No. 754,836. PATENTED MAR. 15, 1904.

C. D. BAIRD.

CALCULATING AND RECORDING MACHINE.

APPLICATION FILED OCT. 23, 1902.

NO MODEL. 11 SHEETS—SHEET 1.

Fig. 1.

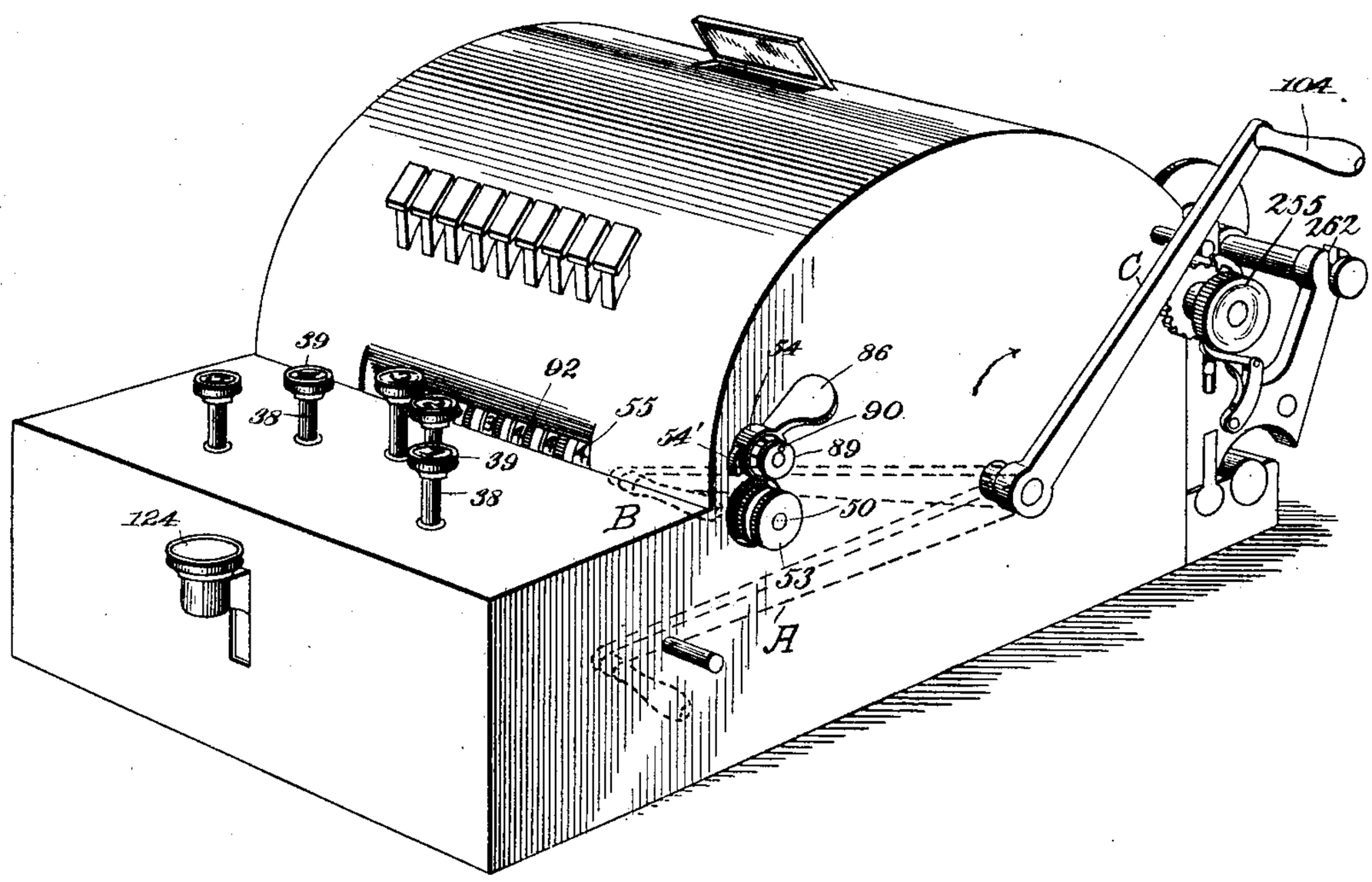


Fig. 13.

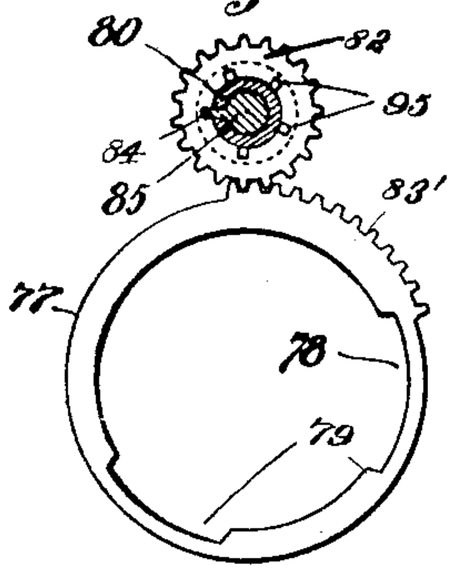


Fig. 15.

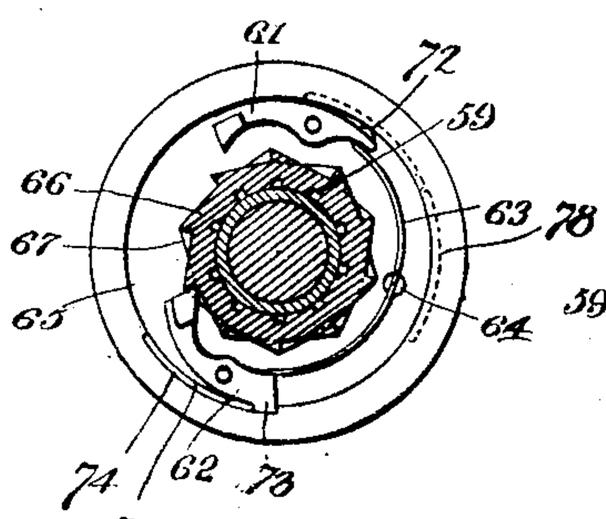


Fig. 14.

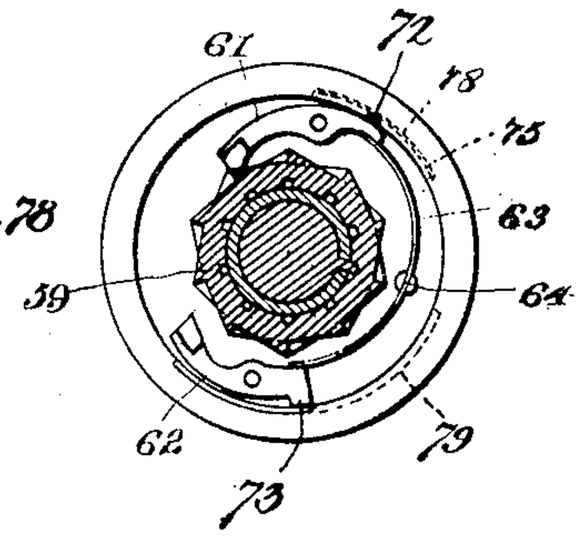
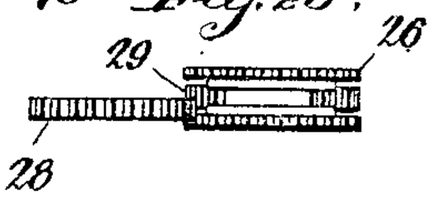


Fig. 19.

Fig. 20.



Witnesses
C. E. Stewart
Jno. E. Parker

C. D. Baird, Inventor.
by Church & Co
Attorneys

No. 754,836. PATENTED MAR. 15, 1904.

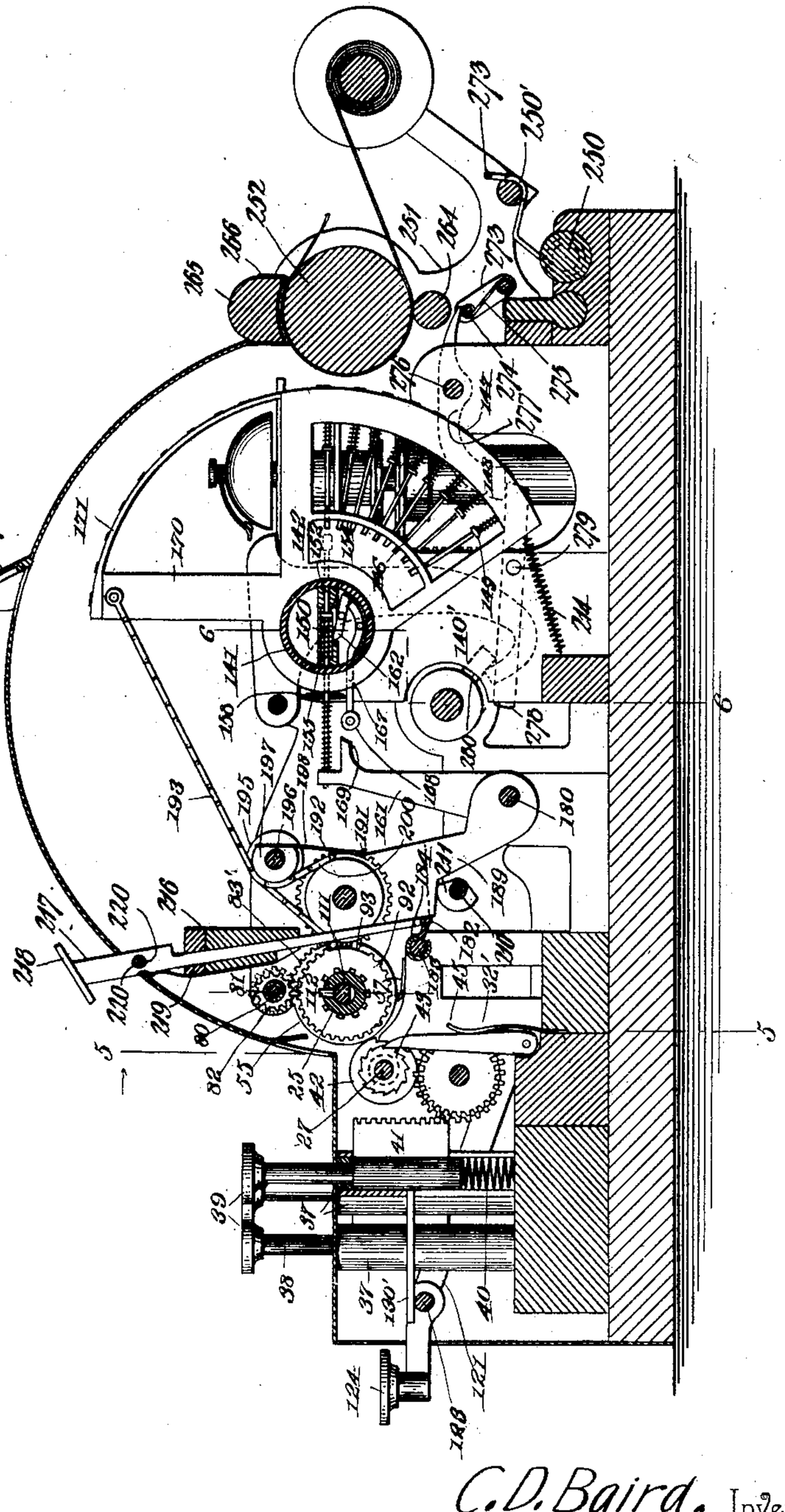
C. D. BAIRD.

CALCULATING AND RECORDING MACHINE.

APPLICATION FILED OCT. 23, 1902.

NO MODEL. 11 SHEETS—SHEET 2.

Fig. 2.



Witnesses
E. F. Stewart
Jno. E. Parker

C. D. Baird, Inventor.
by Church & Co
Attorneys

No. 754,836. PATENTED MAR. 15, 1904.

C. D. BAIRD.

CALCULATING AND RECORDING MACHINE.

APPLICATION FILED OCT. 23, 1902.

NO MODEL. 11 SHEETS—SHEET 3.

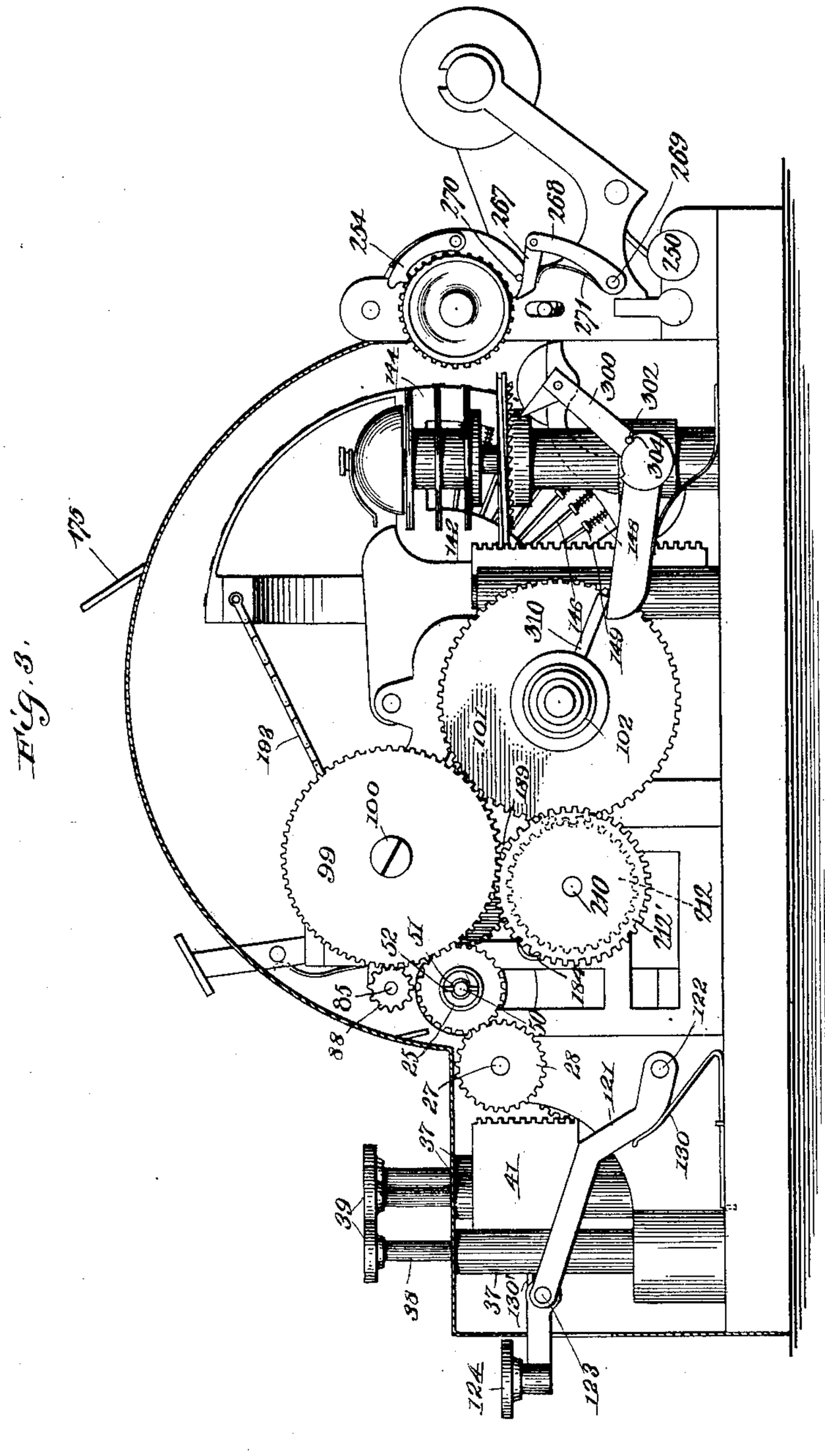


Fig. 3.

Witnesses
C. H. Stewart
Jno. E. Parker

Inventor.
C. D. Baird,
by Crosby & Gregory
Attorneys

No. 754,836. PATENTED MAR. 15, 1904.

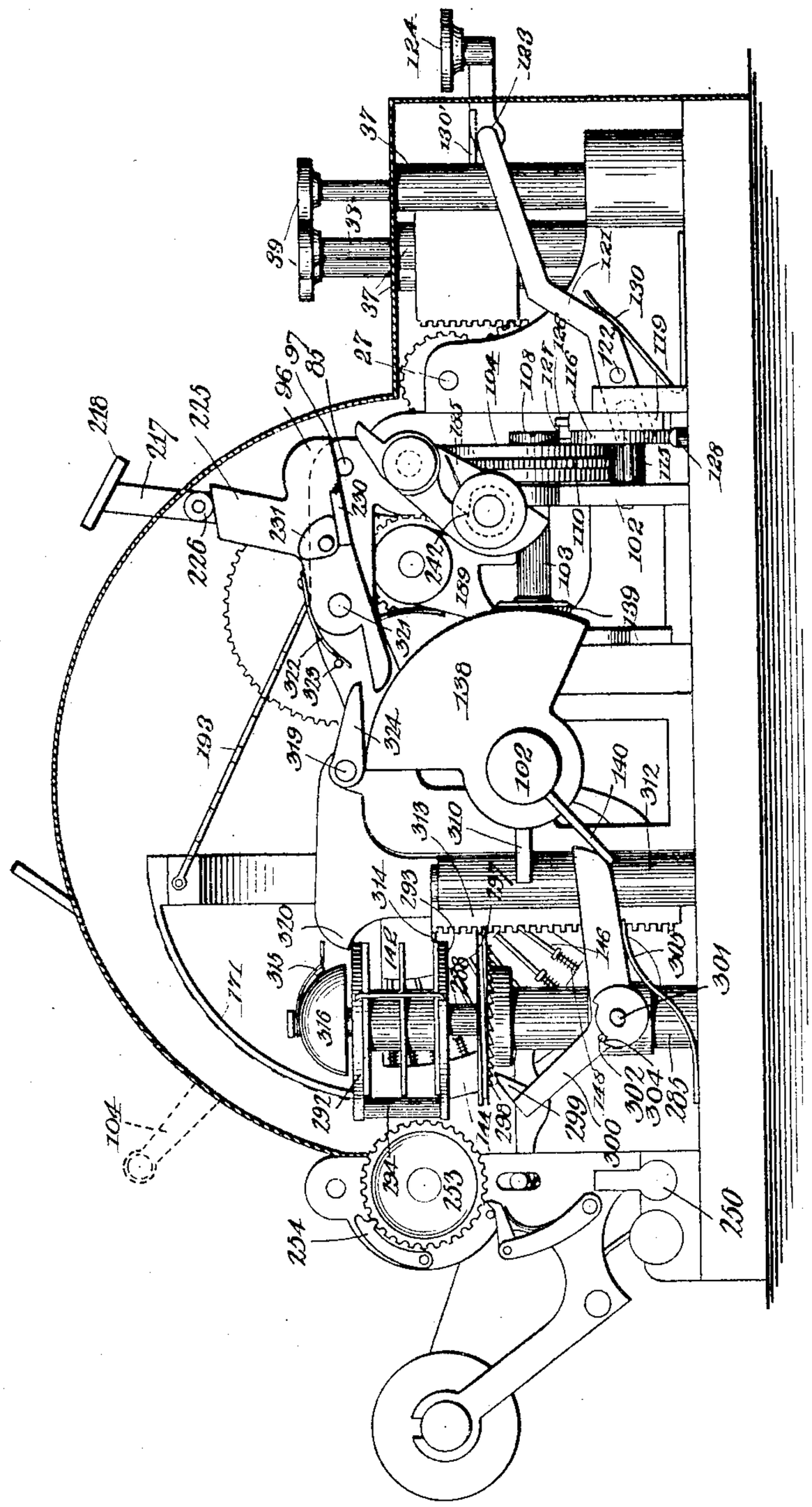
C. D. BAIRD.

CALCULATING AND RECORDING MACHINE.

APPLICATION FILED OCT. 23, 1902.

NO MODEL. 11 SHEETS—SHEET 4.

Fig. 4.



Witnesses
E. F. Stewart
Jno. E. Parker

C. D. Baird, Inventor.
by Cushman & Co
Attorneys.

No. 754,836. PATENTED MAR. 15, 1904.

C. D. BAIRD.

CALCULATING AND RECORDING MACHINE.

