No. 719,701. PATENTED FEB. 3, 1903.

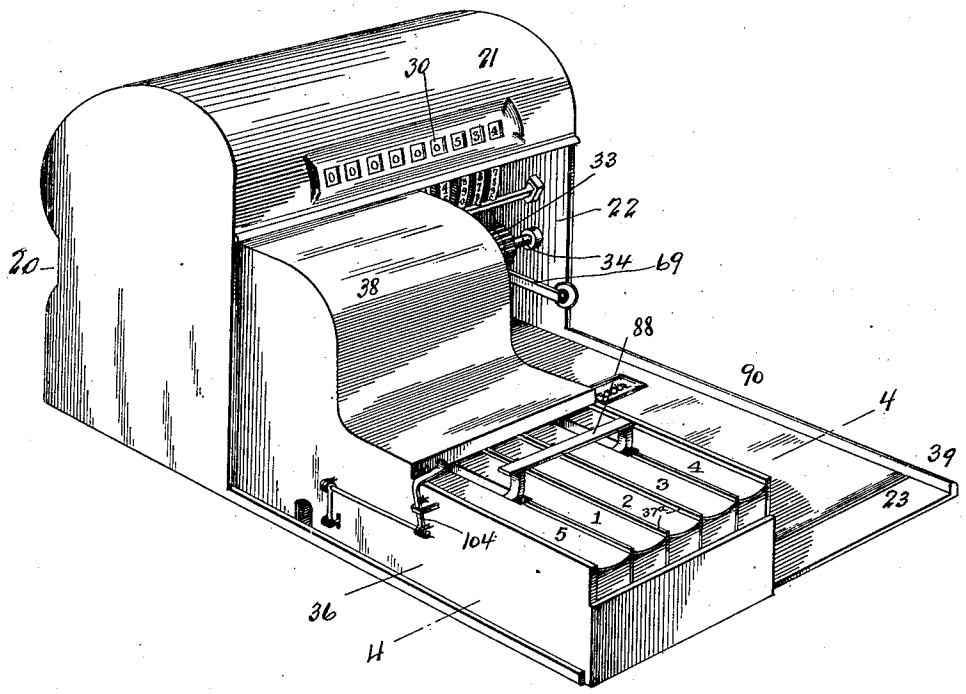
J. M. STEELE.

CALCULATOR.

APPLICATION FILED MAY 17, 1901.

NO MODEL. 5 SHEETS—SHEET 1.

Fig. 1.



Witnesses
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Wm. Geiger

Inventor
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By Louis K. Fiesen Atty

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 719,701. PATENTED FEB. 3, 1903.

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APPLICATION FILED MAY 17, 1901.

NO MODEL. 5 SHEETS—SHEET 2.

Fig. 2.

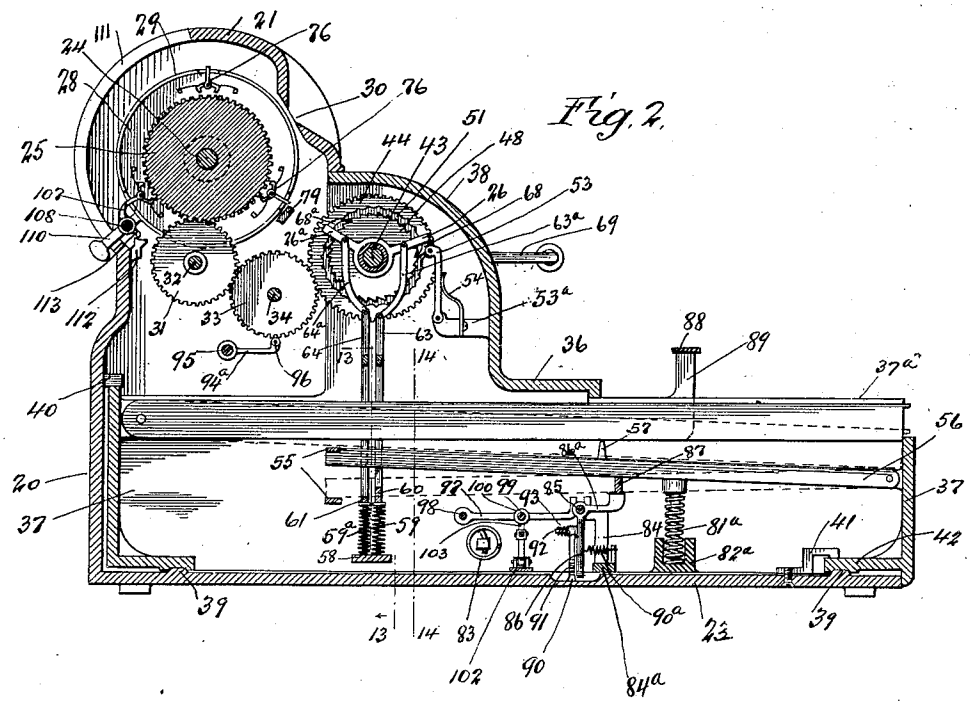
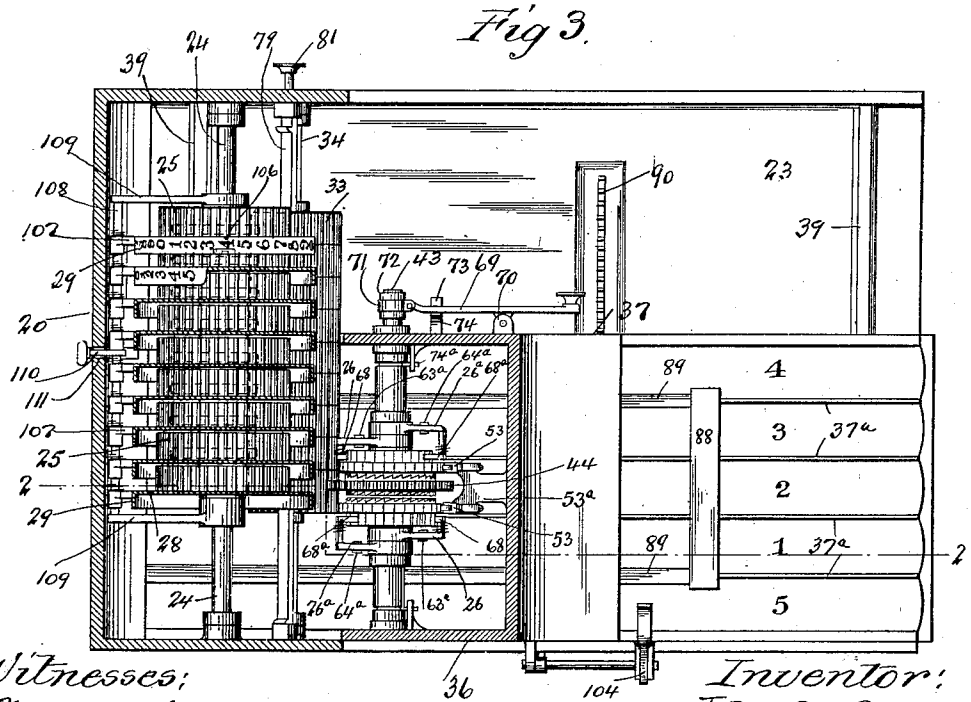


Fig 3.



