on the shafts, rack-bars for said pinions, a series of key-bars each vertically supported by the casing at a short distance from each pinion, links pivoted intermediate their ends to the key-bars and connected at one end and pivotally attached to the upper ends of the racks at their opposite ends with a space between the racks and bars, links pivoted at their ends to the key-bars and to the lower ends of the racks, stop-pins on the key-bars to engage the upper ends of the racks when the links are in horizontal position, and springs attached at one end to the connected ends of the upper links and at their opposite ends to the key-bars.

6. In a calculating-machine, the combination with a series of shafts and means for turning the same; of a loose and a fixed disk on each shaft the loose disk on one shaft being adapted to receive motion from the fixed disk on the next adjacent shaft to the right, and means for locking the loose to the fixed disk on each shaft, moved by the operation of the means for turning the shaft, to disconnect the same.

7. In a calculating-machine, the combination with a series of shafts and means for turning the same; of a loose disk on each shaft provided with a series of notches in its periphery, a disk fixed on each shaft adjacent to the loose disk and provided with a tooth,

said disks being so arranged that the fixed disk on each shaft will engage and turn the loose disk on the adjacent shaft at the left, and means for normally locking the loose disk on each shaft to the fixed disk thereon to transmit motion thereto, and adapted to be actuated by the movement of the means for turning the shafts, to unlock the loose disk on the shaft.

8. In a calculating-machine, the combination with a series of shafts and means for turning the same; of a disk fixed on each shaft, a tooth on each fixed disk, a loose disk on each shaft provided with scallops in its periphery to fit the periphery of the fixed disk on the adjacent shaft and notches at the meeting-points of the scallops to receive the tooth on said fixed disk, a ratchet-and-pawl connection between said fixed and loose disks on each shaft and means for locking the loose disk on each shaft to the fixed disk thereon.

9. In a calculating-machine, the combination with a series of shafts, indicators on said shafts and means for turning said shafts; of a disk fixed on each shaft, a tooth on each fixed disk, a loose disk on each shaft having notches in its periphery to receive the tooth on the fixed disk on the adjacent shaft to the right, a fixed ratchet on each shaft between the disks thereon, a pawl pivoted to each loose disk, a movable pin carried by each loose disk to engage and hold the pawl in engagement with the ratchet, and means for moving the pins to release the pawls, actuated by the means for turning the shafts.

10. In a calculating-machine, the combination with a supporting-casing, of a series of shafts mounted on said casing, an indicator on each shaft, vertically - movable keys guided on the casing, means for turning the shafts carried by the keys, a disk fixed on each shaft, a tooth on each fixed disk, a loose disk on each shaft having a series of scallops in its periphery and notches at the meeting-points of the scallops, a fixed ratchet between said disks on each shaft, a pawl pivoted to each loose disk to engage the ratchet, a sleeve on each shaft, a pin carried by each sleeve and adapted to project through an opening in the loose disks and engage the pawls to lock the same in engagement with their ratchets, operating-bars supported by the casing and engaging said sleeves to move the same by the movement of said keys.

11. In a calculating-machine, the combination with a supporting-casing, of a series of shafts mounted on said casing, an indicator on each shaft, vertically-movable key-bars guided in the casing and each provided with an incline at its lower end, pinions secured on the shafts, racks carried by the key-bars to engage and turn the pinions, a disk fixed on each shaft provided with a tooth on its periphery, a loose disk on each shaft having scallops in its periphery to fit the periphery

of the fixed disk on the adjacent shaft, and provided with notches at the meeting-points of said scallops, a fixed ratchet between the disks on each shaft, a pawl on each loose disk, a sleeve on each shaft having a groove, a pin carried by each sleeve adapted to project through an opening in the loose disk and engage the pawl, operating-bars extending beneath each shaft and supported on the casing in engagement with the inclines on the key-bars, a fork carried by each operating-bar to engage the grooves in the sleeves, and springs engaging the bars to hold the same in contact with the inclines.

12. In a calculating-machine, the combination with a supporting-casing, of a series of shafts mounted on said casing, an indicator-wheel secured on each shaft, pinions secured to each shaft, supporting-bars on the casing near the top and bottom thereof and provided with guide-openings, two parallel rows of key-bars guided vertically in said openings, springs to hold said key-bars in their raised positions, rack-bars to engage the pinions, links pivotally attached to the key-bars and to the racks to support the racks, a stop-pin on each key-bar to engage the racks, springs to normally hold the racks in engagement with the stops, laterally-extending lugs on the lower ends of the racks, a series of superimposed longitudinally - movable plates supported on the lower guide-bars between the rows of operating key-bars and provided with notches opposite the lugs on the racks, bell-cranks pivoted on the frame and attached to one end of said plates, springs attached to the opposite ends of said plates, a series of digit-keys to turn the bell-cranks, a disk fixed on each shaft and having a tooth, a loose disk on each shaft having scallops and notches in its periphery, a ratchet-wheel on each shaft between the disks, a pawl on each loose disk to engage the ratchet, means for engaging and locking the pawl, a sleeve on each shaft carrying said means, and operating-bars engaging and moved by the inclines on the key-bars to move said sleeves.

13. In a calculating-machine, the combination with a supporting-casing, of a series of shafts in said casing, indicator-wheels and pinions carried by said shafts, vertically-guided key-bars in said casing, springs to hold said key-bars in their normal position, rack-bars to engage said pinions, links to pivotally support the racks upon the key-bars, a stop on each key-bar to engage the racks, means for normally holding the racks in engagement with the stops, lugs on the racks, a series of superimposed movable plates supported on the casing provided with notches adapted to register with the lugs on the racks, levers attached to one end of said plates, springs attached to said plates, a series of digit-keys to rock the levers, a fast and a loose disk on each shaft adapted to respect-

tively cooperate with the loose and fast disks
of the adjacent shafts, a ratchet-wheel on
each shaft, a pawl on each loose disk to en-
gage the ratchet, a sleeve on each shaft,
5 means for engaging and locking the pawl car-
ried by said sleeve and operating-bars moved
by the key-bars for actuating said means.

In testimony whereof I affix my signature
in presence of two witnesses.

JUDAH L. LEVIN.

Witnesses:

JACOB LEVIN,
OTTO F. BARTHEL.