APPLICATION FILED OCT. 23, 1902.

NO MODEL. 11 SHEETS—SHEET 5.

Fig. 5.

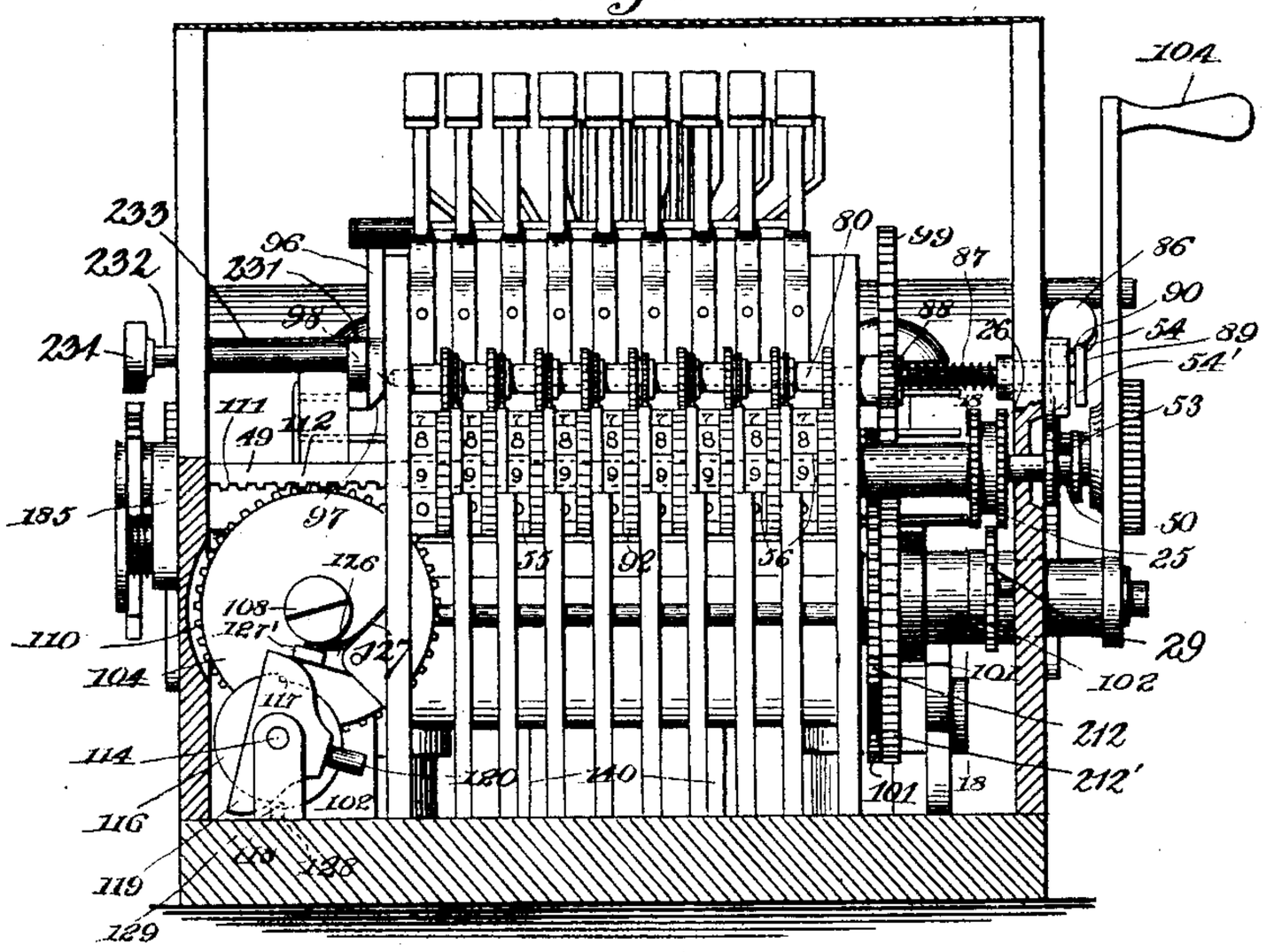
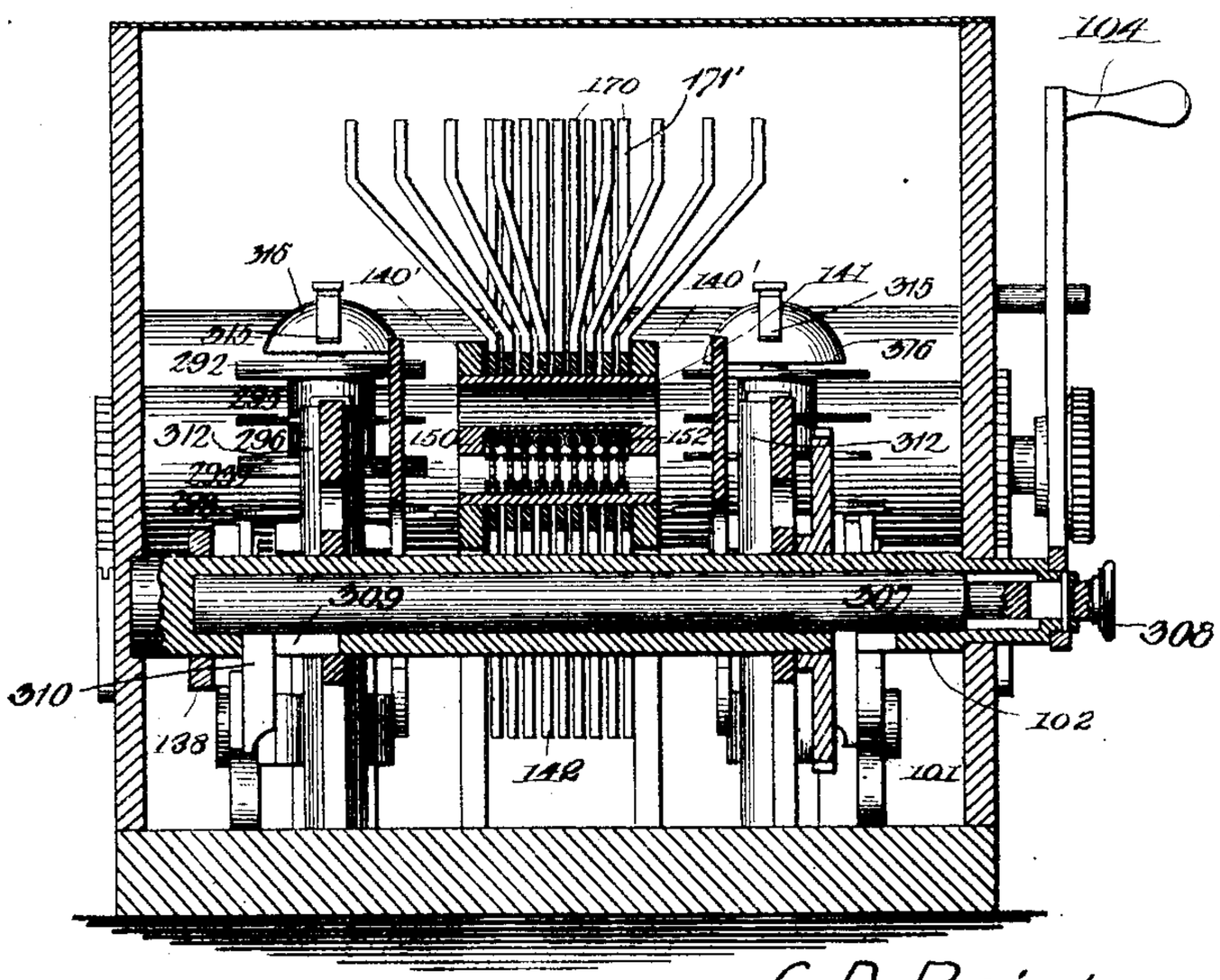


Fig. 6.



Witnesses
E. Fitzgerald
Jno. E. Parker

C. D. Baird, Inventor.
by Cachow & Co
Attorneys

No. 754,836. PATENTED MAR. 15, 1904.

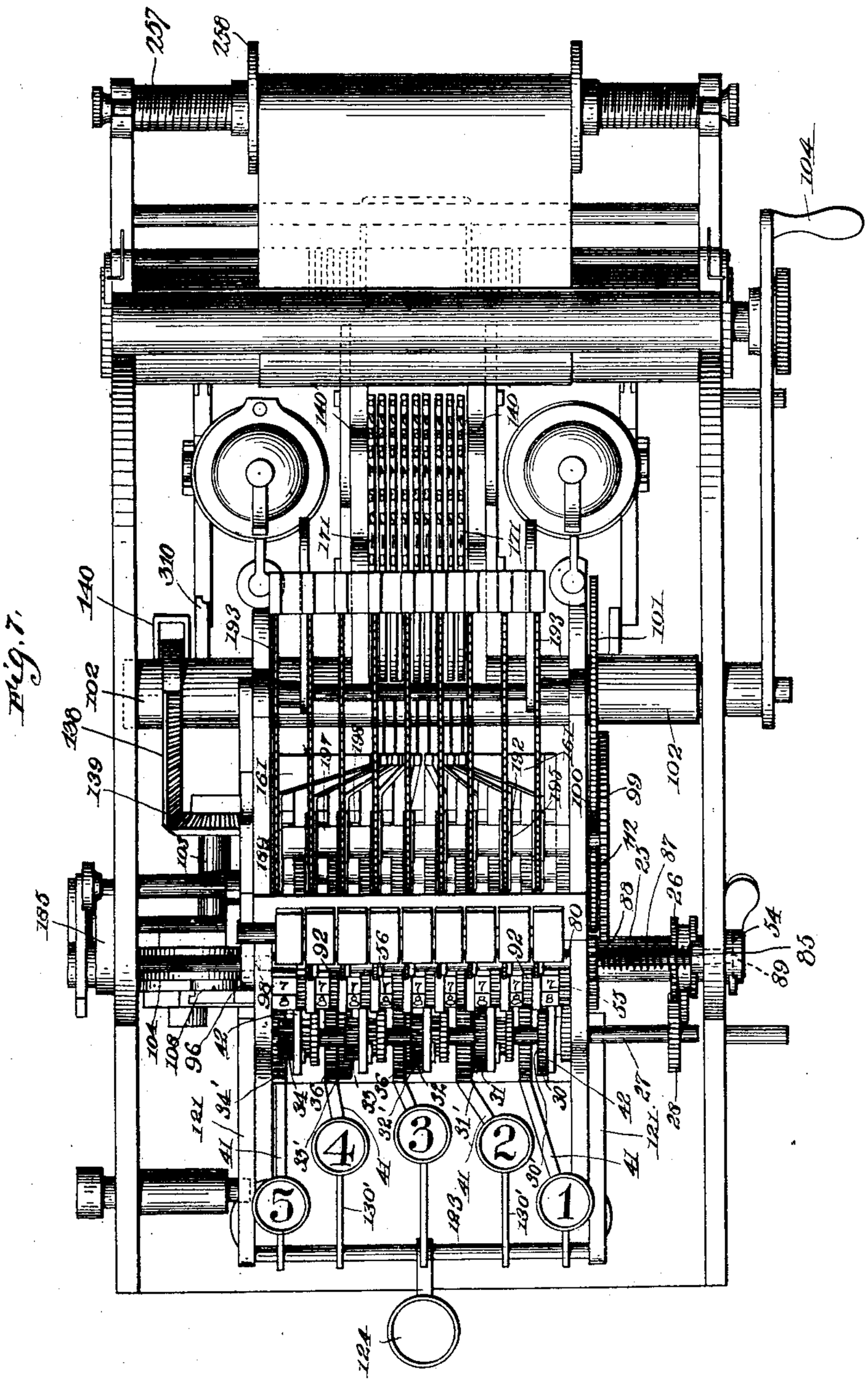
C. D. BAIRD.

CALCULATING AND RECORDING MACHINE.

APPLICATION FILED OCT. 23, 1902.

NO MODEL. 11 SHEETS—SHEET 6.

Fig. 7.



Witnesses
E. F. Stewart
Jno E Parker

C. D. Baird, Inventor
by Cushman & Co
Attorneys

No. 754,836. PATENTED MAR. 15, 1904.

C. D. BAIRD.

CALCULATING AND RECORDING MACHINE.

APPLICATION FILED OCT. 23, 1902.

NO MODEL. 11 SHEETS—SHEET 7.

Fig. 9.

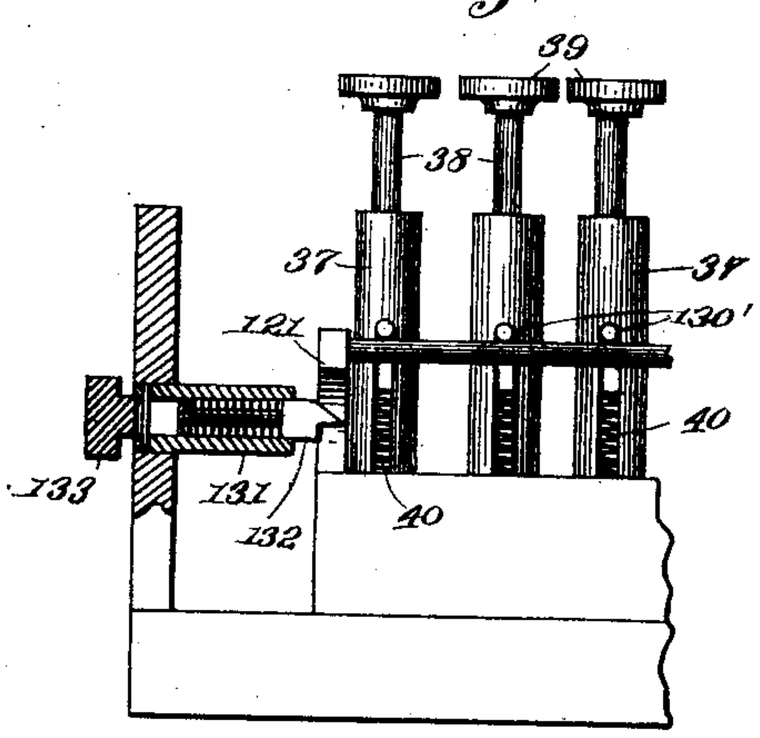


Fig. 8.

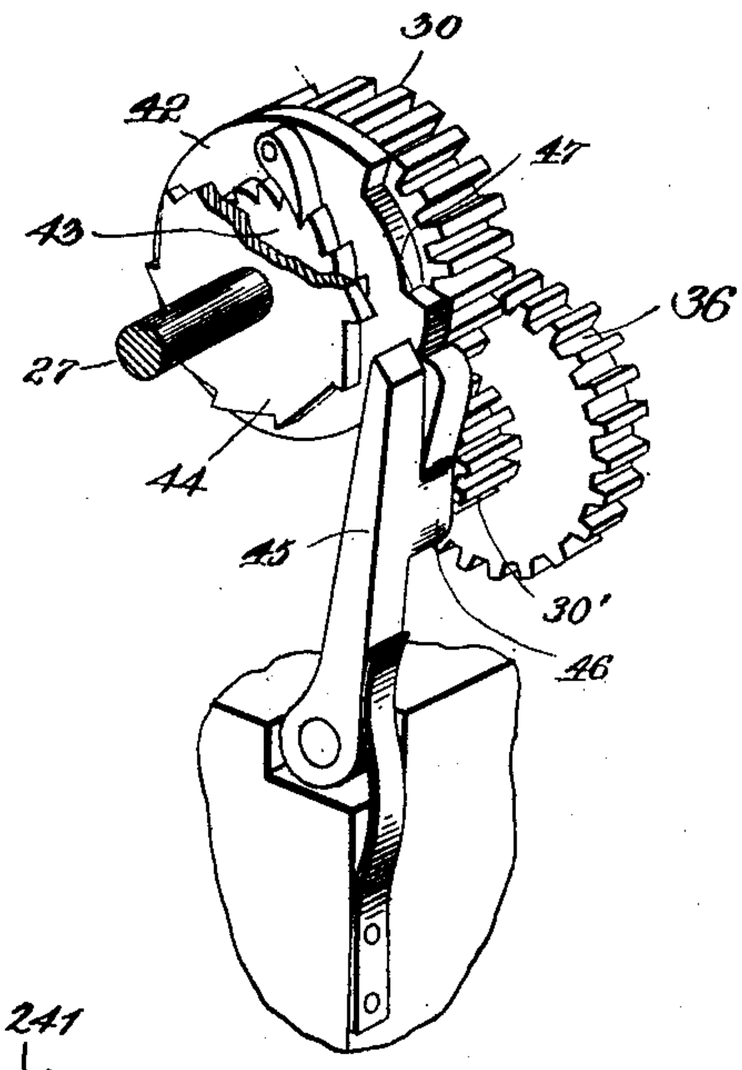


Fig. 21.

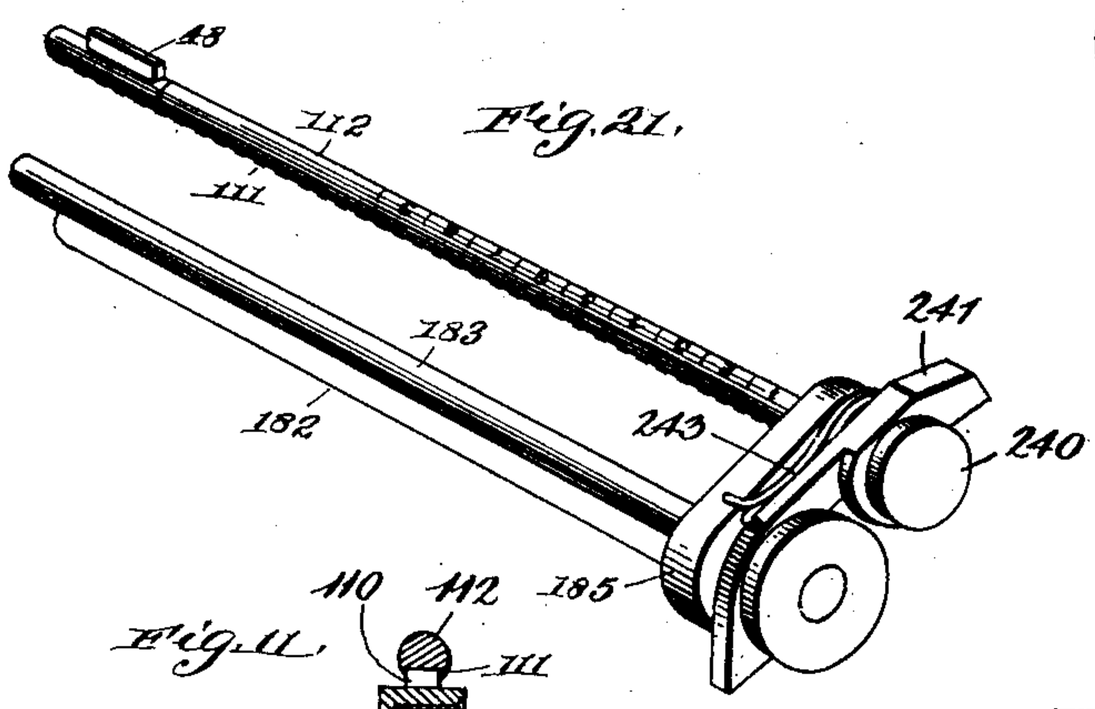


Fig. 11.