Witnesses:
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No. 719,701. PATENTED FEB. 3, 1903.

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NO MODEL. 5 SHEETS—SHEET 3.

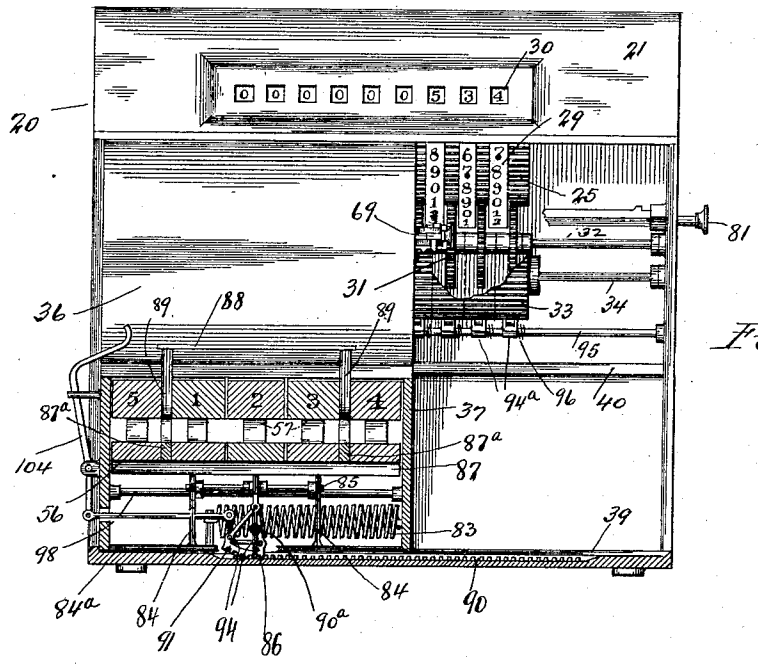


Fig. 4.

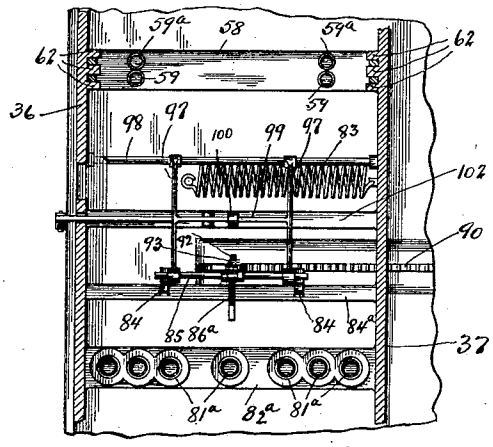


Fig. 5.

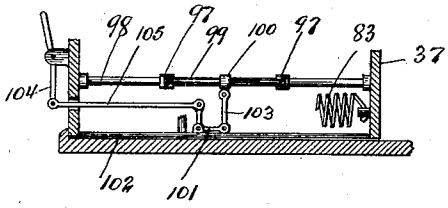


Fig. 6.

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No. 719,701. PATENTED FEB. 3, 1903.

J. M. STEELE.

CALCULATOR.

APPLICATION FILED MAY 17, 1901.

NO MODEL. 5 SHEETS—SHEET 4.

Fig. 7.

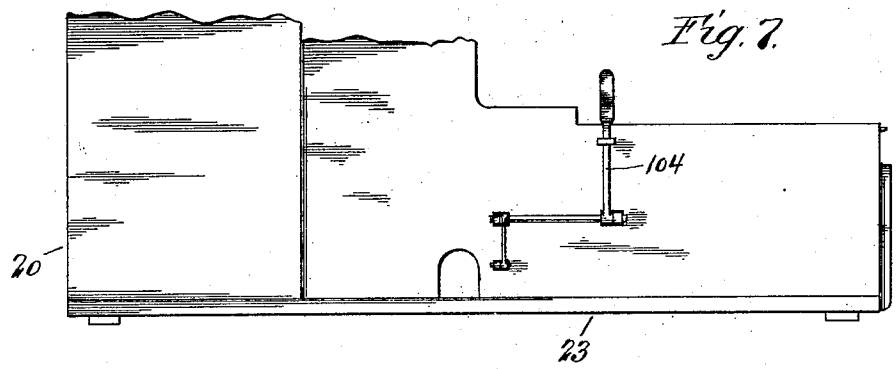
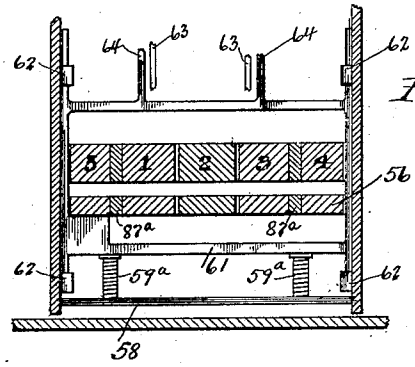


Fig. 13



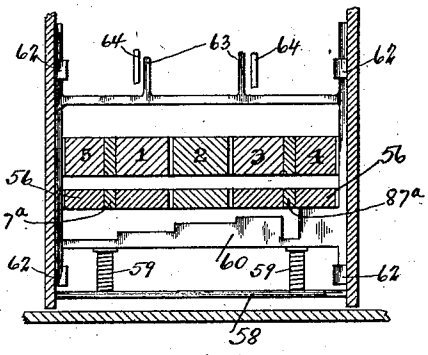


Fig. 14.

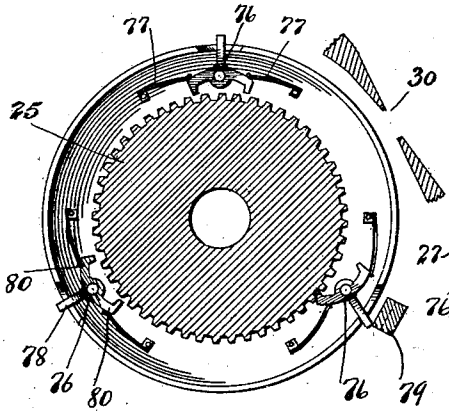


Fig. 15.

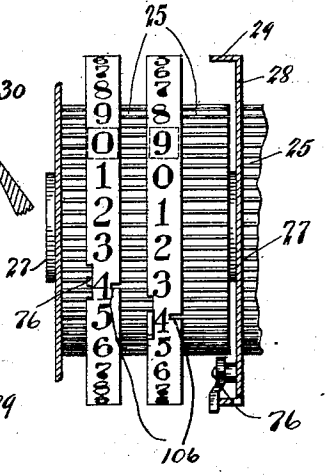


Fig. 16.