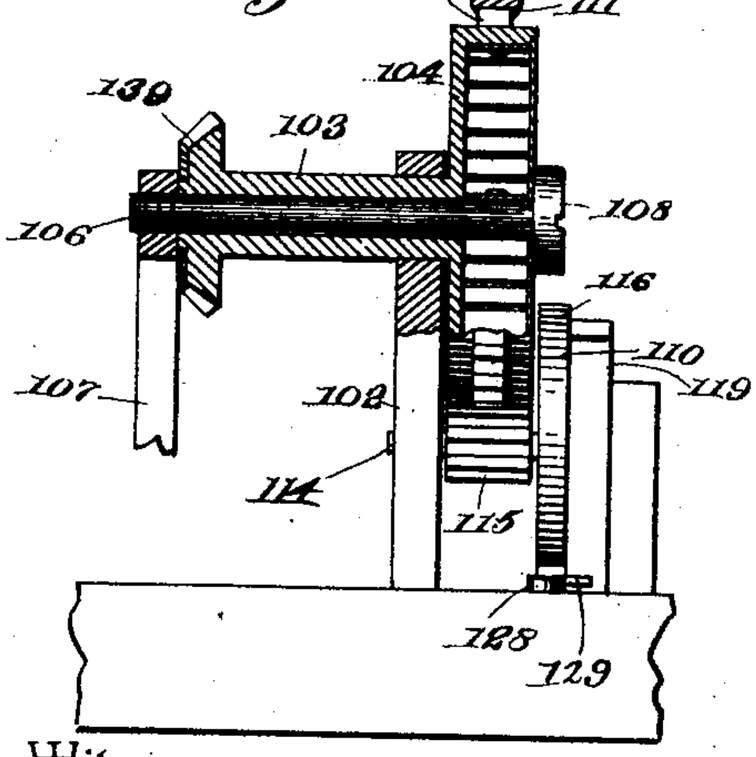
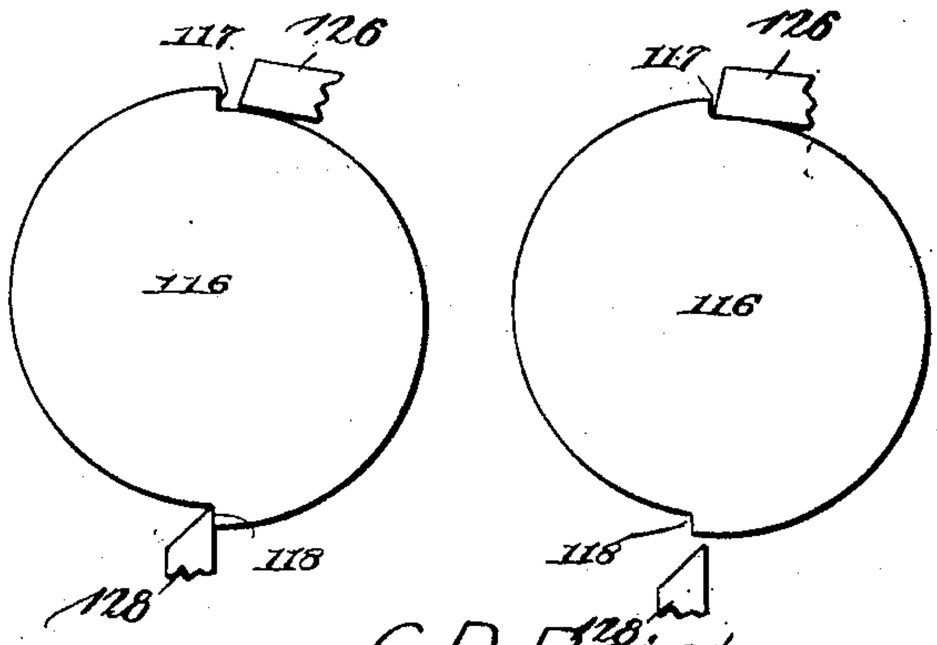


Fig. 12.



Witnesses
E. F. Kellerad
Jno. E. Parker

C. D. Baird, Inventor.
by Church & Co
Attorneys

No. 754,836. PATENTED MAR. 15, 1904.

C. D. BAIRD.

CALCULATING AND RECORDING MACHINE.

APPLICATION FILED OCT. 23, 1902.

NO MODEL. 11 SHEETS—SHEET 8.

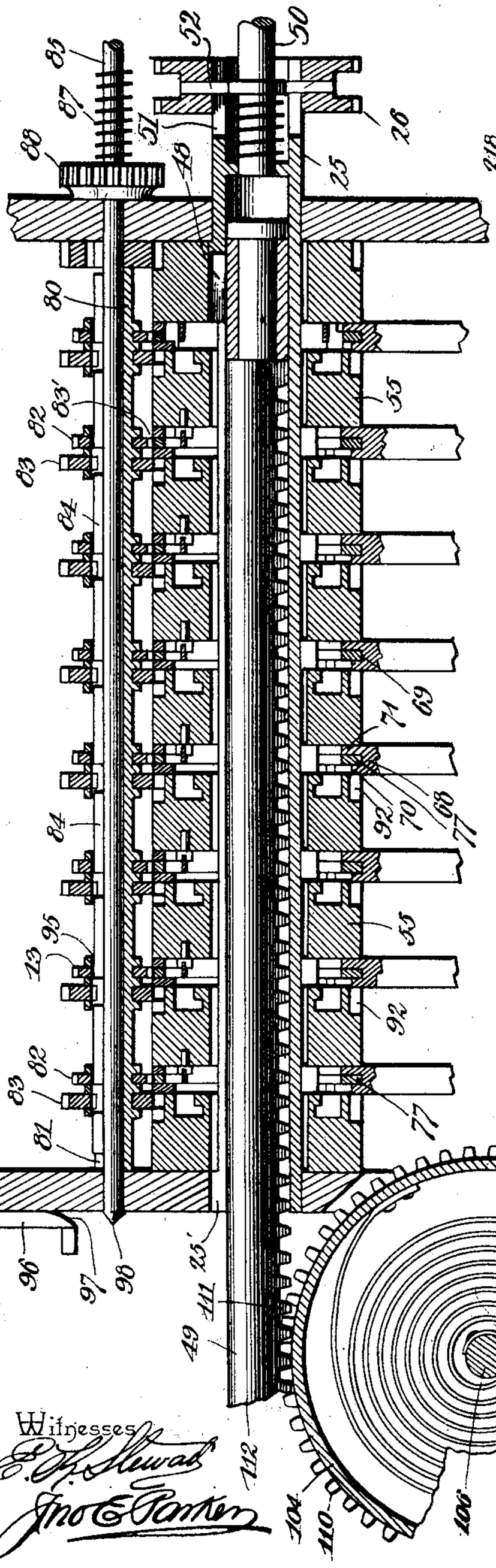


Fig. 10.

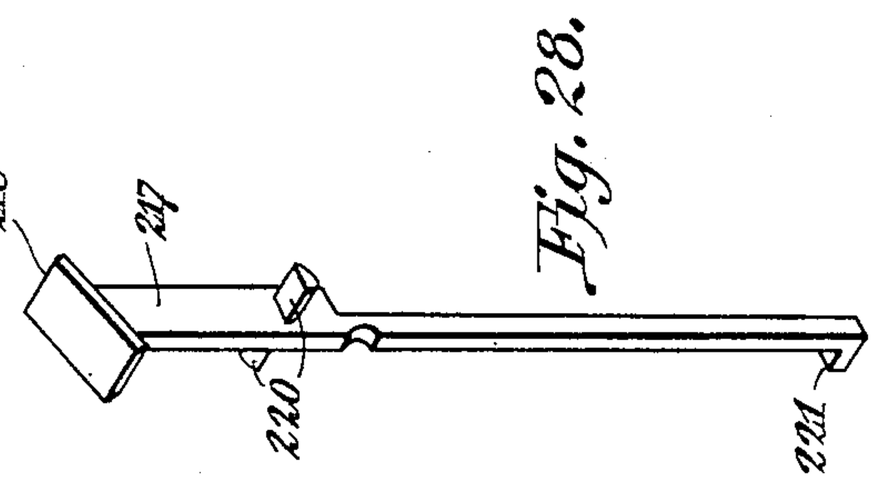


Fig. 28.

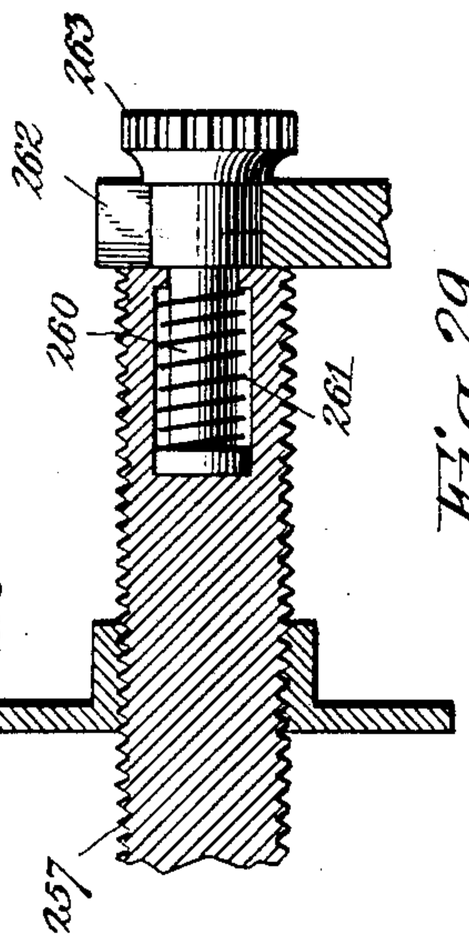


Fig. 29.

Witnesses
E. F. Stewart
Jno. E. Parker

C. D. Baird, Inventor.
by Church & Co.
Attorneys

No. 754,836. PATENTED MAR. 15, 1904.

C. D. BAIRD.

CALCULATING AND RECORDING MACHINE.

APPLICATION FILED OCT. 23, 1902.

NO MODEL. 11 SHEETS—SHEET 9.

Fig. 16.

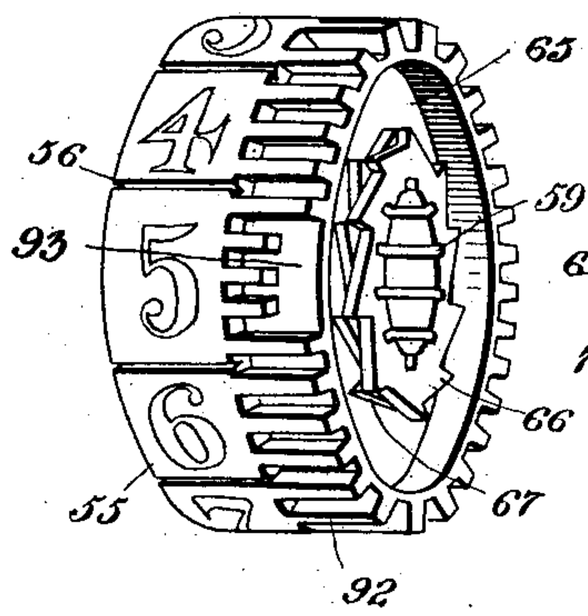


Fig. 17.

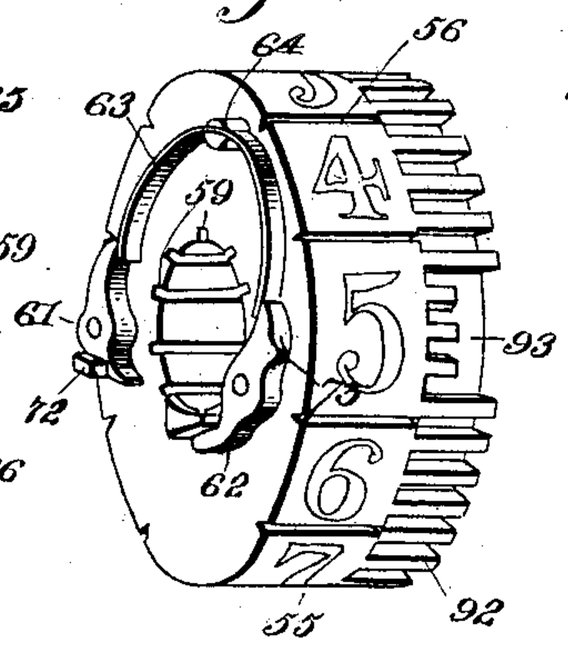


Fig. 18.

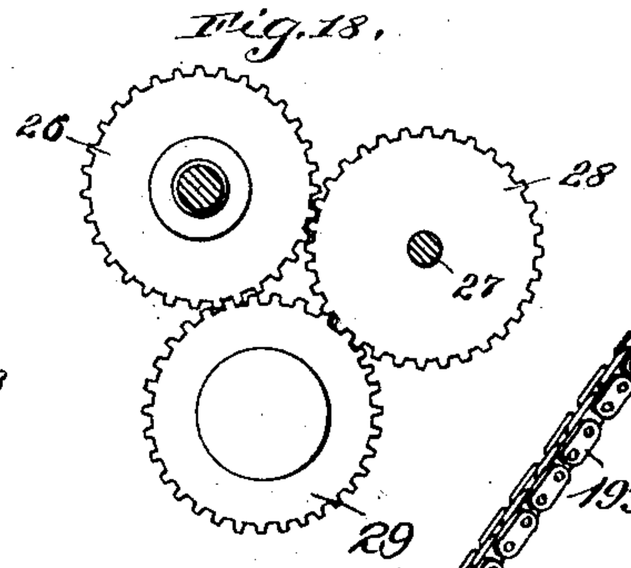


Fig. 26.

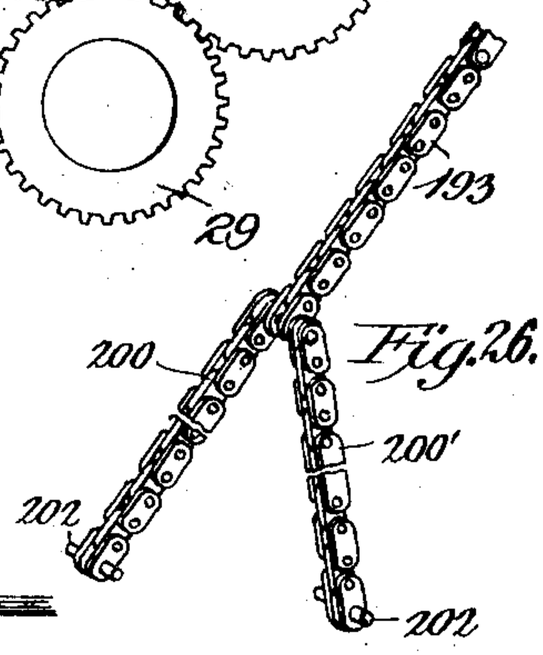


Fig. 25.

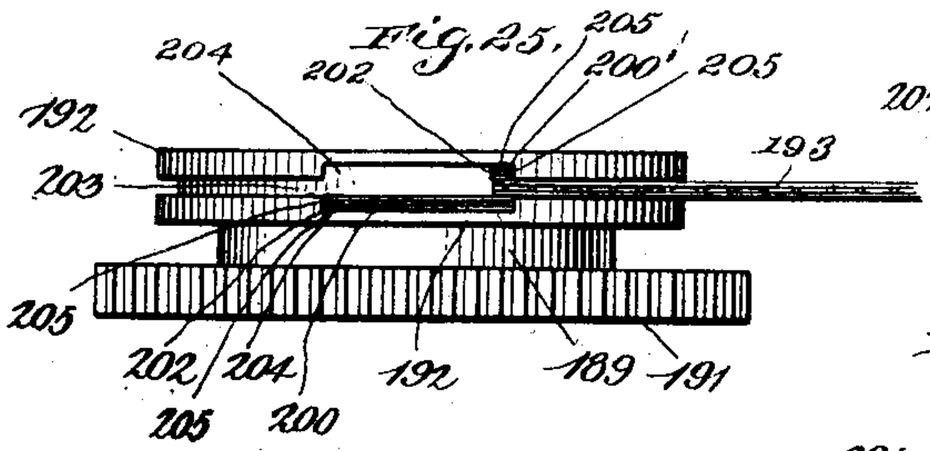


Fig. 27.

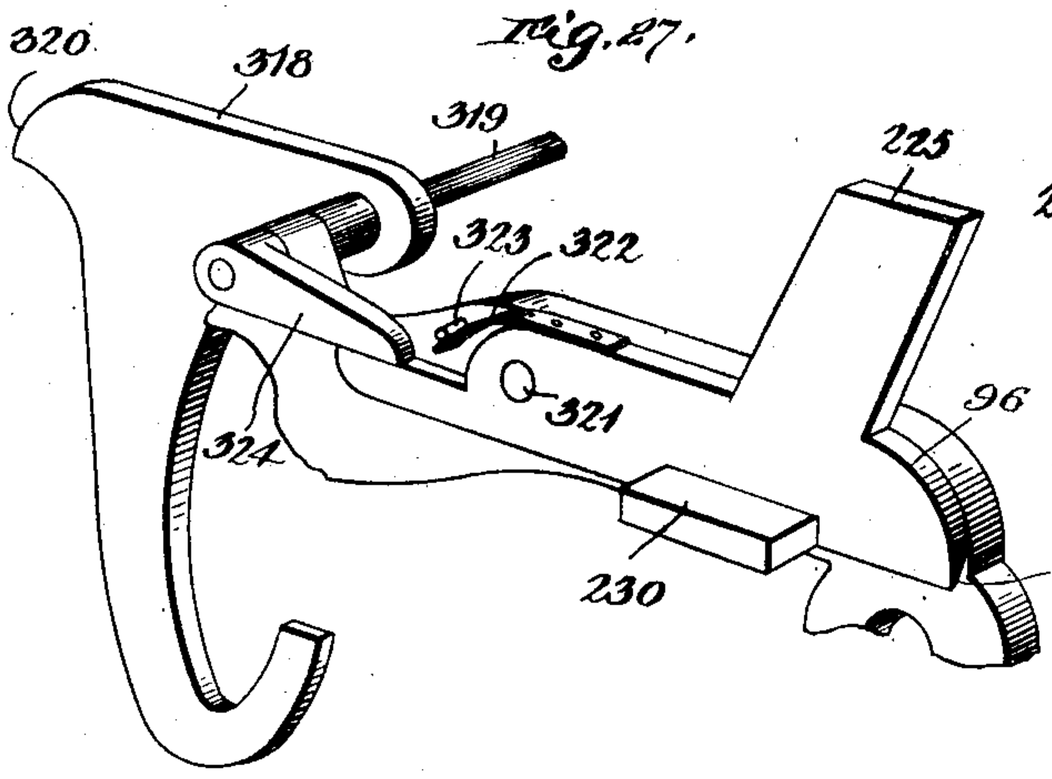
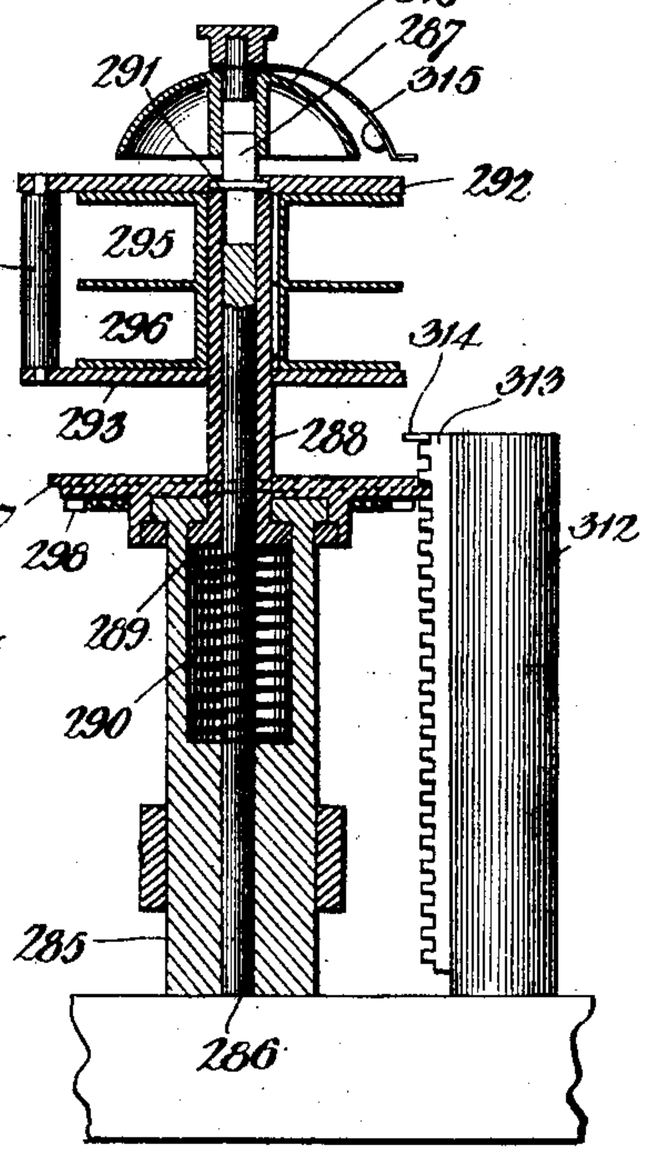


Fig. 30.



Witnesses
E. F. Stewart
Jno. E. Parker

C. D. Baird Inventor
by Church & Co
Attorneys.

No. 754,836. PATENTED MAR. 15, 1904.

C. D. BAIRD.

CALCULATING AND RECORDING MACHINE.

APPLICATION FILED OCT. 23, 1902.

NO MODEL. 11 SHEETS—SHEET 10.

Fig. 22.

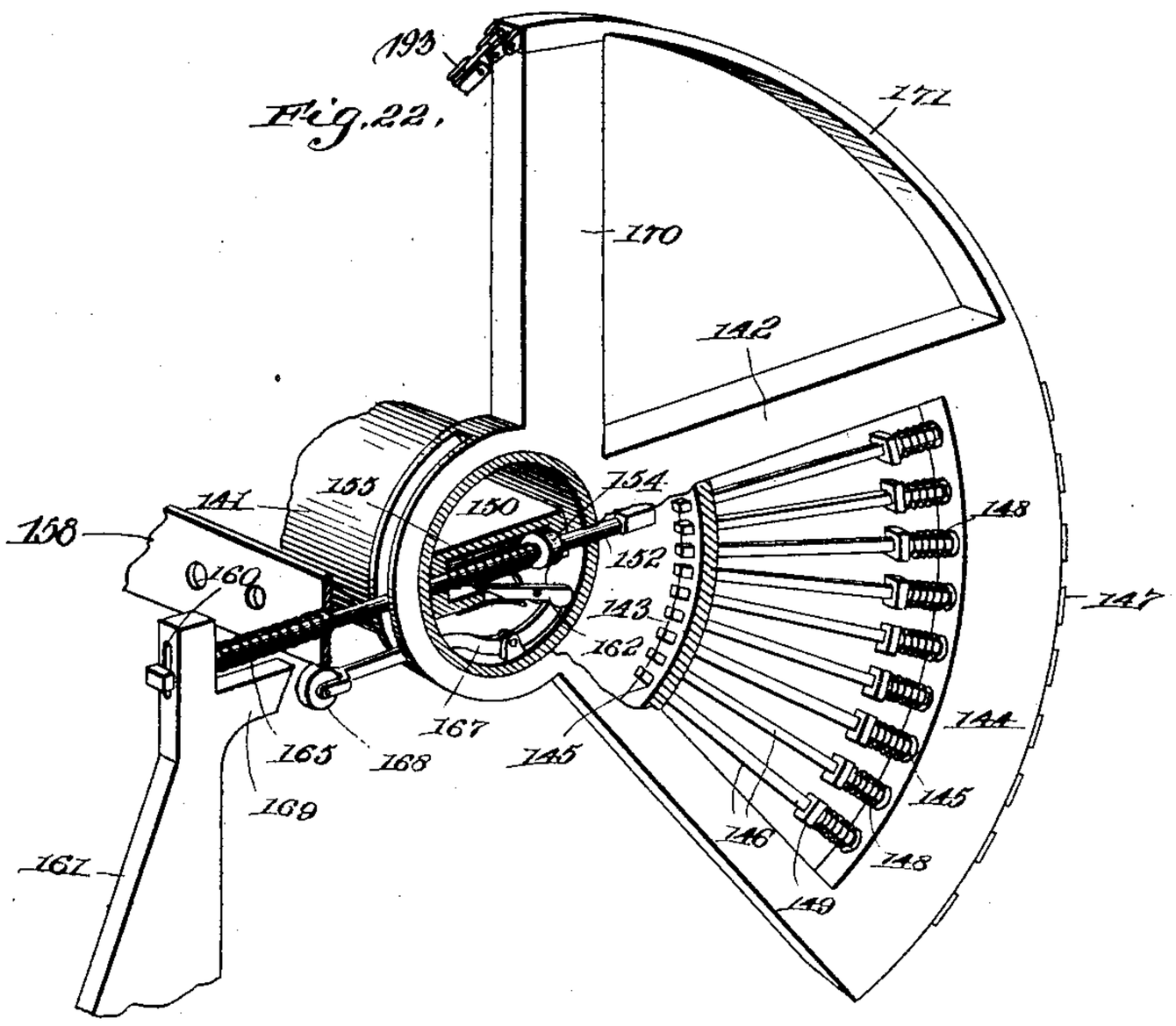


Fig. 23.

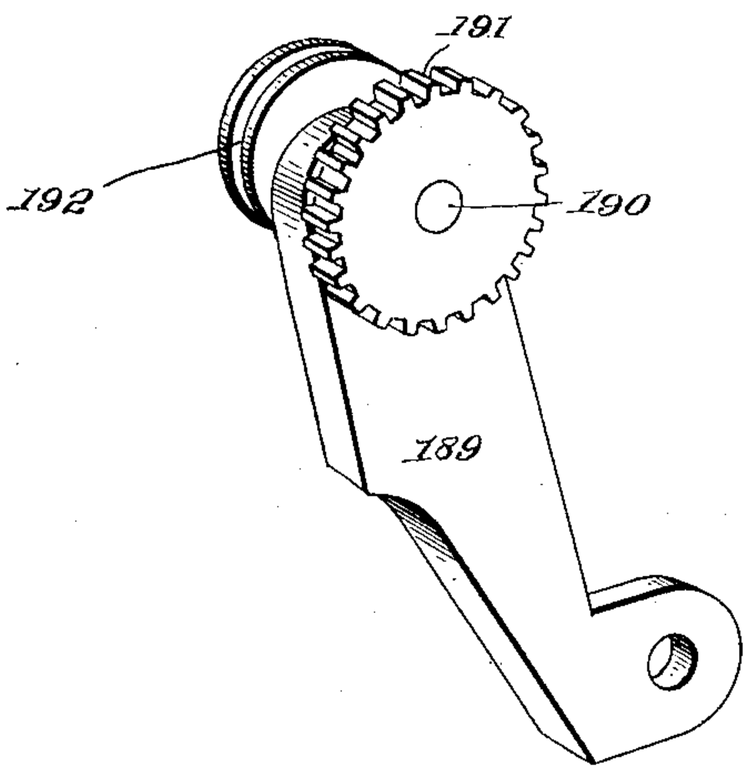
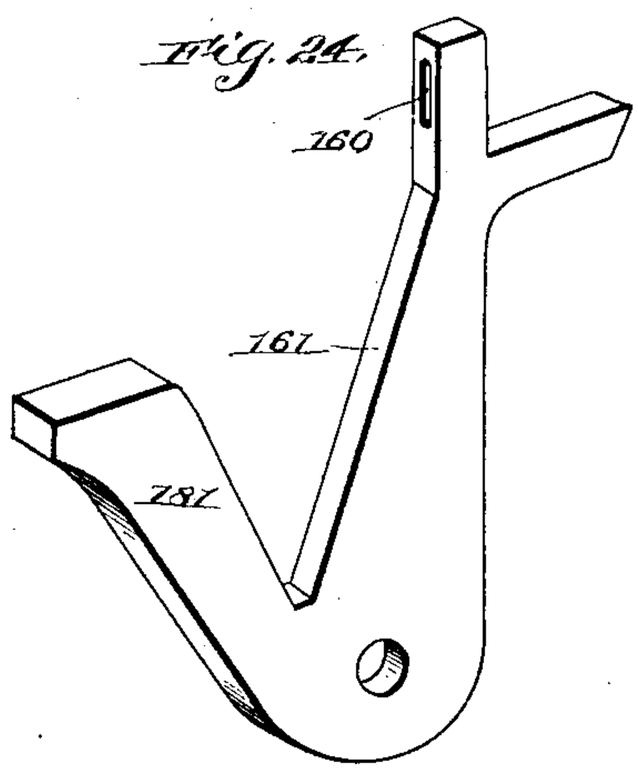


Fig. 24.



Witnesses
E. F. Stewart
Jno. G. Parker

C. D. Baird, Inventor.
by Cushman & Co
Attorneys

No. 754,836. PATENTED MAR. 15, 1904.

C. D. BAIRD.

CALCULATING AND RECORDING MACHINE.

APPLICATION FILED OCT. 23, 1902.

NO MODEL. 11 SHEETS—SHEET 11.

Fig. 31.

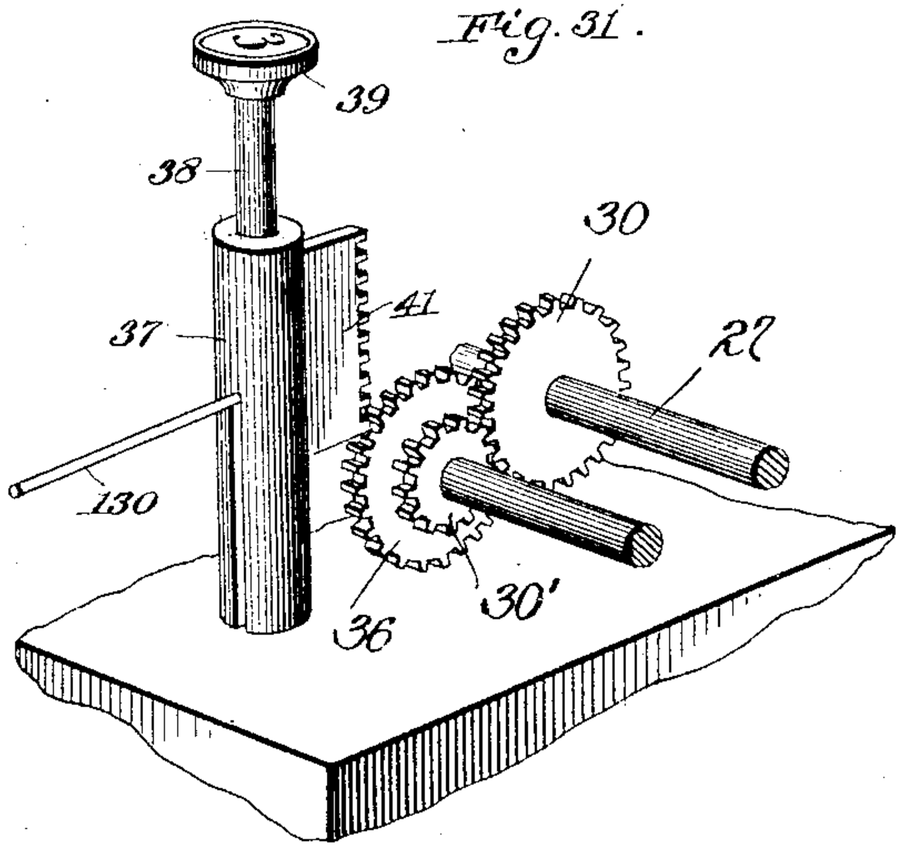


Fig. 32.

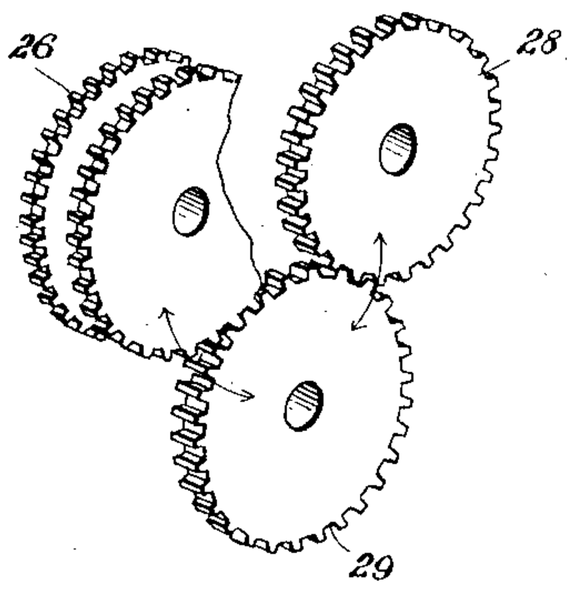


Fig. 34.

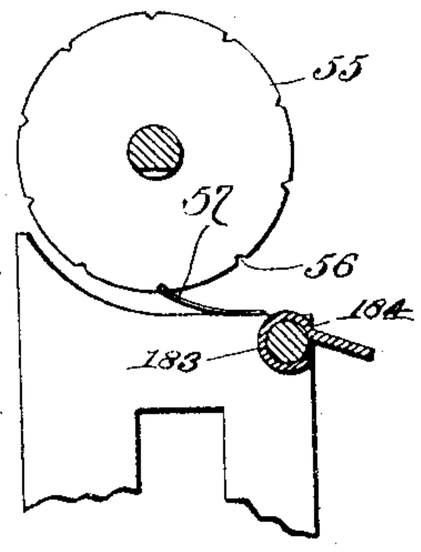


Fig. 33.

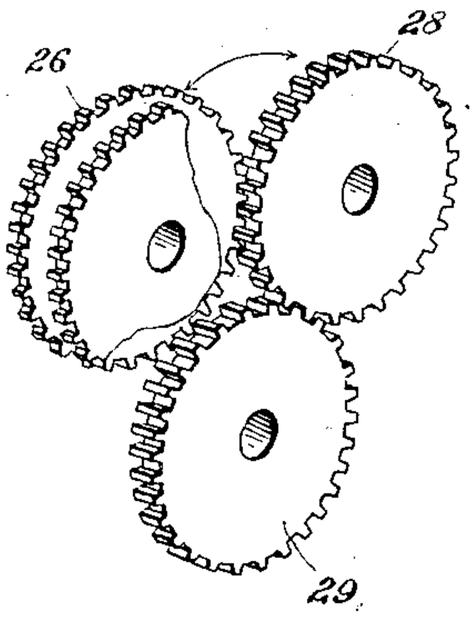
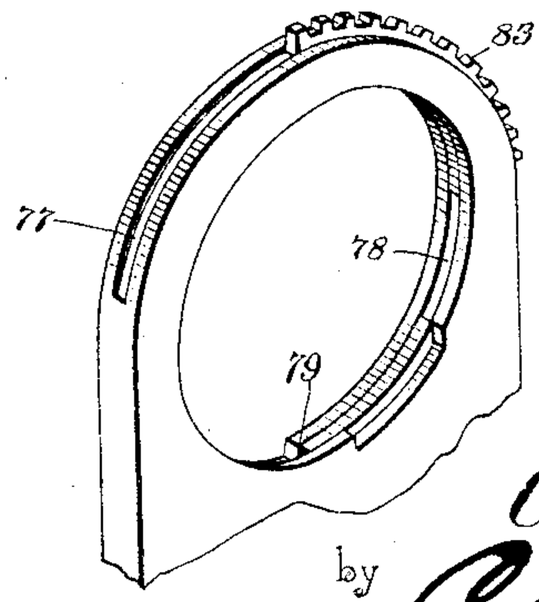


Fig. 35.



Witnesses
E. F. Stewart
Jno. E. Porter

Inventor.
C. D. Baird,
by Cachow & Co
Attorneys

No. 754,836. Patented March 15, 1904.

UNITED STATES PATENT OFFICE.

CLARENCE D. BAIRD, OF ALEXANDRIA, TENNESSEE, ASSIGNOR OF ONE-HALF TO JOHN F. ROY AND JAMES JONES, OF ALEXANDRIA, TENNESSEE.

CALCULATING AND RECORDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 754,836, dated March 15, 1904.

Application filed October 23, 1902. Serial No. 128,473. (No model.)

To all whom it may concern:

Be it known that I, CLARENCE D. BAIRD, a citizen of the United States, residing at Alexandria, in the county of Dekalb and State of Tennessee, have invented a new and useful Calculating and Recording Machine, of which the following is a specification.

My invention relates to certain improvements in calculating and recording machines of that class shown in application for United States Letters Patent filed by me on January 13, 1902, under Serial No. 89,526.

One object of the invention is to provide an improved mechanism for transmitting the movement of the finger or character keys to the indicating and to the recording mechanism, whereby all of the keys may receive precisely the same degree of downward movement without regard to the values which they represent, while the effective movement transmitted to the indicating and recording mechanism will be proportioned to the value represented by each key.

A further object of the invention is to improve and render more certain and effective the mechanism for changing the direction of movement of the indicating-disk when an error is to be corrected and to provide improved means for returning the indicating-disks to zero.

A still further object of the invention is to improve and simplify the mechanism for automatically locking successive indicating-disks to the disk-carrying shaft and to provide an improved mechanism by which the disk-locking key may be allowed to remain in locking position with any desired disk to complete the addition of the number of figures of the same denominational value, to provide for the automatic step-by-step movement of the key and place the latter under the control of the finger or character keys during the employment of the machine for calculating a sum in which the figures have different denominational values, and to further place the disk-locking key under the control of a spacing-key which may be operated independently of the finger-keys to adjust the disk-locking key to any desired position.

A still further object of the invention is to provide an improved form of recording mechanism by means of which successive lines of figures or subtotals may be printed and by which the recording or imprinting mechanism may be adjusted to proper position for the printing of a grand total during the returning movement of the indicating-disks to initial position.

A still further object of the invention is to so connect the indicating and the recording mechanisms as to provide for the proper adjustment of the recording mechanism from a movement of the indicating mechanism in either direction.

A still further object of the invention is to provide an improved means for preventing the printing of ciphers to the left of any row of figures which it may be desired to record and in this connection to so construct a machine that the adjustment preliminary to the printing of a grand total will move an inked ribbon of a color different from that employed for the subtotals into alinement with the printing-types and platen.

A still further object of the invention is to provide an operating means for moving each separate type to printing position and to guard against the adjustment to imprinting position of any type-bars unselected by the operator.

A still further object of the invention is to provide for the operation of all of the parts by a single operating-lever after the indicating and recording devices have been moved to the desired position by the finger-keys.

With these and other objects in view the invention consists in the novel construction and arrangement of parts hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a perspective view of the machine. Fig. 2 is a central longitudinal sectional elevation thereof. Fig. 3 is an elevation looking from the

right-hand side of the machine, the side of the casing being removed in order to more clearly illustrate the construction. Fig. 4 is a similar view looking from the left-hand side of the machine. Figs. 5 and 6 are transverse sectional elevations of the machine on the lines 5 5 and 6 6, respectively, of Fig. 2. Fig. 7 is a plan view of the machine with the casing removed. Fig. 8 is a detail perspective view of a portion of the mechanism for transmitting the movement of the finger-keys to the indicating-disks and illustrating particularly the means employed for preventing excessive movement of the disks. Fig. 9 is a detail sectional view of the locking device employed for retaining the space-key in inoperative position. Fig. 10 is a detail sectional view, on an enlarged scale, of the indicating-disks and the adjusting mechanism therefor, together with the disk-locking key and its actuating mechanism. Fig. 11 is a sectional elevation of the actuating-drum for the disk-locking key, the section being taken on the plane indicated by the line 11 11 of Fig. 10. Fig. 12 is a detail view of a portion of the mechanism shown in Fig. 10, with the parts in different positions. Fig. 13 is a transverse sectional elevation on the line 13 13 of Fig. 10 and illustrating a portion of the mechanism for adjusting the position of the transferring devices to enable the indicating-disks to transfer from a lower to a higher disk during addition or from a higher to a lower disk during subtraction. Figs. 14 and 15 are transverse sectional elevations on the line 14 14 of Fig. 10, illustrating the construction of the mechanism for transferring the movement of one disk to the next succeeding disk, as from a unit to a tens disk or from a tens to a hundreds disk. Figs. 16 and 17 are perspective views of a pair of adjacent indicating-disks, illustrating the mechanism carried by each disk. Fig. 18 is a transverse sectional elevation, partly on the line 18 18 of Fig. 5, illustrating the arrangement of the train of gearing for transmitting the movement of the primary shaft to the indicating-disk shaft. Figs. 19 and 20 are detail views showing the different positions to which said gears may be adjusted for effecting the different operations. Fig. 21 is a detail perspective view of the key for locking the indicating-disks and the various parts which may be connected to the key and its operating mechanism for partially controlling the adjustment of the registering devices. Fig. 22 is a detail perspective view of one of the type-segments and the mechanism for moving selected type to imprinting positions. Figs. 23 and 24 are detail perspective views of portions of the registering mechanism more specifically referred to hereinafter. Fig. 25 is a detail view of one of the chains for adjusting a type-segment to position and the reel on which said chain is wound. Fig. 26 is a detail perspective view of a portion of the chain. Fig. 27 is a detail perspective view of one of the devices for adjusting the mechanism by which the indicating-disks are returned to zero position and by which the total-printing ribbon may be adjusted and held in operative position. Fig. 28 is a detail perspective view of one of the keys for controlling the movement of the recording mechanism. Fig. 29 is a sectional elevation of a detail of the paper-carriage more particularly referred to hereinafter. Fig. 30 is a sectional elevation of one of the ribbon-reels. Fig. 31 is a detail perspective view of a portion of the mechanism for transmitting differential movement from the finger-keys to the indicating mechanism. Figs. 32 and 33 are detail perspective views showing gearing for changing the direction of movement of the indicating-disks. Fig. 34 is a detail view illustrating one of the indicating-disks and its holding-pawl. Fig. 35 is a detail perspective view of a portion of the mechanism shown in Fig. 10, illustrating details of construction.