Witnesses:
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Wm. Geiger

Inventor:
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 719,701. PATENTED FEB. 3, 1903.

J. M. STEELE.

CALCULATOR.

APPLICATION FILED MAY 17, 1901.

NO MODEL. 5 SHEETS—SHEET 5.

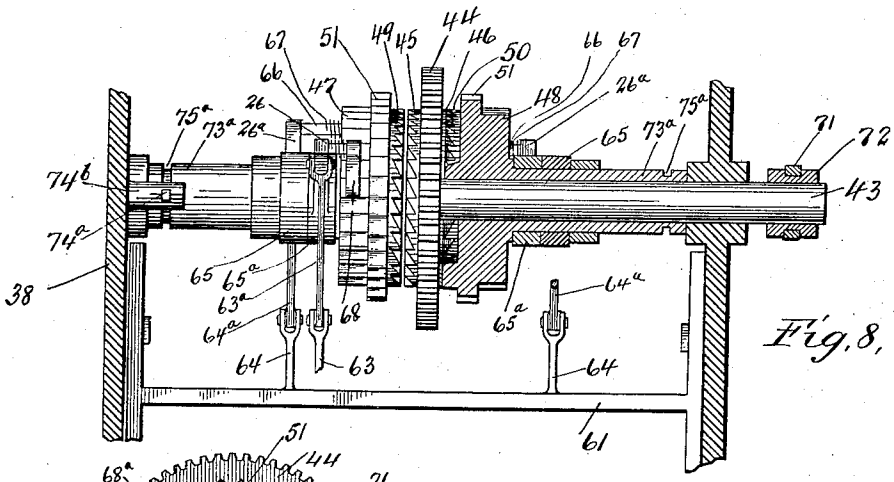


Fig. 8.

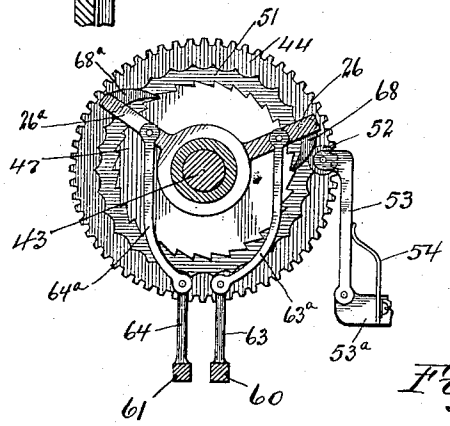


Fig. 9.

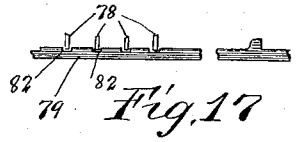


Fig. 17

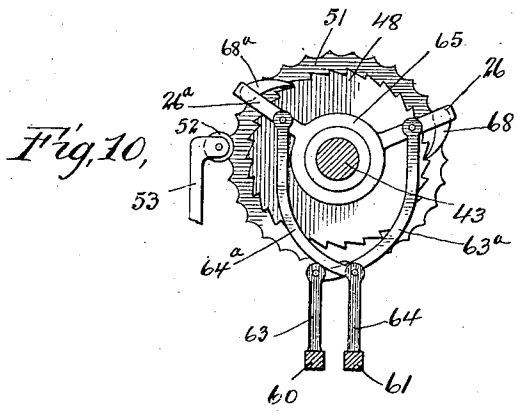
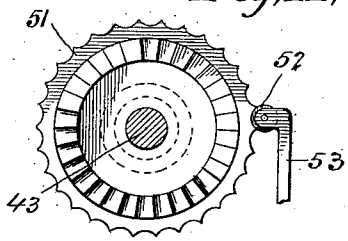


Fig. 10.

Fig. 11.



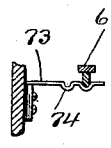


Fig. 12.

Witnesses:
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Wm. Geiger

Inventor:
John M. Steele
By Louis X. Gieson Atty

UNITED STATES PATENT OFFICE.

JOHN M. STEELE, OF PRINCETON, ILLINOIS.

CALCULATOR.

SPECIFICATION forming part of Letters Patent No. 719,701, dated February 3, 1903.

Application filed May 17, 1901. Serial No. 60,754. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. STEELE, a citizen of the United States, and a resident of Princeton, county of Bureau, and State of Illinois, have invented certain new and useful Improvements in Calculators, of which the following is a specification, and which are illustrated in the accompanying drawings, forming a part thereof.

My invention relates to an improved form of calculating-machine adapted to the performance of various arithmetical processes, particularly addition and subtraction.

The mechanism of the machine comprises, in general terms, a series of numeral-wheels so arranged that only one of the figures on each wheel is exposed at a time. These numeral-wheels through the medium of suitable gearing are actuated by mechanism which is mounted on a laterally-sliding carriage, which also carries a set of five operating-keys, spacing mechanism, reversing mechanism, and other parts of a minor character. The mechanism is so arranged that the depression of any one of the keys operates to move the numeral-wheel with which the actuating-wheel is in connection through the number of spaces allotted to the key depressed, and the simultaneous depression of one particular key with either of the others causes the numeral-wheel to move through a number of spaces equal to that allotted to both the keys so depressed, the movement effected by the five keys singly corresponding to the numerals "1," "2," "3," "4," and "5," while the simultaneous action of the key registering five with each of the other keys singly corresponds with the numbers "6," "7," "8," and "9." The function of the spacing mechanism is to move the carriage from one numeral-wheel to the one next to it in successive order for adding or subtracting in columns, and this result is accomplished by the operation of the key mechanism or an independent space-bar.

The above and other and auxiliary features of the invention will be more particularly described in the following specification and are illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of an arithmometer or calculating-machine constructed in accordance with my invention. Fig. 2 is a section on the line 2 2 of Fig. 3. Fig. 3 is a plan of the operating mechanism, the top of the casing of the machine being broken away to show the same. Fig. 4 is a section on the line 4 4 of Fig. 1, showing the spacing mechanism. Figs. 5, 6, and 7 illustrate details of the spacing mechanism. Figs. 8, 9, 10, 11, and 12 relate to the mechanism for operating the numeral-wheel-actuating gear and details thereof. Fig. 13 is a section on the line 13 13 and Fig. 14 on line 14 14 of Fig. 2. Fig. 15 is a detail view of the disk of one of the numeral-wheels and the gear-wheel of another and showing the interlocking dogs carried by the former and the position of one of the same while actually engaging and turning the next higher numeral-wheel, and Figs. 16 and 17 relate to the numeral-wheels and details thereof.

The main casing of the machine 20 consists of a hood 21, opened at the front, as at 22, and a forwardly-projecting base 23. Supported in the hood 21 is a shaft 24, on which are loosely mounted a plurality of gears 25, spaced apart by collars 27, Fig. 16. Each of the gears 25 has fixed to it a disk 28, provided with a peripheral flange 29, on which the mathematical symbols "0," "1," "2," "3," "4," "5," "6," "7," "8," and "9" are marked, and for convenience in operation, as well as to save time in resetting the wheels, as will be hereinafter explained, each flange is provided with three or more of the specified series of figures (shown in Fig. 16) united by completely encircling the flange. The gears 25, with their flanged disks 28, will be hereinafter referred to as "numeral-wheels." The front of the hood 21 is provided with sight-apertures 30, so disposed that the symbols on each numeral-wheel are exposed to view consecutively therethrough when the numeral-wheels are operated. Each of the numeral-wheels, beginning at the right of the machine and excepting the one at the extreme left, which has no neighboring wheel to operate, is intended to actuate the wheel adjacent to it—that is to say, the first wheel having been made to travel one-third of a revolution or the space of one of the series of symbols on the flange 29 moves the next numeral-wheel one space. For this purpose each of the disks 28 of the numeral-wheels

carries a plurality of dogs 76, one for each of the series of figures, pivoted at equal intervals thereon and held normally out of engagement with the teeth of the gear 25 of the adjacent numeral-wheel by springs 77. (See Figs. 15 and 16.) The arms 78 of the dogs extend beyond the periphery of the disks 28, so as to be engaged by a bar 79, supported in the hood 21. Each dog is provided with two fingers 80 in order that the interlocking mechanism may be made to operate when the numeral-wheels are moving in either direction or for adding and subtracting, and when a numeral-wheel has been driven nine spaces, starting at zero, the arm of one of the dogs 76, carried by such numeral-wheel, is in such position that it will upon the next advance of the said numeral-wheel engage the bar 79. During such next movement or that equivalent to the movement of the numeral-wheel from "9" to "0" before the sight-aperture the arm of the dog strikes the bar 79, and one of the fingers 80 thereof, depending on the direction of rotation of the numeral-wheel, is thrown into engagement with the teeth of the gear 25 of the adjacent numeral-wheel, as illustrated in Fig. 15, carrying the latter one space. The arm 78 then passes out of engagement with the bar 79, and this occurring during the movement of the numeral-wheel through a distance equal to one of its spaces or numbers the dog is righted by the springs 77 and the finger thereof withdrawn from the teeth of the gear of the engaged numeral-wheel. By this means adjacent numeral-wheels are never in engagement when at rest, and hence the next higher one of each pair is at all times free to move without disturbing the lower one, while as each numeral-wheel is being shifted from "9" to "0" in one direction or from "0" to "1" in the other the interlocking mechanism carried by it becomes engaged with the next higher wheel, turns it one space, and is disengaged from it. The bar 79 is designed to slide longitudinally, being provided with a handle 81 or pull for operating it, Figs. 3 and 4, and has a series of slots 82 on one side, through which the arms of the rocking dogs 76 may pass, the bar 79 having been shifted to the proper position, when the machine is reset—an operation to be hereinafter explained.

Located under and meshing with each of the gears 25 is a pinion 31, rotating loosely on a shaft 32, mounted in the hood 21, and these pinions 31 are engaged by pinions 33 on a shaft 34, also carried by the hood 21, each of the gears 25 being driven independently of the others by its companion pinions 31 and 33.

Mounted on the base 23 and adapted to slide laterally is a carriage 36, consisting of a rectangular frame 37, extending, as shown, from front to rear of the base and carrying a hood 38, which enters the opening 22 in the casing 20. The base 23 is provided with parallel tracks or ways 39, on which the carriage slides and to which it is held by a flange 40, attached to the rear wall of the casing 20 and extending over the rear wall of the rectangular frame 37 and an angle-plate 41, secured to the base 23 and engaging an inwardly-extending strip 42 of the front wall of the frame.

Secured to a shaft 43, journaled in the end walls of the hood 38, is a wheel or gear 44, adapted to mesh with and actuate the pinions 33 for driving the numeral-wheels, which gear is provided on each face with a clutch member 45 46, the teeth of which are inclined in reverse directions. Loosely journaled on the shaft 43 and on opposite sides of the actuating-wheel 44 are a pair of ratchet-wheels 47 and 48, having clutch members 49 and 50, respectively, designed to be thrown alternately into engagement with the clutch members 45 and 46 of the wheel 44 for driving the same in opposite directions. The ratchet-wheels 47 and 48 are carried by sleeves 73^a on the shaft 43 and held against longitudinal movement thereon by fingers 74^a engaging annular grooves 75^a in the sleeves 73^a and fixed to brackets 74^b, secured to the side walls of the hood 38. The ratchet-wheels 47 and 48 are controlled by a series of five keys carrying the numbers "5," "1," "2," "3," and "4" in the order named from left to right, which extend in front of the hood 38 of the carriage 36 and are pivoted to the back wall of the rectangular frame 37. These keys actuate, through the medium of knife-edges 57, a series of auxiliary levers 56, pivoted to the front wall of the frame 37 and extending back under the hood 38, the said levers 56 being limited in their movement by stop-bars 55. The auxiliary levers 56, and consequently the keys, are returned to their normal positions by springs 81^a, reacting between the said levers, and a socketed bar 82^a, extending transversely of and supported by the frame 37. Five keys are provided in order that the machine may be operated by one hand, the thumb operating the "5" key, and while the keyboard in the construction illustrated is arranged for manipulation by the right hand it will be obvious that the order may be changed and made left-handed. Strips 37^a may be secured to the front of the frame 37 and extend between and slightly above adjacent keys, as shown in Fig. 1, to prevent the fingers from coming in contact with any key other than the one each finger is relied upon to operate and enable the operator to manipulate the keys without looking at the keyboard.

Extending under and parallel with the shaft 43 of the actuating-wheel 44 and carried by the rectangular frame 37 is a bar 58, supporting two pairs of expansion-springs 59 and 59^a. One member of each pair of these springs is located at each end of the cross-bar 58, and resting thereon and held normally upward thereby are sliding stirrups 60 and 61, guided by lugs 62 on the side walls of the frame 37, and each of the sliding stirrups is provided with two arms 63 64, one of each pair extending up to opposite sides of the actuating-

wheel 44, as will be seen on reference to Fig. 8. Pivoted to the arms 63 and 64 are links 63^a and 64^a, connected with arms 26 and 26^a, carried by collars 65 and 65^a, mounted loosely on the sleeves 73^a of the ratchet-wheels 47 and 48 on the shaft 43, and pivoted on pins 66 of the links 63^a and 64^a and controlled by springs 67, encircling the said pins, are pawls 68 and 68^a, engaging the teeth of the ratchet-wheels 47 and 48. Each of the stirrups 60 and 61 is designed through the medium of the keys to control one set of the pawls 68 and 68^a. On reference to Figs. 8, 9, and 10 it will be seen that each of the pawls 68, operated by the stirrup 60, engages one of the ratchet-wheels 47 and 48 and that the pawls are so disposed that when the stirrup 60 is moved downward the ratchet-wheels will be caused to travel in opposite directions. The mechanism for operating the pawls 68^a differs from that just described only in that the said pawls are so positioned that the upward movement of the stirrup 61 moves the ratchet-wheels.