Similar numerals of reference are employed to indicate corresponding parts throughout the several figures of the drawings.

The machine for convenience may be divided into a number of sections, comprising a finger-key mechanism, an indicating mechanism operable by the finger-keys, and a registering mechanism operable from the indicating mechanism.

The indicating mechanism comprises in general a number of disks loosely mounted on a hollow shaft 25 and each bearing numerals from naught to nine, the disks being of different denominational value, as is usual in machines of this class, and means being provided for locking any desired disk to the shaft in order that the rotative movement of the shaft shall be imparted thereto.

The finger-key mechanism has two functions, one to impart differential rotative movement to the shaft 25 in accordance with the value represented by the finger-key depressed, and, secondly, to provide for the locking of a selected disk to said shaft 25. To receive this rotative movement, the shaft 25 is provided with a double gear-wheel 26 and the shaft 27 of the finger-key mechanism is provided with a gear-wheel 28, which may revolve the double gear-wheel by intermeshing directly therewith or indirectly through a gear-wheel 29, as shown in Figs. 18, 19, and 20, the gearing being adjustable in order that the rotative movement of the shaft 27 may be imparted to the disk-carrying shaft in either direction and the machine employed for sums in addition or for ordinary subtraction, in case it may be desired to lessen the sum indicated by the disks for the purpose of correcting an error.

The shaft 27, Figs. 7 and 8, is provided with gear-wheels 30, 31, 32, 33, and 34, said gears being of different diameters and being inter-

meshed, respectively, with gear-wheels 30′, 31′, 32′, 33′, and 34′, all of different diameters and journaled in different vertical planes in order that their teeth may properly intermesh with the gears on the shaft 27. Each of the independently-journaled pinions, with the exception of the pinion 34′, is rigidly secured to a gear-wheel 36, and all of the gears 36 and the pinion 34′ are of equal diameter. In the base of the machine are a number of hollow standards 37, five being employed in the present instance, and each standard supporting a shank 38 of a finger-key 39, the shank and key being normally retained in elevated position by a coiled compression-spring 40. Each shank 38 is provided with a plate or bar 41, extending through a radially-disposed slot in its standard 37, and at the outer edge of each plate is a rack adapted for engagement with the gears 36 and pinion 34′, previously referred to.

The several finger-keys, ranging from right to left, are provided with designating-numerals from "1" to "5" to indicate the value of said keys and the degree of rotative movement which they are adapted to impart to the indicating-disk shaft. In practice it is preferred to employ five keys in order that the device may be readily operated by one hand without rendering it necessary to keep the keyboard in constant view, although any desired number of keys may be employed without departing from the invention. Each key, without respect to the value represented, receives the same degree of downward movement; but the effective movement transferred to the gear 28, and through it to the indicating-disk shaft, is determined by the relative diameter of the gear-wheels. The rack of the finger-key to the right of the machine, having a value of one, intermeshes with one of the large gears 36 and turns the pinion 30′, connected thereto. This pinion is of small diameter and imparts to its intermeshing gear-wheel 30 an angular movement equal to one-tenth of a revolution of the indicating-disk shaft, so that any indicating-disk which may be secured to the shaft will receive a one-tenth movement, sufficient to display the next adjacent numeral on the disk at the visual opening in the casing. The relation between the gears which connect the finger-key marked "2" to its gear-wheel 31 and the indicating-disk shaft are such as to impart to the latter a movement equal to two-tenths of a revolution, and in similar manner the successive keys impart different angular movements to the indicating-disk, that given by the finger-key bearing the numeral "5" being equal to one-half or five-tenths of a revolution. When a larger number, as nine keys, are employed, the movement imparted may range from one-tenth to nine-tenths of a revolution, in accordance with the value of the keys; but where only five keys are employed and it is desired to indicate any number between five and nine the proper keys are successively depressed—as, for instance, to indicate the numeral "7" keys Nos. 5 and 2 or keys Nos. 4 and 3 would be successively actuated.

In order not to tax the strength of the operator, the keys should offer but little resistance to the depressive movement, and when this is the case there is likelihood of the gears whirling from an abrupt movement and imparting an excessive movement to the indicating-disks. In order to avoid this and to check the movement of the gears at the proper time, as well as to permit the free return movement of the keys to elevated position, I employ a mechanism shown in Fig. 8.

To each of the gear-wheels on the shaft 27 is secured a cam 42, the cam and gear-wheel of each set being loosely mounted on the shaft and provided with one or more pawls adapted to engage the ratchet-wheel 43, secured to the shaft 27 and provided with ten teeth, the pawls engaging with the teeth of the ratchet-wheel and positively turning the shaft on the downward movement of the finger-keys, but permitting the gear-wheel and cam to revolve freely on the shaft in the opposite direction, while the finger-keys are being returned to the elevated position by the springs 40. To the shaft are secured a number of ratchet-wheels 44, of which one is arranged adjacent to each cam-disk, said ratchet-wheels each having ten teeth. At a suitable point to the rear of the base of the keyboard are pivoted a number of spring-pressed pawls 45, adapted to engage the ratchet-wheels 44, and from one side of each pawl extends a finger 46, arranged in operable relation to the cam-disk 42, each cam-disk being of a shape corresponding to the value of the finger-key and its connected gearing, with which said cam-disk coöperates. By referring to Fig. 8 it will be seen that each cam-disk is provided with a shoulder 47, and said shoulder is situated when in normal position at a distance in advance of the finger 46 proportionate to the distance through which its adjacent gear-wheel moves under the impulse of the finger-key. The cam-disk to the extreme right of the machine, or that which coöperates with the finger-key marked "1," will have its shoulder one-tenth of a revolution in advance of the finger 46, and when said cam is revolved through this distance the finger will fall and the pawl 45 will engage in the ratchet-wheel 44 and positively stop further movement of the shaft. When the cam-disk is returning to its initial position under the impulse of the returning-spring 40 of the finger-key, the shoulder 47 will engage with the finger 46, and thus raise the pawl 45 from engagement with the ratchet-wheel, the parts being returned to an initial position after each operation. In similar manner the operating-shoulder of the cam-disk governed by finger-key No. 2 will normally be arranged two-tenths of a revolution in advance of the pawl-

finger and the remaining cam-disks will have their shoulders arranged at three-tenths, four-tenths, and five-tenths of a revolution in advance of their respective fingers.

The indicating-disk shaft 25, Fig. 10, is mounted in suitable bearings and provided with an elongated key-slot 25′, through which extends a locking-key 48, mounted on a carriage 49, which may be reciprocated within the hollow shaft either manually or by the automatic mechanism hereinafter described. At the end of the hollow shaft is a short spindle 50, guided in a bearing in a casing of the machine and extending within the end of the shaft. The shaft is provided with two diametrically-disposed slots 51, through which passes a pin 52, the pin serving to secure the spindle 50 to the double gear-wheel 26 and the slots 51 permitting a slight longitudinal movement of the double gear-wheel with respect to the indicating-disk shaft, the outer end of the spindle at a point outside the casing being provided with a grooved knob 53, by means of which the spindle and the double gear may be adjusted, suitable means being employed for locking the parts in adjusted position. Under normal conditions when the machine is employed for purposes of addition the gears are connected in the manner shown in the diagram Fig. 19, the gear 28 intermeshing with the gear 29, carried by a stud on the frame, and the latter intermeshing with the double gear 26 and imparting movement in the proper direction to the indicating-disk shaft. When it is desired to turn the indicating-disk shaft in the opposite direction for purposes of subtraction or to move the indicating-disk shaft backward for the purpose of correcting an error, the knob 53 is forced inwardly and the double gear 26 is shifted to the position shown in Fig. 20, said gear being then intermeshed directly with the primary gear 28 and being revolved in the opposite direction. The knob 53 and the double gear are held in adjusted position by means of a flanged disk 54, having a lug 54′ engaging the groove in said knob, said disk being turned after the knob is pushed in until the lug enters the groove and retains the knob and double gear in position. The turning of this disk effects a movement of another portion of the indicating mechanism, as will more fully appear hereinafter.

On the hollow indicating-disk shaft 25, Fig. 10, are mounted a number of indicating-disks 55, nine in the present instance, although the number may be increased or diminished to any extent. The disks are all of the same construction and are normally loose on the shaft, but capable of being locked thereto by the key 48. The surface of each disk is provided with numerals ranging from "0" to "9," and between each two numerals is a slot or notch 56, Fig. 34, with which engages a spring catch or pawl 57, rigidly secured to a supporting-standard forming a part of the frame, the pawl dropping into the successive notches or grooves and offering but slight resistance to the movement of the disk in either direction.

In the central portion of each disk are ten radially-disposed and equidistant keyways 59, in any one of which may engage the key 48 on the carriage 49, and said carriage may be moved within the hollow shaft to engage and lock any one of said disks to the shaft. The disks, ranging from right to left, designate decimal values from units to tens, hundreds, thousands and the values constantly increasing in multiples of ten, the extreme left-hand disk representing in the present case hundreds of millions, while if the machine be employed for adding money values the two right-hand disks will be employed to represent cents and tens of cents, the extreme left-hand disk then representing one million dollars. On the depression of any one of the numbered finger-keys the degree of movement imparted to the gears will be transmitted to the shaft 25 and to that one of the disks locked to said shaft by the key 48, the movement of the finger-key number 1 revolving an indicating-disk to the extent of one-tenth of a revolution and bringing the numeral "1" of said disk into alinement with a suitable visual slot or opening. In this manner the key 48 may be moved to engage one disk after another and any suitable degree of movement imparted thereto.

In order to transfer a partial rotative movement from a unit or tens disk to a tens or hundreds disk or from any disk representing the lower value to one representing a higher value, I employ a mechanism best shown in Figs. 14, 15, 16, and 17.

On the left-hand side of each indicating-disk are pivoted two pawls 61 and 62, the toothed ends of which are projected toward the center of the disk by a suitable spring 63, centrally held on a stud 64 and having its opposite ends bearing against the rear ends of the pawl. In the adjacent face of the next succeeding disk is arranged a recess 65, within which are two ratchet-wheels 66 and 67, secured to or formed integral with each other and with the disk, each ratchet-wheel being provided with ten teeth, the teeth of one facing in one direction and the teeth of the other in the opposite direction. The pawl 61, which may be termed the "addition-pawl," is adapted to engage with the ratchet-wheel 66 and under normal conditions will engage with and turn said ratchet-wheel to the extent of one-tenth of a revolution each time the disk which supports said pawl makes a complete revolution. The opposing pawl 62, which may be termed the "subtraction-pawl," engages with the ratchet-wheel 67 during such times as the movement of the disk-carrying shaft 25 is reversed to move the disks backward for purposes of subtraction or to correct an error.

On the fixed frame of the machine are secured a number of rings 68, Fig. 10, which

project upwardly between the disks, each ring being provided with a centrally-disposed groove 69, which divides it into two parallel flanges 70 and 71, on one of which bears a lug 72 on the rear face of the tail of the addition-pawl 61, and on the other flange, 70, bears a lug 73 on the tail of the subtraction-pawl 62. In the flange 70 is a recess 74, and in the flange 71 is a similar recess 75, each recess extending for rather more than one-tenth of the circumference of the flange and the recesses being situated at different points in the flanges, as shown in Figs. 14 and 15. If these recesses were open at all times, the lugs on the pawl would enter and permit the toothed ends of the pawls to move toward and engage the ratchet-wheels 66 and 67. In the groove 69, formed between the two flanges, is a cam-ring 77, having two elongated notches 78 and 79, Fig. 13, the notch 78 being normally in alinement with the recess 75 of the flange 71, and as the lugs of both pawls bear partly on this ring and partly on their respective flanges the lugs 72 of the addition-pawl 61 will be permitted to move outwardly into the alining recess 78 of the ring and the corresponding recess 75 of the flange once during each revolution of the indicating-disk to which said pawl is pivoted. This movement of the rear end of the pawl moves the toothed end of said pawl into engagement with a tooth of the ratchet-wheel 66, the latter being turned to the extent of one tooth, or one-tenth of a revolution, to expose a succeeding numeral on the periphery of the disk.

At a point above the shaft 25 the stationary frame is provided with bearings for the reception of a hollow shaft 80, having a key-slot 81 extending throughout its entire length and provided with a plurality of pinions, of which there are two sets 82 and 83, the former being normally secured to the shaft by keys 84, carried by a spindle 85, guided longitudinally within the hollow shaft. The pinions 82 intermesh with racks 83′, formed on the exterior of the ring 77, so that if the shaft and spindle are turned the pinions will be rotated to shift the position of the rings and alter the position of the pawls. When said rings are in the position illustrated in Fig. 14, which is the normal position when the machine is being employed for the addition of a column of figures, the recesses 78 and 75 will be in alinement and the addition-pawl will be permitted to operate once during each revolution. When the ring is in the position shown in Fig. 14, its recess 79 and the recess 74 of the flange 71 are not in alinement, so that the subtraction-pawl 62, which bears against both the ring and the flange, will be constantly held out of engagement with the ratchet-wheel. When the position of the rings 77 is shifted, as illustrated in Fig. 15, the recess 78 moves out of alinement with the recess 75 and keeps the addition-pawl 61 out of operation, and at the same time the recess 79 of the ring moves into alinement with the recess 74, permitting the subtraction-pawl 62 to move into operable relation with the ratchet-wheel 67. This shifting of the ring occurs only when it is desired to reverse the normal direction of travel of the disk-carrying shaft to move the disks backward for purposes of subtraction or to correct an error, and the reversing and shifting mechanism is operated by the engagement of the pinions 82 with the segment 83′ on the several rings. The flanged disk 54, which has been previously referred to, is disposed in alinement with the spindle 85, and the hub of said disk is provided with a central portion of reduced diameter that fits in a suitable bearing-opening in the casing, as shown by dotted lines in Fig. 5, and it may be readily turned by means of a thumb-piece 86, secured to said disk. In the central portion of the disk is a guiding-opening for the passage of the spindle 85, said spindle being normally maintained in the position shown in Fig. 10 by means of a coiled compression-spring 87, extending between a small pinion 88, secured to the spindle, and the hub portion of the disk 54. At the outer end of the spindle is a disk 89, carrying an inwardly-projecting pin 90, adapted to engage in an opening in the disk 54, the pin being normally held within the opening by means of the spring 87. In the operation of this portion of the mechanism the knob 53 is first pushed inward to shift the position of the double gear 26, and while held in this position the thumb-piece 86 on the disk 54 is caught and turned until the lug 54′ of said disk enters the annular slot or groove in the periphery of the knob 53, effectually locking said knob and the double-gear wheel 26 in adjusted position. The turning movement of the disk 54 causes a corresponding movement of the spindle 85 through its connection with the disk and effects a partial rotative movement of each of the pinions 82 and the shifting of the positions of the rings 77. The indicating-disk mechanism remains in either position to which it is adjusted, and the disks are turned in the desired direction by the same operative movement of the finger-keys.

On the periphery of each of the indicating-disks are gear-teeth extending continuously around the disk and forming a gear-wheel 92, this gear intermeshing with connecting-gears for effecting the adjustment of the recording devices. A portion of some of the teeth are cut away to form a space 93, and this portion of the gear of each disk is in alinement and normally in engagement with a loose pinion 83, mounted on the hollow shaft 80, the pinions being idle during the normal operation of the machine. When it is desired to return all of the indicating-disks to zero position after the completion of a problem, the spindle 85 is shifted longitudinally until the several keys 84, projecting through the hollow shaft,

are engaged in one or other of a number of radially-disposed keyways 95 in the gears 83, effectually locking said gears to the hollow shaft and the same time releasing the pinions 82, which operate the cam-rings 77. The longitudinal movement of the spindle is effected by a lever 96, Figs. 10 and 27, pivoted on a stud atthe left-hand side of the frame of the machine and provided with an inclined portion 97, adapted to engage with the conical or rounded end 98 of the spindle, which projects beyond the side of the main supporting-frame. The lever 96 may be depressed in a number of ways; but at each depression the inclined surface 97 engages the end of the spindle and effects the longitudinal movement of the spindle 85 until the keys 84 release the pinions 82 and engage the pinions 83. This same movement of the spindle brings the pinion 88 into mesh with a gear-wheel 99, mounted on a stud or pin 100 at the right-hand side of the frame, said gear 99 being in constant mesh with a gear-wheel 212′ on a cam-shaft 210, hereinafter referred to, and said shaft also carrying a gear 212 in mesh with a gear 101 on the main shaft 102 of the machine, so that when a crank-handle 104, connected to said main shaft, is operated the train of gearing will rotate the pinion 88 and through it the spindle and the hollow shaft, all of the pinions 83 being turned until the spaced portion 93 of the indicating-disk gears is reached, at which time the zeros of said disks will be in alinement with the visual opening of the casing. When the spindle 85 is shifted in the manner described, the pin 90, carried by the spindle-supported disk 89, is moved out of engagement with the opening in the disk 54, so that said spindle may rotate freely, and when the lever 96 is elevated from engagement with the end of the spindle the latter is returned to its initial position by the spring 87, the pinion 88 being moved out of mesh with the gear-wheel 99 and the several locking-keys 84 being moved into engagement with the pinions 82, carried by the hollow shaft. The pinions 83 may be held by suitable pawls which will permit movement in either direction.

The machine as thus far described is of value in the addition of single columns, where the locking-key 48 may be held continuously in engagement with the units-disk until the entire column of units is added and then shifted to the tens-disk to count the next column, and so on until the calculation is finished. Where, however, it is desired to add a number of columns at once, it is preferable to employ means for automatically shifting the key from the units-disk to the tens-disk and from the tens-disk to the hundreds-disk, and so on to disks of correspondingly-increasing values, in accordance with the number of figures in the row. To accomplish this automatic shifting of the position of the locking-key, I employ a spring-drum of the character shown in Figs. 10, 11, and 12.

In a standard 102 is a bearing for the support of a hollow shaft 103, having at one end a hollow drum 104. Arranged within the drum is a spiral spring having one end secured to the inner circular wall of the drum and its inner end secured to a spindle 106, extending through the hollow shaft 103 and having its opposite end adapted to a threaded opening in a bracket 107, projecting from the side of the frame. The outer head of the drum is confined in position by the headed end 108 of the spindle in order to provide a convenient means for renewal of the spring when broken. On the periphery of the drum is secured an annular rack or gear 110, intermeshing with a rack 111, forming part of a bar 112, which extends through the disk-carrying shaft 25 and is securely fastened to the carriage 49. The drum is revolved by the spring in one direction, and the gear 110 thereon being engaged with the rack 111 feeds the bar 112 and the carriage toward the left of the machine, there being means for governing the movement of the drum to stop the key in locking position with the successive indicating-disks. At a point under the drum is a shaft 114, adapted to suitable bearings and provided with a pinion 115, engaging with the gear on the drum. To this shaft is also secured a disk 116, having a pair of diametrically-opposed notches 117 and 118, and the shaft further affords a support for a pivoted cam 119, provided with a pin 120, fitting in the slotted rear end of a spacing-lever 121. The spacing-lever 121 is pivoted on a stud 122 and is connected to a similarly-pivoted lever at the opposite side of the machine by a cross-bar 123, Fig. 7, which extends transversely of the machine in front of the several standards which support the finger-keys. At about the central portion of the cross-bar 123 is secured the shank of a space-key 124, which is arranged outside the casing and disposed in such manner that it may be depressed independent of the finger-keys bearing the numerals when it is desired to effect an independent movement of the indicating-disk-locking key. On one side of the frame is pivoted a pawl 126, normally held by a suitable spring in engagement with or adjacent to a shoulder formed by the notch 117 in the disk 116, and at one side of said pawl is a finger 127′, adapted to be engaged by the upper portion of the cam 119. In the base is disposed a second spring-pressed pawl 128, adapted to engage the shoulder 118, and this pawl is provided with a finger 129, adapted for engagement by the lower portion of the cam 119.

The spring 105 being wound, the operation is as follows: The spacing-lever 121 is depressed against the action of a spring 130, which normally holds the same in elevated position, and the slotted end of said lever

effects a slight turning movement of the cam 119 until its lower shoulder engages the finger 129 of the pawl 128 and releases the same from engagement with the shoulder 118. This permits a slight turning movement of the disk 116 until the shoulder 117 comes into engagement with the pawl 126. When the spacing-lever is released and allowed to rise, the cam 119 moves to the position shown in Fig. 5, permitting the pawl 128 to move into contact with the periphery of the disk; but at this time the shoulder 118 is slightly out of alinement with the engaging surface of said pawl. The continued rocking movement of the cam elevates the finger 127′, and pawl 126 moves out of engagement with the shoulder 117, permitting the disk 116 to revolve to the extent of one-half of a revolution, or until the shoulder 117 engages the pawl 128 and stops the movement. The spring-drum turns to an extent sufficient to move the rack-bar, and the carriage 49 moves its locking-key 48 from engagement with one indicating-disk and into engagement with the next succeeding disk of higher value.

It will be noted that the movement of the locking-key takes place on the upward and not on the downward movement of the spacing-lever and occurs after the rotative movement of an indicating-disk is accomplished on the depressing of a character-key. The spacing-lever may be independently operated to adjust the position of the locking-key by means of the finger piece or key 124; but under normal conditions it is preferred to provide means for actuating the spacing-key at each depression of any character-key, and to this end the shank portion of each key is provided with a forwardly-extending bar or arm 130′, projecting over and in contact with the cross-bar 123 of the spacing-lever, so that a character-key may be depressed to effect the rotation of the units-disk while said units-disk is locked to the shaft and at the same time depress the spacing-lever. On the upward movement of the spacing-lever the locking-key is automatically moved into engagement with the tens-disk, so that the next depression of a character-key will indicate a succeeding numeral in the second or tens column.

In order to temporarily lock the spacing-lever in inoperative position when it is desired to add a vertical row of figures in one column, the side of the casing is provided with a barrel 131, Fig. 9, in which is guided a locking-bolt 132, having at one end a suitable knob or handle 133 outside of the casing. The bolt is pressed inwardly by a suitable spring, and its inner end is inclined and arranged in such manner that the spacing-lever when fully depressed will be automatically engaged and held from movement. The fully-depressed position of the spacing-lever is lower than that to which the lever is moved by the engagement of the arms 130 of the character-keys with the cross-bar 123 of the spacing-lever, so that said character-keys may be freely operated without releasing or effecting any movement of the spacing-lever when the latter is in locked position, and the operator may add continuous rows of any denominational value by retaining the locking-key in engagement with any desired disk. To provide for the rewinding of the spring and the return of the disk-locking key to its initial position after each operation, the main operating-shaft 102 of the machine is employed. On this shaft is loosely mounted a bevel-gear segment 138, Fig. 7, which is constantly in mesh with a bevel-pinion 139 on the hollow shaft 103, the segment being turned as the drum revolves and for an angular distance dependent on the extent of movement of the drum. The shaft 102 has a radially-disposed rigid arm 140, which during a portion of the movement of said shaft engages one of the edges of the segment, turning the latter and the bevel-gear and rewinding the spring in the drum. As the extent of effective winding movement of the segment is governed by the degree of movement imparted thereto by the spring-drum, it will be seen that the winding movement of the spring is proportioned to the extent of movement of the disk-locking key, the tension of the spring being the same each time the drum is moved to an initial position.

The recording mechanism.—At a point to the rear of the indicating mechanism are suitable standards 140′, to which is secured a hollow cylinder or tube 141, serving as a pivotal support for type-segments 142 of a number equal to the number of indicating-disks. Each segment has two arcuate arms 143 and 144, provided with polygonal and radially-alining openings 145 for the reception of type-bars 146, the latter being ten in number and bearing numerals from "0" to "9," the cipher or zero bar being normally in horizontal position in readiness for printing. The type-heads 147 at the outer end of each bar are somewhat larger in diameter than the bars proper in order to prevent their passing through the guide-openings 145, and the rear faces of the type-heads are normally held in engagement with the outer curved surface of the segments by springs 148, extending between the inner faces of the outer arcuate bars and collars 149, secured to the type-bars. The segments are moved on the cylinder 141 as a center until any desired rack-bar is in the horizontal or printing position, and when the entire row of type-bars are so adjusted they are forced outwardly and the types moved into contact with the ribbon and the paper on which the figures are to be recorded.

Secured within the cylinder 141 is a horizontally-disposed block 150, having bearings for the support of striker-bars 152 of a number equal to the number of type-segments and

one of such bars being disposed in alinement with each segment. The bar 152 is provided with a shoulder or flange 154, arranged within a recessed portion, against which presses one end of a helical compression-spring 155, the inner end of which bears against a seat formed in the recessed portion of the bar 150, and the outer end of said bar is maintained in a horizontal position in alinement with the zero type-bar or any other type-bar which may be moved by the segment to the horizontal or printing position. The rear end of the striker-bar extends through a guiding-opening in a plate 158 and at its extreme rear end passes through a vertical slot 160 in the upper end of a two-armed lever 161, the end of the bar being T-shaped in order to engage the rear face of said lever on each side of the slot, so that on a movement of the lever in one direction the bar will be drawn in the direction of the indicating-disks and away from the type-bars, and as this forward movement of the lever 161 is to an extent sufficient to move the flanged portion 154 beyond a spring-pressed pawl 162, fulcrumed to the block 150, the pawl moves behind the flange and retains the striker-bar in the rear position with the spring 155 compressed. Between the front face of the plate 158 and the lever 161 the bar is provided with a helical compression-spring 165, possessing greater strength than the spring 155 and normally holding the lever 161 away from the cylinder 141 and retaining the inner spring 155 in a slightly-compressed condition. Within the cylinder 141 is pivoted an arm 167, having one end adapted to engage the pawl 162 and its opposite end being provided with an antifriction-roller 168, with which may engage an inclined lug 169, carried by the lever 161. In the operation of this portion of the mechanism, the type-segment having been adjusted until the desired type-bar is in printing position, the lever 161 is drawn toward the front of the machine until the spring 155 is compressed and the pawl 162 engages the flange 154 and holds the striker-bar in the rear position. The movement of the lever 161 is accomplished by the heavy compression-spring 165, and after the parts are ready to operate said lever is forcibly moved to the rear against the stress of the spring 165 until its inclined lug 169 engages the antifriction-roller 168 of the lever 167 and moves the pawl 162 to releasing position. The spring 155 being thus released projects the striker-bar until its outer end comes into contact with the selected type-bar and forcibly moves the same until the type-head 147 strikes the ribbon and the paper.

To each type-segment, Fig. 22, is secured a substantially radial arm 170, and extending between the outer end of this arm and the upper surface of the type-segment is an arcuate bar 171, bearing numerals from "0" to "9" in the same relation in which they appear on the type-segments, these numerals being movable into alinement with a visual opening 173 in the upper portion of the casing as the type-segments are adjusted to position. As the position of the opening and the numerals displayed on the bar 171 is such as to prevent the operator from seeing the numerals while in a sitting position, said numerals are preferably arranged in reverse order, being provided with type-faces, and at the rear wall of the opening is hinged a cover 175, having on its lower face a mirror or similar device in which the numerals are reflected in convenient position to be observed by the operator.

The several levers 161 are mounted on a transversely-disposed pivot-pin 180, carried by the frame, and the forward and upwardly extending arm 181 of each lever is pressed against a rib or flange 182, projected radially from a sliding and rocking bar 183, adapted to a stationary grooved guide 184 at a point below and to the rear of the indicating-disks. The rack-bar 112, which is connected to the locking-key of the indicating-disk, and the bar 183 are both extended out through openings at the left-hand side of the casing of the machine, and the two bars are connected together by a cross-bar 185, the bar 183 moving with the bar 112 as the latter is operated by the spring-drum. One of the levers 161 is employed for each of the indicating-disks and type-segments, and the position of the web or flange 182 of the sliding bar 183 is normally or at the starting of a problem or the beginning of a line in such position as to prevent movement of the arms 181 of said lever in the direction of the indicating-disk, and thus prevent the coiled compression-spring 165 from setting the striker-bar. When the units-indicating disk is revolved, the movement is transmitted by the mechanism hereinafter described to the first of the type-segments, and as the locking-key 48 of the indicating-disks moves to engage the tens-disk the movement is transmitted through the bars 112 and 185 to the bar 183, the web 182 of the latter being then moved from contact with the first of the levers 161 and allows the compression-spring 165 to compress the spring 155 of the striker-bar and set or cock the latter in readiness for a printing operation, and this releasing movement of the web or flange 182 occurs successively as each indicating-disk and its corresponding type-segment is moved to the selected position, while all of the striker-bars to the left of the disk and segment last moved will remain in inoperative position and will not strike against the zero type-bars and imprinting zero-marks on the paper to the left of the row of figures.

Pivotally mounted on the pin 180 are a plurality of levers 189, of which there is one for each of the indicating-disks and type-segments, and each lever is movable independently of the other. At the upper end of each lever is a

bearing for the support of a short shaft or arbor 190, to which are secured a gear-wheel 191 and a chain-wheel 192, disposed, respectively, on opposite sides of the lever. These levers also are under the control of the web or flange 182 of the sliding bar 183, and said web or flange holds the levers in such position that the gear-wheels 191 are held out of mesh with the adjacent gear-teeth 92 of the indicating-disks, the latter being adapted to engage with and turn the gear-wheels 191, and thus turn the reels 192 to wind thereon the chains 193, which extend from the reels to the radial bars 170 of the type-segments. At the beginning of an operation the gear-wheel 191 to the extreme right of the machine is in mesh with the gear-teeth of the units-indicating disk, the web or flange 182 being out of engagement with this lever, but remaining in engagement with the striker-connecting lever 161. The movement of the units-disk will therefore revolve the gear-wheel 191, and through it the wheel 192, causing the winding up of the chain 193 and the adjustment of the type-segment to the desired position. As the bar 112 moves to adjust the locking-key to engagement with the tens-indicating disk the bar 183 receives a corresponding movement and first releases the initial striker-connected lever 161 to permit the setting of the striker-bar which shall cooperate with the selected type-bar of the units-segment. The further movement of this bar 183 moves its web 182 out of engagement with the second of the levers 189 and permits the gear-wheel 191, carried by said lever, to fall into engagement with the gear-teeth of the tens-indicating disk in advance of the rotative movement of said disk. To prevent lost motion, each of the chains 193 passes over a guiding-pulley 195, mounted on a pin or spindle 196, and between these guiding-pulleys are spacing-blocks 197, having flattened sides, to which are secured springs 198, bearing on the rear faces of the levers 189 and tending to force the gears 191 into engagement with the indicating-disk gears as soon as the web or flange 182 moves to releasing position.

In order to concentrate the printed record, the type-segments are arranged closely together, much more closely than it would be possible to provide the indicating-disks, the finger-keys, and other connected mechanisms, and to provide for this the several arms 170 of the type-segments, while extending in substantially radial lines in the vertical plane, diverge laterally until their upper ends are in horizontal alinement with the respective pulleys, indicating-disks, and the like, and in similar manner the rear ends of the levers 161 converge to the planes of the striker-bars, and in this connection it may be observed that the arcuate bars 171, which carry the display-numerals of the type-segments, are arranged in the same plane with the type-segments, their upper inner ends being secured to bars 171′, disposed in the same plane with the type-segments and connected to the lower portions of the arms 170. The operative connections between the indicating-disk gears and the chain-wheels are such that the latter must move to adjust the type-segments without regard to the direction of movement of the indicating-disks. The chains are formed of pivotally-connected links, and to the lower end of each main section are pivoted two short sections 200 and 200′, disposed, respectively, on opposite sides of the main section of the chain, and at the end of each of the short sections is a laterally-extended pin 202. Each chain-reel 192 has a centrally-disposed annular groove 203, into which the chain is wound, and on each side of the groove are recesses 204 for the reception of the end sections of said chain. At the end of each recess is an opening 205, extending into the body of the reel and adapted to receive the pins 202 at the end of the short sections. In the operation of this portion of the mechanism, with the indicating-disks rotating in the normal direction, the pin at the end of the section 200 will be engaged at the mouth of one of the recesses and, as the reel rotates, a short section of chain 200 will be received in the recess 204, and then the main section of chain will be gradually wound in the annular groove 203 for a distance dependent on the extent of movement of the indicating-disks. The short section 200′ of the chain during this movement will hang loose and will be gradually received within the opening 205 and all danger of twisting of the chain will be prevented. The short chain-sections permit operative movement of the chain-wheels in either direction and without any lost motion.

For the sake of clearness the movements of the type-segments and the striker-bar mechanism have been described as occurring in consecutive order as the web or flange 182 is moved to the left and successively releases the several levers 161 and 189. The machine may operate successfully in this manner; but for reasons hereinafter described it is preferred to delay the setting operation of the striker-bars until all of the type-segments have been moved to the desired position. To effect this, I employ a cam-shaft 210, on which are mounted a number of cams 211, of which one is disposed in alinement with each of the arms 181 of the levers 161, and the larger portions of said cams are normally in engagement with the levers and prevent movement of the latter in the direction of the indicating-disks without, however, interfering with the operation of the type-segments and the movement of selected type-bars to the horizontal or printing position. This shaft 210 is provided at one end with gear-wheels 212 and 212′, the former intermeshing with the gear-wheel 101 on the main operating-shaft 102, and after the horizontal row of figures has been indicated

on the disks 55 and the corresponding type-segments have been moved in similar manner the main operating-lever 104 is moved forward or in the direction of the arrow in Fig. 1 to move the cams from contact with the arms 181 of the levers 161 and permit the heavy compression-springs 165 of all of the striker-bars to move simultaneously to cocked position and in readiness for the imprinting operation. Further turning of the lever in the same direction brings the larger portions of the cams in contact with the arms 181, and the inclined lugs 169 are forced into contact with the antifriction-rollers 168 of the several trip-levers 167 and the type-striker bars are released and forced into contact with the type-bars, which have been adjusted to printing position. The initial position of the operating-lever is horizontal, as indicated at A by dotted lines in Fig. 1, the movement taking place in the direction of the arrow and the imprinting operation being completed by the time the operating-lever has reached the dotted-line position B in Fig. 1. Continued movement of the operating-lever in the direction of the arrow also rewinds the spring-drum through the gear-segment 138 and bevel-pinion 139 and forces the connected bars 112 and 182 to initial position, the disk-locking key 48 being returned to engagement with the units-disk, while the flange or web 182 engages the several levers 189 and effects the disengagement of the pinions 191 from the gear-teeth of the respective indicating-disks, and when so released the chains 193 are unwound from the reels and the type-segments are returned to initial position by tension-springs 214, extending between the several type-segments and a fixed point, the type-segments being returned to initial position before the operating-lever reaches the position illustrated in full lines in Fig. 1. During this forward movement of the operating-lever the platen of the paper-carriage is turned, the ribbons on the reels are shifted, and the upper ribbon-reel is forced downward to bring the ribbon of distinctive color in alinement with the type, and when the lever is returned from the position C to the position A the only effect is to release the upper ribbon and permit the same to reassume its elevated position and at the same time restore the operating-cams to positions in engagement with the arms 181 of the levers 161, the parts then being in position for a further movement of the indicating mechanism.

The mechanism thus far described may be operated in connection with any form of platen and ribbon mechanism for imprinting each row of figures as represented by the depression of the finger-keys, the type-segments being moved to properly record each successive horizontal row of figures in the problem, while the indicating-disks show the gradually-increasing totals until the problem is finished, at which time it is desirable to properly record the grand total displayed by the indicating-disks.

At a point above the indicating-disks and reel-shafts the frame is provided with a transversely-disposed bar 216, in which are guided a number of substantially vertically-disposed bars 217, one of such bars being provided for each of the levers 189 and the upper ends of all the bars extending out through openings in the casing and being provided with push-buttons or keys 218 by which they may be depressed. Each bar is notched for engagement by a locking-spring 219 to hold the bar in adjusted position. Projecting laterally from each side of each of the bars 217 are pins 220, arranged in series throughout the several bars, all of the pins on the left-hand side of each bar being above and adapted to engage the corresponding pins projecting from the right-hand side of the next adjacent bar to the left, so that on the depression of any one of said bars all of the remaining bars on the left will be depressed. At the lower end of each of the bars is a laterally-extending lug or finger 221, Fig. 28, adapted for engagement with the arms 181 of the levers 161 and when depressed into engagement with said bar or lever will prevent inward movement of the latter to an extent sufficient to permit the cocking of its corresponding striker-bar.

When the grand total is displayed by the indicating-disk, all of the bars to the left of the first numeral, or, in other words, all bars alining with indicating-disks displaying the zero-mark to the left of the total, are depressed and the lugs or fingers 221 of said bars come into engagement with the arms 181 of levers 161 and prevent the movement of the bars 152. The depression of the bars also forces the web 182 to an angular position below all of the levers 189 and 161, but at this time the enlarged portions of the cams 211 are in engagement with the arms 181 of the levers 161 and inward movement of these levers is prevented. The pinions 191 of all of the levers 189 are allowed to move into engagement with the gear-sections 192 of the indicating-disks 55, and when said disks are turned in the manner hereinafter described each of the pinions 191 in mesh with the disk of an indicating-gear which has been previously moved will receive rotative movement for an angular distance equal to the distance which the zero-mark or space of said indicating-disk has been turned from the initial position.

Reference has previously been made to a lever 96, pivoted at one side of the frame of the machine and having an inclined portion 97, adapted to engage the end of the spindle 85 and move the latter, together with the locking-keys 84, to release the pinions 82 and engage the pinions 83. This lever is provided with an upwardly-extending arm 225, Figs. 4 and 27, adapted to be engaged by a pin or

stud 226, projecting laterally from the bar 217 at the extreme left of the machine, so that on the depression of said bar the inclined portion of the lever 96 will cause the restoration-pinions 83 to be locked to the spindle 85 and the pinion 88 will be moved into engagement with the gear-wheel 99.

When the parts are adjusted to the position last described, a slight turning of the crank 104 will turn all of the indicating-disks 55, through the medium of the pinions 83, until the latter arrive at the spaced portions 93 of the gear-teeth carried by the indicating-disks, and this rotative movement will be transmitted to all of the type-segments and the proper type-bars adjusted to horizontal or imprinting positions. The movement of the indicating-disks at this time is the reverse of the normal; but the movement transmitted to the gears 191 and the type-segments is equal to the angular distance which each indicating-segment has been moved from the zero position, or, in other words, if an indicating-disk is displaying the numeral "6" at the visual opening and has consequently been moved through six-tenths of a revolution the returning movement will be six-tenths of a revolution and the connected type-segment will receive movement to an equal extent or until the type-bar carrying the numeral "6" is adjusted to imprinting position. In carrying out this portion of the invention or the imprinting of the grand total at the completion of a problem the operating-lever is first moved to the position shown in full lines in Fig. 1 to effect the printing of a subsequent amount, to restore the bars 112 and 183 to initial position, to depress the ribbon-reels, and to partly feed the ribbons in the manner previously described. The lever is then allowed to remain in this position, while the operator depresses all of the bars 217 to the left of the total amount as displayed by the indicating-disks, the fingers or lugs 221 of the depressed bars coming into engagement with the arms 181 of such levers 161 as it may be desired to hold from printing and the web 182 being forced out of engagement with all of the levers 161 and 189. All of the gears 191 carried by the levers 189 then intermesh with their respective indicating-disks, while the lever 96 is forced against the pointed end of a spindle 85, the keys 84 of said spindle being moved from engagement with the adjusting-pinions 82 and serving to lock the restoration-pinions 83 to the hollow shaft on which they are mounted. The pinion 88 is forced into engagement with the gear-wheel 99, and the parts are then ready for a reverse movement of the lever, the latter being traveled in the opposite direction. The depression of the lever 96 forces its outer or rear end upwardly against the arm 324 and retains the outer ends 320 of the arms 318 in engagement with the ribbon-reels and locks said ribbon-reels in the lowest position with the ribbon of distinctive color in printing position. As the lever is drawn back toward the normal position the movement is transmitted, through the connecting gearing and pinions 83, to all of the indicating-disks, the latter being turned until the pinions 83 are opposite the mutilated or spaced portions of the indicating-disk gear-teeth. This movement is transmitted, through the gears 191 and the chain-reels and chains, to the type-segments, the latter being moved to positions representing the grand total to be printed. By this time the operating-lever has reached the position B in Fig. 1, and after passing this position the cams 211 are turned to permit inward movement of such levers 161 as are not engaged by the lugs or fingers 221 of the bars 217, the operated levers serving to cock their respective striker-bars and then to release the same to effect the printing operation. By the time the operating-lever reaches the position A in Fig. 1 the printing operation is complete and the several parts have reassumed the normal position in readiness for a subsequent operation. After the printing of the grand total it becomes necessary to elevate the bars 217 which have been depressed in order to permit the flange 182 to reassume initial position and to elevate the lever 96 to restore the locking-keys 84 into engagement with the pinions 82, this movement also releasing the ribbon-reels and allowing the same to rise until the lower ribbon is in alinement with the printing-type. This movement may be automatic, inasmuch as the relief of pressure on the ribbon-reels as the operating-lever returns to initial position will permit the reel-elevating springs to restore all these parts to proper position.