The shaft 43 is caused to slide longitudinally by a lever 69, pivoted at 70 to the side of the hood 38 and pivoted to a band 71, encircling a sleeve 72, carried by the shaft 43. A spring-arm 73, provided with indentations 74, with which the lever 69 engages, holds the lever in the position to which it is last thrown, and the shifting of this lever sliding the shaft 43 moves the actuating-wheel 44 alternately into engagement with the ratchet-wheels 47 and 48 to drive the actuating-wheel in either direction.

In operation each of the keys is intended to move the numeral-wheels 25 a number of spaces corresponding to the number on the key operated. For example, if the "3" key be struck the numeral-wheel will be moved three spaces or digits, and so on. This is accomplished by providing the stirrup 60, which coöperates with the keys 1, 2, 3, and 4, with steps which decrease in height from right to left, so that the movement of the stirrup will depend on the key depressed, each consecutive key being compelled to travel a greater distance than the previous one before coming in contact with its step, and thereby determining the movement of the stirrup and consequently of the actuating-wheel 44. The stirrup 60 is returned to its normal position by the springs 59 retracting the pawls 68. The stirrup 61 is controlled by the "5" key only, and in order to increase the throw of the actuating-wheel 44 when operated thereby, the height of the step of the stirrup 61 being the same as that of the step of the stirrup 60 operated by the "4" key, the links 63^a are pivoted to the pawl-arms 26 at a greater distance from the axis of the ratchet-wheels 47 and 48 than are the links 64^a on the arms 26^a. This is clearly illustrated in Figs. 9 and 10. When the "5" key is depressed, the stirrup 61 is lowered against the resistance of the springs 59^a, the pawls 68^a riding over the teeth of the ratchet-wheels 47 and 48, and when the key is released the springs 59^a force the stirrup 61 upward, causing the pawls 68, actuated thereby, to move the ratchet-wheels a distance equal to five spaces of the numeral-wheels 25. This construction renders it possible to use the "5" key with one of the other keys. If, for instance, the "2" and "5" keys be operated simultaneously on depressing the keys, the numeral-wheel in connection with the actuating-wheel 44 will be moved two spaces or digits, and on the release of the keys through the medium of the stirrup operated by the "5" key and its ratchet mechanism the numeral-wheel will be moved an additional five spaces.

An annular fluted flange 51 on each of the ratchet-wheels 47 and 48 is engaged by a roller 52, carried by a lever 53, pivoted to an arm 53^a, extending from the hood 38, and the roller 52 is forced into engagement with the fluted flange 51 by a spring 54 reacting against the lever 53 to hold the ratchet-wheels 47 and 48 from further movement after the pawls 68 and 68^a have ceased to act.

The carriage is moved from right to left by a retractile spring 83, fastened to the side wall of the frame 37 and the base of the machine, and the movement of the carriage is regulated by an escapement mechanism now to be described and shown in Figs. 2, 4, 5, and 6.

Mounted in slotted supports 84, rising from a bar 84^a, carried by the frame 37 of the carriage, is a shaft 85, carrying a bell-crank lever comprising a vertical arm 86 and a horizontal arm 86^a, the latter being in the path of a vertically-reciprocating bar 87, carried by levers 87^a, pivoted to the frame 37, which levers are controlled by other levers 89, pivoted to the rear wall of the frame 37 and actuated by a finger-bar 88, located over the keys of the machine. Fixed transversely across the base of the machine is a rack 90, parallel with the shaft 85 and which is normally engaged by a toothed quadrant 91, hung on a pin 92, extending from the arm 86 of the bell-crank lever. When the finger or space bar 88 or any one of the keys is depressed, the bar 87, being in the path of the key mechanism, will be moved downward, rocking the bell-crank lever in the supports 84, and thereby throwing the quadrant out of engagement with the rack 90, which is immediately engaged by the arm 86 of the bell-crank lever. The quadrant under the influence of a spring 93, coiled about the pivot-pin 92, on which the quadrant is hung, is moved to the left, being limited in its movement in either direction by pins 94, carried thereby and which engage the arm 86 of the bell-crank lever. When the finger-bar 88 is released, the arm 86 is withdrawn from the rack 90 by a retractile spring 90^a, connected at its ends to the arm 86 and a post carried by the bar 84^a, bringing back the quadrant 91 into engagement with the rack, and the spring 83

for moving the carriage being stronger than the spring 93, controlling the quadrant, the carriage is moved a distance to the left corresponding to the play of the quadrant 91 between the pins 94 or just far enough to carry the actuating-wheel 44 into engagement with the succeeding pinion 33 for operating the next numeral-wheel 25, the teeth of the pinions 33 alining and being held in alinement by spring-arms 94ª, supported by a rod 95 and carrying rollers 96, engaging the teeth of the pinions, in order that the actuating-wheel 44 may readily slide from one to another when the spacing mechanism is operated. To disengage the quadrant 91 from the rack-bar 90 when it is desired to move the carriage back to the starting-point—that is, from left to right—the shaft 85 is carried by a pair of levers 97, pivoted on a shaft 98, fixed in the side walls of the frame 37 and connected by a bar 99, carrying a collar 100, connected to a bell-crank lever 101, pivoted on a bar 102, carried by the rectangular frame 37, by a link 103. The bell-crank lever 101 is rocked on its pivot to lift the levers 97 by a hand-lever 104, pivoted to the outside of the carriage and connected to the bell-crank lever by a rod 105.

Suitable means are provided for setting the numeral-wheels 25 to zero in beginning a calculation, which means may consist in providing each of the flanges 29 of the disks 28 with a recess 106, located opposite to each of the dogs 76 and adapted to be engaged by spring-controlled pawls 107, pivoted on a rod 108, carried by arms 109, journaled on the shaft 24 and operated by a lever 110, playing in a slot 111 in the hood 21. Normally the bar 108 is in the position illustrated in Fig. 2, the pawls 107 being held out of engagement with the flanges 29 by a web 112, against which extensions 113 of the pawls rest. When the bar 108 is raised, the bar 79 having been previously moved so that the arms 78 of the dogs 76 will pass through the grooves 82 thereof, the pawls 107 slide over the flanges 29 and are thrown by their springs into engagement with the first recesses 106 in their paths, and a continued movement of the bar will carry all the wheels back to zero—that is to say, the bar will be arrested in its movement by the upper end of the slot 111 just as one of the zeros of each numeral-wheel is exposed through the apertures 30 in the front of the hood 21. Preliminary to resetting the numeral-wheels the carriage should be moved by hand to the extreme left of the machine, first disengaging the escapement mechanism, so that the actuating-wheel 44 will be in engagement with the last pinion 33, and that pinion being merely an idler, not meshing with one of the gear-wheels 25, the latter not having any duty to perform except as it is operated by the numeral-wheel adjacent to it, the numeral-wheels may be moved for resetting without affecting the actuating mechanism. The numeral-wheels having been reset, the rod 108 will then fall back to its orignal position, and the bar 79 having been pushed in so as to be in the path of the arms 78 of the dog 76 and the carriage moved to the extreme right, so that the actuating-wheel 44 meshes with the first pinion 33, the machine is ready for manipulation.