In some cases when the recording mechanism is not in use the lever 96 may be depressed independently of the bars 217 when it is desired to restore the indicating-disks to zero, and for this purpose the lever 96 is provided with a projecting lug 230 for engagement by a cam 231, carried by a shaft 232, adapted to a suitable bearing-sleeve 233, carried by the casing, and provided at a point outside the casing with a turning-knob 234, by means of which the shaft and cam may be revolved and the lever 96 depressed to shift the spindle 85. This in similar manner permits the return of the indicating-disk to zero position by means of the crank 104.

The indicating and recording mechanism may be further disconnected in order to allow independent operation of the indicating mechanism by disconnecting the link 185, which connects the rack-bar 112 and the webbed or flanged bar 183. This link is placed outside the casing of the machine and is held to the bar 112 by a threaded nut 240, having a groove in which is swiveled a pawl 241, adapted to engage a tooth 242 at one end of the bar 183, so that when the latter is turned to move the web out of contact with

the several levers 161 and 189 it will be retained in position until released by the depression of the pawl. That end of the rod 183 beyond the connecting-link 185 carries a coiled torsion-spring 243, of which one end is secured to the rod and the opposite end to the link, so that when the pawl is released the rod 183 will be returned to its normal position, with the web or flange in engagement with the levers 161 and 189.

The imprinting mechanism includes a platen and paper-carriage situated at the rear end of the machine, the paper-carriage having at its lower end a transversely-disposed bar 250, adapted to a circular recess extending across the base of the machine to permit rocking movement of the carriage and allow lateral adjustment of said carriage in order that the figures may be printed at any desired point in the width of the sheet, a torsion-spring 250′ holding the carriage in place and normally tending to force said carriage toward the types. The spring may enter notches in the bar against which it bears to hold the carriage in any position to which it may be adjusted. The bar 250 is secured to or formed integral with opposite side frames 251, in the upper portions of which are suitable bearings for the reception of the spindle of a platen 252 in the form of a roller covered with rubber or other suitable material. At a point outside the end frames the platen-spindle is provided with toothed wheels 253, with which may engage locking-pawls 254, the shape of the pawls and teeth being such as to permit rotative movement of the platen in either direction, and for this purpose the platen-spindle is provided at one end with a milled knob 255. The side members 251 of the frame are rearwardly extended and slotted for the reception of the ends of a threaded roller 257, on which is wound a strip of paper to be fed over the platen and receive the type impressions. On the threaded shaft are disks 258, which may be adjusted toward and from each other in order to properly hold a roll of paper of any desired width, and for convenience in removal of the paper-roller in order to renew the supply of paper the ends of said roller are recessed for the reception of stems 260, having portions of different diameter and normally held in the position shown in Fig. 29 by a coiled compression-spring 261, surrounding a reduced portion of the stem at a point within the recess. That portion of the stem of largest diameter fits closely within the bearing-opening at the outer end of the rearwardly-extending arms, said opening being continued to the outer end of the arms in the form of a slot 262 of a width less than the greatest diameter of the stem, but somewhat greater in width than the diameter of the narrowest portion of said stem, so that when the stem is pulled outwardly by means of its knob 263 the paper-roller may be readily removed from position. After leaving the paper-roller the strip of paper is guided under the platen by means of a small roller 264, which may be provided with suitable springs in order to press the same against the under surface of the platen, and at the top of said platen the paper is guided under a transversely-disposed bar 265, having on its rear face a cutting-blade 266 for convenience in severing a printed portion of the paper from the strip. The cross-bar 265 may be further provided with a dating-stamp of any desired character in order that the date on which the machine is used may be imprinted on the strip of paper.

To automatically turn the platen and bring a fresh portion of the strip of paper in alinement with the imprinting-type, I employ a pair of pivoted pawls 267, carried by rocker-arms 268 on a rock-shaft 269, extending transversely of the paper-carrier, said pawls being normally held in inoperative position by pins 270, projecting from the frame of the carriage, but being pressed in the direction of the toothed wheels 253 by means of springs 271. The pins are so disposed as to keep the pawls inoperative in order that the platen may be freely turned in either direction by means of the milled knob 255. The rock-shaft 269 is connected by links 273 to a bar 274, extending transversely of the carriage and terminating at points within the carriage-frame, while the bar and rock-shaft are held in normal position, as illustrated in Fig. 2, by torsion-springs 275, surrounding the rock-shaft and having one end secured to the bar 274 and the opposite end to the main carriage-supporting bar 250. At each operation of the imprinting mechanism the cross-bar 274 is depressed and imparts a slight rotative movement to the rock-shaft, this movement being transmitted to the rocker-arm 268 and pawls 267, and the latter after disengagement from the stop-pins 270 engage with and turn the toothed wheels 253, secured to the supporting-spindle of the platen.

The construction of the parts is such that the supporting-bar 250 of the carriage may be shifted laterally of the machine in order to present any desired point of the width of the platen opposite the type, so that the imprinting operation may be made at any point in the width of the paper.

The standards 140′ are extended rearwardly to a point near the paper-carriage, and each is provided with a pivot-stud 276, on which is mounted a lever 277, adapted to engage the cross-bar 274 to effect the step-by-step rotative movement of the platen. The rear end of each of levers 277 is disposed in the path of movement of a lever 278, mounted on a stud 279, also carried by the fixed frame, and the opposite ends of said levers 278 are adapted to be engaged by cams 280, projecting from the main shaft 102 and so positioned with respect to the remaining parts of the mechanism as to operate only after an operation of the imprinting-type.

In connection with the apparatus I may employ any desired form of ribbon holding and feeding mechanism for moving an inked ribbon into position between the type and the paper; but it is preferred to employ a mechanism in which two ribbons are used, each of a different color, a ribbon of one color being used to imprint the successive horizontal rows of numerals and the ribbon of different color being used to imprint the grand total. For this purpose there is arranged at each side of the machine a standard 285, carrying a fixed spindle 286, which is slotted at its upper end, as indicated at 287. On this spindle is mounted an elongated and vertically-movable sleeve 288, having at its lower end an enlarged flange 289, fitting within a recess in the standard and acted upon by a coiled compression-spring 290, which normally tends to maintain the sleeve in elevated position. The spindle 287 is rigid and near its upper end is connected by a pin 291 to an upper plate 292, which in turn is connected to a lower plate 293 by a vertically-disposed ribbon-guiding pin 294, and the upper and lower plates may be further connected by additional bars, if desired. The frame formed by the plates 292 and 293 is held from revoluble movement; but as the pin 291 extends through the slot 287 of the spindle free vertical movement is permitted. At a point between the upper and lower plates the sleeve 288 is keyed to a double reel 295, divided by a centrally-disposed diaphragm 296 into two spaces, each adapted to receive a ribbon of different color. The elongated sleeve 288 receives a step-by-step rotative movement, and the ribbon-reel is turned with said sleeve, while the plates 292 and 293 remain stationary in so far as revoluble movement is concerned. Near the lower portion of each sleeve 288 is secured a disk 297, having on its under side a circular row of ratchet-teeth 298, adapted to be engaged by a pivoted pawl 299, mounted on one arm of a bell-crank lever 300, which is pivoted on a stud 301, projecting from the side of the standard 285. A pawl-carrying lever 300 is disposed at each side of the machine in connection with the ribbon-reels, and each is provided with a pin 302, adapted to engage a fixed stop-shoulder 304, against which it is pressed by a plate-spring 305, and normally the springs retain the pawl-carrying levers in such position that the pawls are out of contact with the ratchet-teeth, so that either of the ribbon-reels may be rotated independent of the other. The free ends of each of the pawl-carrying levers extend forwardly in the direction of the main shaft 102, and the shaft 102 is hollow, as indicated in Fig. 6, for the reception of a longitudinally-adjustable rod 307, having at one end a knob or handle 308, which will permit longitudinal adjustment of the rod within the shaft. The hollow shaft is furthermore provided with a pair of radially disposed slots 309, through which may pass radial arms 310, secured to said rod and adapted to engage the pawl-carrying levers 300. The arrangement of the parts is such that when one of the arms 310 is in alinement with the pawl-carrying lever at one side of the machine the opposite arm is out of alinement with its pawl-carrying lever, so that only one of the ribbon-reels receives motion, the reel receiving a positive step-by-step movement serving to gradually wind up the ribbons which it receives from the reels at the opposite side of the machine, and when the winding-reel is filled an alarm is sounded to notify the operator in order that he may shift the position of the rod 307 and cause the empty reel to be rotated and receive the ribbon from the full reel. An alarm mechanism convenient for this purpose is illustrated in Fig. 30, and it comprises a hollow stem 312, in which is guided a vertically-movable rack 313, adapted to be engaged by a worm-tooth formed on the periphery of the ratchet-disk 297, so that as the latter is turned the rack is elevated. At the upper end of the rack is a pin 314, adapted to make contact with a spring clapper-arm 315, adapted to strike against an alarm-bell 316, disposed at the top of the spindle 286. In the operation of this portion of the mechanism the rack receives a step-by-step vertical movement until the pin engages and raises the clapper-arm, and after passing beyond the end thereof the clapper-arm returns to position and sounds the bell.

The disks 296 of the ribbon-rollers separate the two differently-colored ribbons which are employed in connection with this machine, the lowermost ribbon being normally in alinement with the imprinting-type, while the upper ribbon is only used when grand totals are to be imprinted, and for this purpose special mechanism is employed to automatically depress the reels and bring the upper ribbon into alinement with the type.

One form of ribbon-adjusting mechanism which may be employed comprises a pair of levers 318, secured to a cross-bar 319, having bearings in the frame of the machine. The lower ends of these levers are hook-shaped, as indicated more clearly in Fig. 27, and are adapted to be engaged by the cams 280 when the main crank-shaft 102 is turned, and it will be noted on reference to Fig. 2 that the engagement of these cams with the levers 318 takes place only after the occurrence of an ordinary imprinting operation and the engagement of the cams with the levers 278 to effect a slight rotative movement of the platen to present a fresh portion of the paper to imprinting position. The forwardly-projecting ends 320 on the levers 318 are adapted for contact with the upper faces of the reel-guiding plates 292, and the movement imparted by the operation of the crank and the main

shaft 102 is sufficient to depress the reels the required distance to bring the upper ribbon into alinement with the types. As the main crank must continue to move to effect the imprinting of the grand total in the manner previously described, it is desirable to employ an auxiliary mechanism for locking the reels in printing position until the imprinting operation can be accomplished, and for this purpose it is preferred to utilize the lever 96, which is depressed by the bars 217, immediately in advance of the adjustment of the type-segments to position.

The lever 96 is pivoted at a point intermediate of its end with a stud 321, projecting from one side of the supporting-frame, and to return this lever to initial position after each operation I employ a plate-spring 322, which engages a pin 323, projecting from one side of the frame. The shaft or spindle 319, which is rigidly secured to both of the levers 318, is provided with a forwardly-extending arm 324, adapted to be engaged by the rear end of the lever 96, so that when the latter is depressed the arm 324 is maintained in elevated position and the ribbon-reels are held depressed by the engagement of the end portion 320 of the levers 318 with the reel-guiding plates 292. In connection with this portion of the mechanism it is of course clear that the lower hooked portion of the levers 318 may be altogether omitted and the ribbon-reels depressed through the downward movement of the bars 217 and the similar movement of the forward end of the levers 96.

While the construction herein described and illustrated in the accompanying drawings is the preferred form of the device, it is obvious that various changes in the form, proportions, size, and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus described my invention, what I claim is—

1. In a calculating-machine, a plurality of indicating-disks, a shaft on which said disks are arranged, means for locking a selected disk to said shaft, a plurality of finger-keys each adapted to be moved to the same extent, vertical racks of equal length secured one to each finger-key, and intervening gearing between the racks and the shaft of the indicating-disk, said gearing being proportioned to the values represented by the keys to which they are connected.

2. In a calculating-machine, a plurality of indicating-disks, a shaft on which said disks are mounted, means for locking a selected disk to said shaft, a plurality of finger-keys each adapted to receive movement to a similar extent, and gearing connections between the keys and the disk-shaft, the diameters of the gears connected to the keys being proportioned to the values represented by said keys.

3. In a calculating-machine, a plurality of indicating-disks, a shaft carrying the disks, means for locking a selected disk to the shaft, a plurality of finger-keys adapted to receive movement to a similar extent, vertical racks connected to said keys, a separate gear intermeshing with each of the racks, a primary shaft having a gearing connection with the indicating-disk shaft, and a plurality of pinions of different diameter carried by the primary shaft and intermeshing with the rack-actuated gears, the diameters of said gears being proportioned to the values represented by the keys to which they are connected.

4. In a calculating-machine, a plurality of indicating-disks, a shaft carrying the same, means for locking a selected disk to said shaft, a plurality of finger-keys each adapted to receive movement to a similar extent, racks carried by said finger-keys, a gear-wheel engaging each rack, a primary shaft having a gearing connection with the indicating-disk shaft, intermeshing pinions of varying size carried by the rack-actuated gears and by the primary shaft, and means for locking the pinions of the latter shaft in one direction of movement and for releasing the same in the opposite direction of movement.

5. In a calculating-machine, the combination with a plurality of indicating-disks, of a shaft carrying said disks, means for locking a selected disk to the shaft, a plurality of finger-keys adapted to receive movement to a similar extent, hollow standards forming guides for the shanks of said keys, springs disposed in the standards and adapted to return the keys to initial position, a plate or bar carried by each shank and provided with rack-teeth, all of said racks being of the same length, a primary shaft having a gearing connection with the indicating-disk shaft, and gearing connecting each of the racks independently to the primary shaft, the diameters of the gears being proportioned to the values represented by the keys to which they are connected.

6. In a calculating-machine, the combination with a plurality of indicating-disks, of a hollow shaft carrying said disks, a carriage disposed in said hollow shaft and having a disk-locking key, a plurality of finger-keys having gearing connections with the hollow shaft, a spacing-key adapted to control the movement of the carriage, pins or fingers carried by the keys and adapted for engagement with the spacing-key, and means for locking said spacing-key in inoperative position.

7. In a calculating-machine, the combination with a plurality of indicating-disks, of a hollow shaft carrying the disks, a locking-key carried by the shaft and movable into engagement with any one of the disks, means for moving said key, a spacing-lever for controlling the key-moving means, mechanism for locking the spacing-lever in inoperative position, and a plurality of finger-keys each adapted to en-

gage with and depress the spacing-lever when the latter is permitted to assume an operative position.

8. In a calculating-machine, a hollow shaft, a series of disks mounted loosely thereon and having key slots or seats, a locking-key carried by the shaft and adapted to engage in said key slots or seats, a rack-bar extending through the hollow shaft and having swiveled connection with the locking-key, a spring-drum having teeth engaging said rack, and an escape mechanism for controlling the movement of said drum.

9. In a calculating-machine, a hollow shaft, a series of disks mounted loosely thereon and having key slots or seats, a locking-key carried by the shaft and adapted to engage in said key slots or seats, a rack-bar extending through the hollow shaft and having swiveled connection with the locking-key, a spring-drum having teeth engaging said rack, a pinion intermeshing with the drum-teeth, a disk connected to the pinion and having escapement-teeth, pawls adapted to engage said escapement-teeth, and a cam controlling the movement of said pawls.

10. In a calculating-machine, a hollow shaft, a series of disks mounted loosely thereon and having key slots or seats, a locking-key carried by the shaft and projecting through an elongated slot therein, a rack-bar extending through the hollow shaft and having swiveled connection with the locking-key, a spring-drum having teeth intermeshing with the rack-bar, a pinion intermeshing with the drum-teeth, a disk connected to the pinion and being provided with escapement-teeth, a pair of pawls adapted to operatively engage the escapement-teeth, a pivoted cam for moving the pawls alternately to releasing position, and a spacing-lever connected to said cam.

11. In a calculating-machine, a hollow shaft, a series of disks mounted loosely thereon and having key seats or slots, a key carried by the shaft and projecting through an elongated slot therein, a rack-bar extending through the hollow shaft and having swiveled connection with the key and provided with a scale for indicating the position of the key within the shaft, a spring-drum having teeth intermeshing with said rack-bar, and an escapement mechanism for controlling the operative movement of said spring-drum.

12. In a calculating-machine, a hollow shaft, a series of disks mounted loosely thereon and having key slots or seats, a key carried by the shaft and projecting through an elongated slot therein, a rack-bar connected to the key, a stationary spindle, a sleeve mounted thereon, a drum forming part of the sleeve and provided with peripheral teeth for engagement with the rack-bar, a spring having one end connected to the drum and its opposite end to the stationary spindle, an escapement mechanism for controlling the action of the spring, a bevel-pinion secured to the sleeve, and a curved rack intermeshing with said pinion and serving as a means for transmitting a winding movement to the spring.

13. In a calculating-machine, an indicating-disk shaft having a recess at one end, a plurality of indicating-disks mounted loosely on the shaft, means for locking a selected disk to the shaft, a double gear-wheel mounted on the shaft at the recessed end thereof, a longitudinally-movable stem mounted in the recessed portion of the shaft and connected to the double gear-wheel to thereby permit of the adjustment of said gear-wheel on the shaft, a primary shaft, finger-keys having gearing connections with the primary shaft, a gear-wheel secured to the primary shaft, and an idler-gear intermeshing with the primary-shaft gear, the double gear-wheel being adjustable on its shaft to intermesh with either the primary-shaft gear or the idler-gear.

14. In a calculating-machine, a shaft, a plurality of disks including an initial and a secondary disk, mounted on said shaft and bearing designating-marks, an adjustable cam situated between said disks, ratchet-wheels carried by the secondary disk and having oppositely-facing teeth, a pair of oppositely-facing pawls carried by the initial disk for engaging said teeth, said pawls being under the control of the cam to permit the engagement of either pawl with its ratchet-wheel, gear-segments carried by the cams, a hollow shaft disposed above the disk-carrying shaft, a plurality of pinions carried thereby and intermeshing with the segments, means for normally locking said pinions to the shaft, an engaging device disposed at the outer end of the pinion-locking mechanism for turning the pinions and cams, a primary shaft, gears connecting the primary shaft to the indicating-disk shaft, and a finger-key mechanism for imparting differential movement to said primary shaft.

15. In a calculating-machine, a shaft, a plurality of disks including an initial and a secondary disk, mounted on said shaft and bearing designating-marks, an adjustable cam situated between said disks, ratchet-wheels carried by the secondary disks and having oppositely-facing teeth, a pair of oppositely-facing pawls carried by the initial disk for engaging said teeth, said pawls being under the control of the cam to permit the engagement of either pawl with its ratchet-wheel, gear-segments carried by the cams, a hollow shaft disposed parallel with the disk-carrying shaft, pinions disposed on the hollow shaft and engaging said segments, a longitudinally-movable spindle disposed within said hollow shaft and provided with locking-keys for engaging the segments, means for rotating the spindle and the hollow shaft and pinions, a primary shaft, gearing connecting the primary shaft to the

indicating-disk shaft, and a finger-key mechanism for imparting differential movement to said primary shaft, substantially as specified.