If it is desired to employ the machine for adding, the lever 69 is moved outwardly on its pivot, sliding the actuating-wheel 44 into engagement with the clutch member 49 of the ratchet-wheel 47. For the purpose of illustration it will be assumed that it is desired to add the following amounts:

85061
7429

Beginning with the last numeral of the top row of figures the key marked "1" is depressed, causing the auxiliary lever 56 thereof to engage the lowest step of the bottom bar of the stirrup 60 and to force that stirrup downward. The stirrup carries with it the links 63ª, moving, through the medium of the pawls 68, the ratchet-wheels 47 and 48 a distance equal to the space between two numbers on the numeral-wheel 25, and motion is communicated to the actuating-wheel 44 by the ratchet-wheel 47, the ratchet-wheel 48 being out of engagement therewith. This operation causes the figure "1" to appear behind the sight-aperture in front of the first numeral-wheel. On releasing the key the stirrup 60 is returned to its normal position by the springs 59 and the carriage is moved to the left by the spacing mechanism until the actuating-wheel 44 engages the second pinion 33. To produce the next figure, "6," the "5" and "1" keys are operated simultaneously, depressing both stirrups, thereby moving the second numeral-wheel on the depression of the keys one space and bringing the figure "1" to view, as in the operation just described. When the keys are released, the stirrups rise under the influence of the springs 59 and 59ª, and the ratchet-wheels 47 and 48, through the medium of the pawls 68ª, governed by the stirrup 61, are rotated a distance equal to the space of five figures on the numeral-wheels 25, which, added to the travel of the second numeral-wheel when operated by the "1" key, causes the figure "6" to appear. This movement is completed before the actuating-wheel has been moved by the spacing mechanism into engagement with the succeeding pinion 33. Each subsequent operation for recording a number, whether one key alone is depressed or the "5" key simultaneously with one of the others, is but a repetition of one of the operations just described, the carriage moving one space on the release of each key. The next character being a zero, the spacing-bar is operated, causing the actuating-wheel 44 to be shifted to the next pinion 33 without moving the numeral-wheel with which it was in connection and leaving the zero at the sight-aperture thereof. The "5" key is then actuated, and finally the "5" and "3" keys,

producing at the apertures in the hood 21 the first row of figures—that is to say, "85061." The quadrant of the spacing mechanism is now lifted out of engagement with the rack 90 by pressing on the lever 104 and the carriage moved back by hand to its original position at the right of the machine, the actuating-wheel 44 sliding over the alined teeth of the pinions 33. The last character of the second row of figures being a "9," the "5" and "4" keys are simultaneously depressed and released, moving the first numeral-wheel nine spaces, and that wheel having already been moved one space in recording the first row of figures the zero appears at the sight-aperture, and the arm 78 of the rocking-dog of the first numeral-wheel having reached the bar 79 on the passage of the ninth figure behind the sight-aperture the dog is thrown into engagement with the second numeral-wheel 25 and moves that wheel one space, causing a "7" of the second wheel to appear at its aperture. The "2" key is now operated, which, moving the second wheel two spaces, brings a "9" to the second aperture. Then the "4" key is depressed, and the third numeral-wheel, not having been previously operated, will be moved four spaces or digits. Finally the "5" and "2" keys are operated, moving the fourth numeral-wheel seven spaces, which, added to the five already indicated by that wheel, produces a "2," the fifth numeral-wheel being actuated by the fourth one space by its dog 76 in the manner just described, causing the fifth wheel to present a "9" at its aperture and disclosing a total of "92490." The problem assumed is a simple one; but it will be obvious from the operations just described that the machine as arranged, having a series of nine numeral-wheels, is capable of adding any combination of numbers up to nine hundred and ninety-nine millions nine hundred and ninety-nine thousand nine hundred and ninety-nine. Of course I do not limit myself to any particular number of numeral-wheels, as more or less may be employed, as desired. In subtracting, the movement of the numeral-wheels is simply reversed, the operation otherwise being the same as for adding, the actuating-wheel 44 being preliminarily thrown into engagement with the ratchet-wheel 48 instead of 47. The numeral-wheels having been set to zero and the carriage moved to the extreme right, as before, it will be assumed that "275" is to be subtracted from "627." In the first instance the latter amount must be recorded, which is done by actuating the "5" and "2," then the "2," and finally the "5" and "1" keys, as for adding, and producing the figures "627" at the first three apertures in the hood 21. The movement of the numeral-wheels is now reversed by throwing, by means of the lever 69, the actuating-wheel 44 into engagement with the ratchet-wheel 48 and the carriage moved to the right again. The "5" key is now operated, causing the first numeral-wheel to be moved backward five spaces, making that wheel indicate at its aperture the figure "2." The "5" and "2" keys are now operated, thereby moving the second numeral-wheel backward seven spaces, so that the figure "5" appears. During this movement when the "9" of the second wheel passes the aperture in the hood the dog 76 thereof engages the third numeral-wheel and moves it backward one space, so that the "6" originally recorded is changed to "5." The "2" key is now depressed, moving the third wheel back two spaces and changing the "5" to a "3," giving a final result of "352."

While I have shown and described a movable carriage for the keyboard and a stationary series of numeral-wheels, my invention is also applicable to a stationary keyboard in connection with series of numeral-wheels mounted upon a movable carriage.

I claim as my invention—

1. In a calculating-machine, in combination, a plurality of numeral-wheels, mechanism for actuating the numeral-wheels, a plurality of keys, and means for transmitting to the actuating mechanism the action of a plurality of the keys when simultaneously operated, and means for shifting the actuating mechanism to drive the numeral-wheels independently of each other.

2. In a calculating-machine, in combination, a plurality of numeral-wheels, a wheel for actuating the same, pawl-and-ratchet mechanism for driving the actuating-wheel, a lever governing the pawl, key mechanism for moving the lever, means for limiting the movement of the lever so that the numeral-wheel with which the actuating-wheel is in connection will be moved a number of steps corresponding to the number of the key operated, means for shifting the actuating-wheel to drive the numeral-wheels independently of each other, and means for reversing the rotation of the actuating-wheel.

3. In a calculating-machine, in combination, a plurality of independently-movable numeral-wheels, keys for turning such wheels, connecting mechanism for transmitting to the wheels the action of each of a plurality of the keys when simultaneously operated, and means for shifting such connecting mechanism from wheel to wheel.

4. In a calculating-machine, in combination, a plurality of numeral-wheels, an actuating-wheel therefor, keys, means for transmitting to the actuating-wheel the action of each of a plurality of the keys when simultaneously operated, and spacing mechanism for shifting the actuating-wheel for driving the numeral-wheels independently of each other.

5. In a calculating-machine, in combination, a plurality of numeral-wheels, an actuating-wheel therefor, an intermediate pinion for each of the numeral-wheels, keys, means for transmitting to the actuating-wheel the successive action of each of a plurality of the keys when simultaneously operated, and

means for shifting the actuating-wheel into engagement with each pinion independently of the others.

6. In a calculating-machine, in combination, a plurality of numeral-wheels, a movable carriage, an actuating-wheel and a key mechanism mounted on the carriage, means for shifting the carriage to bring the actuating-wheel into connection with the numeral-wheels in successive order, and means for transmitting to the actuating-wheel the action of each of a plurality of keys when simultaneously operated.

7. In a calculating-machine, in combination, a plurality of numeral-wheels, means carried by certain of the numeral-wheels for moving at fixed intervals in their travel the numeral-wheels adjacent thereto in successive order, an actuating-wheel for driving the numeral-wheels independently of each other, means for shifting the actuating-wheel into connection therewith, keys, and means for transmitting to the actuating-wheel the action of a plurality of the keys when simultaneously operated.

8. In a calculating-machine, in combination, a shaft, a plurality of numeral-wheels loosely mounted thereon, actuating mechanism for the wheels, means for shifting the actuating mechanism to drive the numeral-wheels independently of each other, a frame carried by the shaft, spring-pressed pawls pivoted on the frame and for engaging the numeral-wheels to simultaneously set the same to a desired point when the frame is moved, and a flange for tripping the pawls to throw the same out of engagement with the numeral-wheels.

9. In a calculating-machine, in combination, a plurality of numeral-wheels, an actuating-wheel, means for shifting the actuating-wheel to drive the numeral-wheels independently of each other, a ratchet-wheel for driving the actuating-wheel, levers alternately actuating the ratchet-wheel, and keys representing certain numbers, one of which keys operates one of the levers, the other lever being controlled by the other keys so that the first-mentioned single key may be operated simultaneously with one of the others to move a numeral-wheel a number of steps corresponding to the sum of the numbers allotted to the two keys operated.

10. In a calculating-machine, in combination, a plurality of numeral-wheels, means for actuating the numeral-wheels, double-tooth pivoted dogs carried by certain of the numeral-wheels for engaging and moving at fixed intervals in the travel of such numeral-wheels in either direction the numeral-wheels adjacent thereto in successive order, means for tripping the dogs, means for withdrawing the dogs from engagement with the numeral-wheels after passing the tripping means, and means for shifting the actuating-wheel into connection with the numeral-wheels carrying the dogs for driving the same independently of each other.

11. In a calculating-machine, in combination, a numeral-wheel, a plurality of keys for turning the wheel in either direction, and means for transmitting to the wheel the action of each of a plurality of the keys when simultaneously operated.

12. In a calculating-machine, in combination, a numeral-wheel, a plurality of keys for turning the wheel in either direction, and means for transmitting to the wheel the successive action of each of a plurality of keys when simultaneously operated.

13. In a calculating-machine, in combination, a plurality of numeral-wheels, a wheel for actuating the same, a ratchet-wheel for driving the actuating-wheel, a pawl engaging the ratchet-wheel, a sliding stirrup governing the pawl, key mechanism for sliding the stirrup, and means for limiting the movement of the stirrup so that the numeral-wheel with which the actuating-wheel is in connection will be moved a number of steps corresponding to the number of the key operated.

14. In a calculating-machine, in combination, a plurality of numeral-wheels, a wheel for actuating the same, a ratchet-wheel for driving the actuating-wheel, sliding stirrups alternately actuating the ratchet-wheel, and keys representing certain digits one of which keys operates one of the stirrups, the other stirrup being controlled by the other keys so that the first-mentioned single key may be operated simultaneously with one of the others to move a numeral-wheel a number of steps corresponding to the sum of the digits allotted to the two keys operated.

15. In a calculating-machine, in combination, a plurality of numeral-wheels, a wheel for actuating the same, a ratchet-wheel for driving the actuating-wheel, sliding stirrups each alternately actuating the ratchet-wheel, and keys representing certain digits one of which keys operates one of the stirrups, the other stirrup being controlled by the other keys, and means for limiting the movement of the stirrups and depending on the key depressed whereby the first-mentioned single key may be operated simultaneously with one of the others to move a numeral-wheel a number of steps corresponding to the sum of the digits allotted to the two keys operated.

16. In a calculating-machine, in combination, a plurality of numeral-wheels, a wheel for actuating the same, a sliding shaft to which the actuating-wheel is secured, a ratchet-wheel loosely mounted on the shaft adjacent to each face of the actuating-wheel, pawls for successively imparting motion to each of the ratchet-wheels, sliding stirrups governing the movement of the pawls, keys representing certain digits for operating the stirrups, the pawls governed by one of the stirrups being actuated on the downward movement of the stirrup while the others are actuated on the

upward movement of the other stirrup, one of the stirrups by one key the other being operated by the other keys, whereby the first-mentioned key may be operated simultaneously with one of the other keys to move a numeral-wheel a number of steps corresponding to the sum of the digits allotted to the two keys operated, and means for sliding the actuating-wheel alternately into engagement with the ratchet-wheels to reverse the movement of the actuating-wheel.

17. In a calculating-machine, in combination, a plurality of numeral-wheels, a wheel for actuating the same and being provided with a clutch member on each face, a sliding shaft to which the actuating-wheel is secured, a ratchet-wheel having a clutch member and loosely mounted on the shaft adjacent to each clutch member of the actuating-wheel, pawls for successively imparting motion to each of the ratchet-wheels, sliding stirrups actuating alternately one of the pawls of each ratchet-wheel, and keys representing certain digits, one of which keys operates one of the sliding stirrups, the other stirrup being controlled by the other keys whereby the first-mentioned single key may be operated simultaneously with one of the others to move a numeral-wheel a number of steps corresponding to the sum of the digits allotted to the two keys operated, means for determining the movement of the stirrups and depending on the key depressed, and means for sliding the actuating-wheel alternately into engagement with the ratchet-wheel to reverse the movement of the actuating-wheel.

18. In a calculating-machine, in combination, a plurality of numeral-wheels, actuating mechanism therefor, a traveling carriage on which the actuating mechanism is mounted, means for moving the carriage, means for operating the actuating mechanism, an escapement for regulating the movement of the carriage, keys, and means for transmitting to the actuating mechanism the action of each of a plurality of the keys when simultaneously operated.

19. In a calculating-machine, in combination, a plurality of numeral-wheels, actuating mechanism therefor, a moving carriage on which the actuating mechanism is mounted, means for moving the carriage, means mounted on the carriage and for controlling the actuating mechanism, a stationary rack-bar, and a toothed quadrant adapted to be thrown into and out of engagement with the rack-bar for regulating the movement of the carriage.

20. In a calculating-machine, in combination, a plurality of numeral-wheels, actuating mechanism therefor, a traveling carriage on which the actuating mechanism is mounted, means for moving the carriage, key mechanism and a space-bar also mounted on the carriage and for controlling the actuating mechanism, a stationary rack-bar, a lever operated by the key mechanism and the space-bar, a quadrant pivoted to the lever and normally engaging the rack-bar to hold the carriage against movement, the operation of the key mechanism or space-bar moving the quadrant and the lever alternately into engagement with the rack-bar, a spring for moving the quadrant on its pivot, a spring for returning the quadrant into engagement with the rack-bar when the key mechanism or space-bar is released, whereby, the spring for moving the carriage being stronger than the spring for moving the quadrant on its pivot, the carriage will be moved a distance corresponding to the arc of the quadrant, and means for limiting the movement of the quadrant on its pivot.

21. In a calculating-machine, in combination, a plurality of numeral-wheels, actuating mechanism therefor, a traveling carriage on which the actuating mechanism is mounted, means for moving the carriage, key mechanism mounted on the carriage and for operating the actuating means, a space-bar, an escapement mechanism actuated by the key mechanism or the space-bar for limiting the movement of the carriage, and means for throwing out of action the escapement mechanism.

22. In a calculating-machine, in combination, a plurality of numeral-wheels, actuating mechanism therefor, a traveling sliding carriage on which the actuating mechanism is mounted, means for moving the carriage in one direction, key mechanism for operating the actuating mechanism, a stationary rack-bar, a toothed quadrant adapted to be thrown into and out of engagement with the rack-bar for limiting the movement of the carriage, levers pivoted to the carriage and carrying the toothed quadrant, and means for raising the levers for throwing the quadrant out of action with the rack.

23. In a calculating-machine, in combination, a plurality of numeral-wheels mounted on a shaft, actuating mechanism therefor, means for shifting the actuating mechanism to drive the numeral-wheels independently of each other, arms pivoted to the shaft, a rod connecting the arms, pawls carried by the rod for engaging the numeral-wheels to simultaneously set the same to a desired point when the rod is moved, and means for throwing the pawls out of engagement with the numeral-wheels.

24. In a calculating-machine, in combination, a plurality of numeral-wheels, actuating mechanism therefor, a moving carriage on which the actuating mechanism is mounted, means for moving the carriage, means mounted on the carriage and for controlling the actuating mechanism, means for holding the carriage against movement, and means for releasing said holding means.

25. In a calculating-machine, in combination, a numeral-wheel, an actuating-wheel therefor, a plurality of keys, means for transmitting to the actuating-wheel the successive

action of each of a plurality of keys when simultaneously operated, and means for reversing the rotation of the actuating-wheel.

26. In a calculating-machine, in combination, a plurality of numeral-wheels, an actuating-wheel therefor, means for shifting the actuating-wheel from connection with one numeral-wheel to another, a plurality of keys, and means for transmitting to the actuating-wheel the successive action of each of a plurality of keys when simultaneously operated.

27. In a calculating-machine, in combination, a shaft, a plurality of numeral-wheels mounted thereon and each of which is provided with a peripheral recess, means for actuating the numeral-wheels, a movable rod, and spring-pressed pawls carried by the rod and for engaging the recesses of the wheels to simultaneously set the same to a desired point when the rod is moved.

28. In a calculating-machine, in combination, a plurality of numeral-wheels, a wheel for actuating the numeral-wheels, means for shifting the actuating-wheel to bring the same into engagement with the numeral-wheels in successive order, means for reversing the rotation of the actuating-wheel, keys, and means for transmitting to the actuating-wheel the actuation of each of a plurality of the keys when simultaneously operated.

29. In a calculating-machine, in combination, a plurality of numeral-wheels, means for actuating the numeral-wheels, a double-toothed dog carried by each of certain of the numeral-wheels and coupling to and at fixed intervals in the travel in either direction of such numeral-wheel the numeral-wheel next in order thereto, and means for tripping the dog to couple the numeral-wheels.

30. In a calculating-machine, in combination, a plurality of numeral-wheels each of which comprises a gear and a disk having a peripheral flange overhanging the gear of the adjacent numeral-wheel, means for actuating the numeral-wheels, a double-toothed dog pivoted to each flange and for coupling to and at fixed intervals in the travel in either direction of such numeral-wheel the gear of the numeral-wheel next in order thereto, and means for tripping the dog.

31. In a calculating-machine, in combination, a plurality of numeral-wheels, a dog having an arm and pivoted to each of certain of the numeral-wheels for engaging and moving at fixed intervals in the travel of such numeral-wheel the numeral-wheel adjacent thereto, and a sliding bar in the path of the arm of the dog and having a slot through which the arm passes when the bar is in a certain position.

32. In a calculating-machine, in combination, a plurality of numeral-wheels, a wheel for actuating the numeral-wheels, oppositely-rotating ratchet-wheels, means for connecting the actuating-wheel with either of the ratchet-wheels, a pair of pawls for driving each ratchet-wheel in one direction, a lever governing one pawl of each ratchet, a plurality of keys, connection between at least one of the keys and the lever of one pair of pawls, and connection between the remaining keys and the lever of the other pair of pawls.

33. In a calculating-machine, in combination, a plurality of numeral-wheels, a movable carriage, an actuating-wheel and keys mounted on the carriage, and connection between the keys and the actuating-wheel.

34. In a calculating-machine, in combination, a plurality of numeral-wheels, a longitudinally-movable shaft, a wheel keyed to the shaft and for actuating the numeral-wheels, oppositely-turning ratchet-wheels loosely mounted on the shaft, one at each side of the actuating-wheel, means for clutching the actuating-wheel with the ratchet-wheels in alternation, a pair of pawls for driving each ratchet-wheel in one direction, a lever governing one pawl of each ratchet, a plurality of keys, connection between at least one of the keys and the lever of one pair of pawls, and connection between the remaining keys and the lever of the other pair of pawls.

35. In a calculating-machine, in combination, a plurality of numeral-wheels, a movable carriage, means mounted on the carriage for actuating the numeral-wheels, means for shifting the carriage to bring the actuating means into engagement with the numeral-wheels in successive order, a plurality of keys, and means for transmitting to the actuating means the action of each of a plurality of the keys when simultaneously operated.

JOHN M. STEELE.

Witnesses:
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WM. W. ARMSTRONG.