16. In a calculating-machine, a shaft, a plurality of disks mounted on said shaft and bearing designating-marks, an adjustable cam situated between said disks, teeth carried by the secondary disk, a pair of oppositely-facing pawls carried by the initial disk for engaging said teeth, said pawls being under the control of the cam to permit the engagement of either pawl with said teeth, a hollow shaft disposed parallel with the disk-carrying shaft, a plurality of pinions mounted on the hollow shaft and adapted for engagement with gear-segments on the several cams, a longitudinally-movable rod disposed in the hollow shaft and having locking-keys for engagement with said pinions, a turning knob disposed at the end of the rod, a primary shaft, a plurality of gear-wheels connecting the primary shaft to the indicating-disk shaft and one of said wheels being adjustable to alter the direction in which motion is imparted to said indicating-disk shaft, an adjustable stem carrying said gear-wheel, and means for interlocking the adjustable stem and said longitudinally-movable rod.

17. In a calculating-machine, an indicating-disk shaft, a plurality of finger-keys having a gearing connection therewith, means for adjusting a portion of the gearing connection to alter the direction in which movement is imparted to said shaft, a plurality of indicating-disks mounted on the shaft, a transferring mechanism disposed between adjacent disks, means for adjusting the position and direction and operation of the transferring mechanism, and means for interlocking the gearing-adjusting mechanism and the adjusting means of the transferring mechanism.

18. In a calculating-machine, a revoluble indicating-disk shaft, an actuating mechanism adjustable for imparting movement in either direction to said shaft, a plurality of indicating-disks carried by the shaft, a transfer mechanism disposed between adjacent disks, means for adjusting the transfer mechanism for operation in either direction, and means for interlocking the disk-actuating mechanism and the adjusting device of the transfer mechanism.

19. In a calculating-machine, an indicating-disk shaft having a recessed end, a longitudinally-adjustable stem disposed in the recessed end of the shaft, a grooved knob connected to the stem, a double gear-wheel mounted on the shaft and connected to said stem, a primary shaft, a gear-wheel disposed therein, an intermediate gear engaging the primary-shaft gear, said gears being so arranged that the double gear-wheel may be moved into engagement with either the primary-shaft gear or the intermediate gear, a plurality of indicating-disks mounted on the indicating-disk shaft, a transfer mechanism disposed between adjacent disks, cams for adjusting the position of the transfer mechanism, gear-segments on said cams, a hollow shaft arranged parallel with the indicating-disk shaft, a series of pinions mounted on said hollow shaft and intermeshing with said segments, a longitudinally-movable rod mounted in the hollow shaft, a plurality of locking-keys carried by the rod and adapted to engage said pinions, a turning-knob having an operative connection with the end of said rod, and a locking-lug operable by said rod and adapted to engage in the grooved knob of the gear-wheel-adjusting mechanism.

20. In a calculating-machine, an indicating-disk shaft, a plurality of indicating-disks mounted loosely thereon, means for engaging a selected disk with the shaft, a mutilated gear forming part of each disk, a hollow shaft disposed parallel with the indicating-disk shaft, a series of pinions mounted loosely on the hollow shaft and engaging said mutilated gears, a longitudinally-movable rod carried by the hollow shaft and provided with locking-keys for engagement with said pinions, a revoluble gear-wheel, and a pinion carried by the rod and movable into engagement with said gear-wheel when the several pinions are locked to the hollow shaft.

21. In a calculating-machine, a plurality of indicating-disks each having gear-teeth, a type-carrier for each indicating-disk, a reel having a gearing connection with each indicating-disk, and a flexible connection between the reel and the type-carrier to thereby permit adjusting movement of the latter from rotative movement of the indicating-disk in either direction.

22. In a calculating-machine, the combination with a plurality of indicating-disks, of a shaft on which said disks are loosely mounted, means for turning all of the disks in reverse direction to restore the same to zero-indicating position, a type-carrier for each disk, and mechanism connecting the type-carrier to the disk to permit adjustment of said type-carrier from a movement of the indicating-disk in either direction.

23. In a calculating-machine, a plurality of indicating-disks each having gear-teeth, a type-carrying segment for each of the indicating-disks, connecting mechanism including a gear-wheel between each disk and its corresponding segment, and an automatic mechanism for successively engaging the gear-wheels with the indicating-disk gears.

24. In a calculating-machine, a plurality of indicating-disks each having gear-teeth, type-carrying segments of a number equal to the indicating-disks, an operative connection, including a gear-wheel, between each type-disk and its corresponding segment, said gear-wheels being normally held out of engagement with the indicating-disk gears, and means for automatically and successively engaging the disk-gears with their respective gear-wheels.

25. In a calculating-machine, an indicating-

disk shaft, a series of toothed indicating-disks mounted thereon, means for returning said disks to their zero position, type-carriers of a number equal to the number of indicating-disks, an operative connection, including a gear-wheel, between each type-disk and its corresponding indicating-disk, means for successively engaging the respective gear-wheels with the disk-gears in advance of the movement of the latter to indicating position, means for disconnecting all of the gears to permit the independent return of the type-carriers to zero position, and means for imparting operative movement to the type-carriers as the indicating-disks are returned to zero position.

26. In a calculating-machine, a hollow shaft, a plurality of indicating-disks mounted thereon, a locking-key carried by the shaft and adapted to lock a selected disk thereto, a longitudinally-movable bar connected to the key, means for imparting a step-by-step movement to said bar, a plurality of type-carriers adapted to be operated by the disks, and means controlled by said longitudinally-movable bar for permitting the operative connection of the disks to said type-carriers.

27. In a calculating-machine, a plurality of indicating-disks having gear-teeth, type-carrying segments, a series of pivoted levers, a gear-wheel and a reel carried by each lever, the gear-wheel being adapted to intermesh with the gear-teeth of a disk, mechanism for governing the positions of the levers and the intermeshing of the gears, and flexible connections between the type-carrying segments and the reels.

28. In a calculating-machine, a plurality of indicating-disks having gear-teeth, type-carrying segments, a series of pivoted levers, a gear-wheel and a reel carried by each lever, the gear-wheel being adapted to intermesh with the gear-teeth of a disk, mechanism for governing the positions of the levers and the intermeshing of the gears, and a flexible connecting device connected at one end to its type-segment and bifurcated at its opposite end and connected to the reel, said flexible connecting device being wound upon the reel in either direction of movement of the latter.

29. In a calculating-machine, a plurality of indicating-disks having gear-teeth, type-carrying segments, a series of pivoted levers, a gear-wheel and a reel carried by each lever, the gear-wheel being adapted to intermesh with the teeth of a disk, mechanism for governing the positions of the levers and the intermeshing of the gears, and a chain connecting each reel and segment, the reel-connected end of said chain being bifurcated and connected at different points on the periphery of the reel to thereby permit winding movement in either direction of rotation of the reel.

30. In a calculating-machine, a plurality of indicating-disks having gear-teeth, type-carrying segments, a series of pivoted levers, a gear-wheel and a reel carried by each lever, the gear-wheel being adapted to intermesh with the teeth of a disk, mechanism for governing the positions of the levers and the intermeshing of the gears, a chain connecting each reel and segment, an annular groove formed in the reel for the reception of the main portion of the chain, recesses disposed in the periphery of the reel at each side of the groove, and connecting-sections of chain extending between the main chain and different points on the periphery of the reel to thereby permit winding movement in either direction of rotation of said reel.

31. In a calculating-machine, a plurality of indicating-disks having gear-teeth, type-carrying segments, a series of pivoted levers, a gear-wheel and a reel carried by each lever, the gear-wheel being adapted to intermesh with the gear-teeth of a disk, mechanism for governing the position of the levers and the intermeshing of the disks, a type-carrier for each disk, a chain connecting the type-carrier to the reel and adapted to be wound on the latter, and a guide-roller mounted above said reel and in contact with the chain.

32. In a calculating-machine, a plurality of indicating-disks having gear-teeth, type-carrying segments, a series of pivoted levers, a gear-wheel and a reel carried by each lever, the gear-wheel being adapted to intermesh with the teeth of a disk, flexible connections between the type-carrying segments and the reels, means for preventing the engagement of gear-wheels with inactive indicating-disks, and means for returning the indicating-disks to zero position to thereby transmit an operative movement to the type-segments.

33. In a calculating-machine, a plurality of indicating-disks having gear-teeth, type-carrying segments, a series of pivoted levers, a gear-wheel and a reel carried by each lever, the gear-wheel being adapted to intermesh with the teeth of a disk, a shaft disposed parallel with the line of indicating-disks, a plurality of pinions normally loosely mounted on said shaft, a series of finger-operated keys for preventing contact between inactive indicating-disks and their adjacent gear-wheels and for automatically locking the series of pinions to the shaft, and means for revolving said shaft to restore the indicating-disks to zero position.

34. In a calculating-machine, a plurality of indicating-disks having gear-teeth, type-carrying segments, a series of pivoted levers, a gear-wheel and a reel carried by each lever, the gear-wheel being adapted to intermesh with the teeth of a disk, mechanism for governing the positions of the levers and the intermeshing of the gears, a chain connecting each reel and segment, a guiding-wheel in contact with each chain at a point adjacent to the reels, a shaft carrying the series of chain-guiding wheels, spacing-blocks disposed between the

wheels, springs carried by said spaced blocks and tending to force the pivoted levers in the direction of the indicating-disks, and means for turning the indicating-disks to restore the same to zero position.

35. In a calculating-machine, a plurality of indicating-disks, finger-key mechanism for rotating the same, a recording mechanism including type-carriers of a number equal to the number of indicating-disks, mechanism for transmitting the movement of each indicating-disk to one of the type-carriers, and means for automatically permitting the operative engagement of said mechanism with the indicating-disks in advance of the operative movement of each indicating-disk and for preventing such connection between unoperated disks and their type-carriers.

36. In a calculating-machine, a plurality of indicating-disks, finger-key mechanism for rotating the same, a recording mechanism including type-carriers of a number equal to the number of indicating-disks, said type-carriers being normally disconnected from the disks, and means for automatically permitting the operative connection of a disk and type-carrier in advance of the movement of said disk and for preventing such connection between unoperated disks and their type-carriers.

37. In a calculating-machine, a plurality of indicating-disks having keyways, a hollow shaft carrying said disks, a locking-key carried by the shaft and adapted to successively engage and lock the disks thereto, gear-teeth on each indicating-disk, a plurality of pivoted levers, a gear-wheel and a reel carried by each lever, a type-carrier, a flexible connecting device between each type-carrier and reel, a rack-bar connected to the locking-key, and webbed rod connected to the rack-bar and adapted to hold the pivoted levers in inoperative position, and means for imparting a step-by-step movement to the rack-bar and the webbed rod.

38. In a calculating-machine, a hollow shaft, a plurality of indicating-disks carried by the shaft and provided with keyways, a locking-key carried by the shaft and adapted to engage and lock the indicating-disks thereto, a rack-bar connected to the locking-key, means for imparting a step-by-step movement to said rack-bar, gear-teeth on each indicating-disk, a plurality of pivoted levers, a gear-wheel and a reel carried by each lever, the gear-wheel being adapted to intermesh with the teeth of a disk, a series of type-carriers, a flexible connecting device between each type-carrier and one of the reels, a rod normally in contact with the levers and holding the gears out of engagement with the gear-teeth of the indicating-disks, and means for connecting said rod to the rack-bar.

39. In a calculating-machine, a hollow shaft, a plurality of indicating-disks carried by the shaft and provided with keyways, a locking-key carried by the shaft and adapted to engage and lock the indicating-disks thereto, a rack-bar connecting with the locking-key, means for imparting a step-by-step movement to said rack-bar, gear-teeth on each indicating-disk, a plurality of pivoted levers, a gear-wheel and a reel carried by each lever, the gear-wheel being adapted to intermesh with the gear-teeth of a disk, a series of type-carriers, a flexible connecting device between the type-carrier and one of the reels, a webbed rod normally engaging with the levers and holding the gear-wheels out of mesh with the gear-teeth of the disks, a connecting-link between the rack-bar and the webbed rod and in which said rod may be circumferentially adjusted to remove its webbed portion from engagement with the levers, and means for temporarily locking said webbed rod in adjusted position.

40. In a calculating-machine, a hollow shaft, a plurality of indicating-disks carried by the shaft and provided with keyways, a locking-key carried by the shaft and adapted to engage and lock the indicating-disks thereto, a rack-bar connected to the locking-key, means for imparting a step-by-step movement to said rack-bar, a continuous and a mutilated gear on each indicating-disk, a plurality of pivoted levers, a gear-wheel and a reel carried by each lever, the gear-wheel being adapted to intermesh with the continuous gear of a disk, a series of type-carriers, a flexible connecting device between each type-carrier and one of the reels, a webbed rod normally engaging with the levers and holding the gear-wheels out of mesh with the gear-teeth of the disks, a connecting-link between the rack-bar and the webbed rod and in which said rod may be circumferentially adjusted to remove its webbed portion from engagement with the levers, finger-keys adapted to engage the webbed portion of the rod and move the same to disengaged position, a hollow shaft disposed parallel with the indicating-disk shaft, a plurality of pinions mounted on said hollow shaft and engaging the mutilated gears of the disks, a longitudinally-movable rod disposed within said hollow shaft and provided with a plurality of locking-keys for engagement with the pinions, said rod having an inclined or pointed end portion, a lever having an inclined face adapted to engage with the end of the rod, means for operatively connecting said lever to the finger-keys, and means for turning the rod and shaft to restore the indicating-disks to zero position.

41. In a calculating-machine, a plurality of indicating-disks each having a mutilated gear, a hollow shaft disposed parallel with the line of indicating-disks, pinions mounted on said shaft and engaging the mutilated gears, a rod disposed within the shaft and having a plurality of locking-keys for engagement with the pinions, said rod having an inclined or

pointed end portion, a pivoted lever having an inclined face for engaging the end of the rod and forcing the keys to pinion-engaging positions, a revoluble gear-wheel, and a pinion carried by the rod and movable into mesh with said gear-wheel to thereby permit the turning of the rod and disk-engaging pinions and the restoration of the disks to zero position.

42. The combination with a plurality of indicating-disks, of finger-key mechanism for rotating said disks, a normally inactive mechanism for restoring the disks to zero position, type-carriers operable from the several disks but normally disengaged therefrom, and means for simultaneously engaging the disks and type-carriers and for locking the restoration mechanism in operative position.

43. In a device of the class described, a hollow cylindrical support, a segment mounted thereon, a plurality of radially-disposed type-bars carried by the segment, means for moving the segment to adjust any one of the type-bars to imprinting position, a striker-bar carried by the support, means for positively moving the striker-bar away from the type and for locking the same in position, means for releasing said striker-bar, and a spring for forcing the striker-bar into engagement with an adjusted type-bar.

44. In a device of the class specified, a pivotally-mounted segment, a plurality of radially-disposed type-bars guided in said segment, means for moving the segment to adjust any one of the type-bars to imprinting position, a striker-bar, a compression-spring for retracting the striker-bar, a latch for locking said bar in retracted position, a spring for forcibly moving the striker-bar against the end of a selected type-bar, means for compressing the first spring to permit the operation of the second spring, and means for releasing the latch, substantially as specified.

45. In a device of the class specified, a pivotally-mounted type-segment, a plurality of radially-disposed type-bars carried thereby, means for adjusting the segment to move any one of the type-bars to imprinting position, a striker-bar, a compression-spring for retracting the striker-bar, a lever in engagement with the end of said striker-bar and movable in one direction by the action of said spring, means for positively moving said lever in the opposite direction to effect the compression of the spring, a latch for locking the striker-bar in retracted position, a spring for forcibly moving the striker-bar against the end of a selected type-bar, a pivotally-mounted latch-releasing bar, and a lug carried by said lever for engagement with the latch-releasing bar.

46. In a calculating-machine, a plurality of indicating-disks, finger-key mechanism for rotating the same, a plurality of pivoted segments, radially-disposed type-bars carried by each of said segments, a spring retracted and propelled striker-bar adapted to force a selected type-bar of each segment against a recording-surface, a normally disconnected mechanism extending between each disk and segment, means for automatically permitting the operative connection of a disk and segment in advance of the movement of said disk, and a plurality of cam-controlled levers for permitting the retractive movement of the striker-bars and for effecting the simultaneous release of all of the striker-bars.

47. In a calculating-machine, a plurality of indicating-disks, finger-key mechanism for rotating the same, a plurality of type-segments connected one to each of the disks and adapted to be operated successively as said disks are rotated, a plurality of type-bars carried by each segment and adjustable to a position corresponding to the indicating-disk movement, and means for simultaneously moving all of said type-bars against a recording-surface.

48. In a calculating-machine, a plurality of indicating-disks, finger-key mechanism for rotating the same, a plurality of type-segments connected one to each of the disks and adapted to be operated successively as said disks are rotated, a plurality of type-bars carried by each segment and adjustable to a position corresponding to the indicating-disk movement, a plurality of spring-retracted striker-bars, means for locking said striker-bars in retracted position, means for positively preventing a retractile movement of striker-bars of which the related segments and disks have received no operative movement, and means for simultaneously releasing all of the retracted striker-bars.

49. In a calculating-machine, a plurality of indicating-disks, finger-key mechanism for rotating the same, a plurality of pivoted segments connected one to each of said disks, radially-disposed type-bars carried by each segment and movable thereby to imprinting position, striker-bars for effecting the imprinting movement of the type-bars, pivoted levers controlling the operation of the striker-bars, a cam-shaft, a series of cams carried thereby and adapted to engage said levers, longitudinally-movable finger-bars for locking any of said levers in inoperative position at will, and means for revolving the cam-shaft to permit simultaneous movement of all of the striker-bars.

50. In a calculating-machine, a plurality of indicating-disks, mechanism for rotating the same, a plurality of pivoted segments connected one to each of said disks, radially-disposed type-bars carried by each segment and movable thereby to imprinting position, striker-bars for effecting the imprinting movement of the type-bars, pivoted levers controlling the operation of the striker-bars, a cam-shaft, a series of cams carried by the shaft and adapted to engage said levers, a plurality of longitudinally-movable finger-bars ar-

ranged one in operative relation to each of the levers and adapted to engage and lock any of said levers in inoperative position, and interengaging pins or lugs connecting said bars in a continuous series to permit the depression of all or any number of said bars by the movement of one of the bars.

51. In a calculating-machine, a plurality of indicating-disks having key-levers, a hollow shaft carrying said disks, a locking-key carried by the shaft and adapted to successively engage and lock the disks thereto, gear-teeth on each indicating-disk, a plurality of pivoted levers, a gear-wheel and a reel carried by each lever, a pivoted segment, a flexible connecting device between each segment and reel, a plurality of type-bars carried by each segment and movable thereby to imprinting position, striker-bars for moving the selected type-bars, striker-bar-controlling levers, a webbed rod adapted to hold the pivoted levers and the striker-bar-controlling lever in inoperative position, a rack-bar connected to the disk-locking key and to said webbed rod, means for imparting a step-by-step movement to the rack-bar to permit the interengagement of the lever-carried gears and the gear-teeth of the disks, a cam-shaft, and a plurality of cams mounted on the shaft for operative engagement with the striker-bar-controlling levers, the striker-bar-controlling levers of non-operated disks being retained in locked position by said webbed rod, substantially as specified.

52. In a calculating-machine, a plurality of indicating-disks having continuous and mutilated gears, a shaft disposed parallel with the line of indicating-disks, a plurality of pinions normally loosely mounted on said shaft and engaging the mutilated gears, a plurality of pivoted segments, type-bars carried thereby, means for connecting the segments and disks, striker-bars for forcing the type-bars to imprinting position, striker-bar-controlling levers, a series of finger-operated keys for locking the controlling-levers connected to non-operative segments and for automatically locking the series of pinions to the shaft, and means for revolving said shaft to restore the disks to zero position.

53. In a calculating-machine, a plurality of indicating-disks having gear-teeth, type-carrying segments, a series of pivoted levers, a gear-wheel and a reel carried by each lever, the gear-wheel being adapted to intermesh with the teeth of a disk, flexible connections between the type-carrying segments and the reels, springs for returning the segments to zero position after each operation, and means for disconnecting the gear-wheels from the gear-teeth of the disks to permit the returning movement of the segments independent of said disks.

54. In a calculating-machine, the combination with indicating devices, of type-segments, a casing inclosing the same and provided with a visual opening, arcuate strips carried by the segments and provided with type-face-indicating devices, and a reflector arranged at the opening and arranged at such an angle as to permit the operator to observe the type-face-indicating devices in said reflector.

55. In a calculating-machine, a hollow shaft, a plurality of indicating-disks mounted thereon, a locking-key for engaging and locking successive disks to the shaft, a spring-drum for imparting a step-by-step movement to the key, a series of type disks or segments, means for connecting the segments to the indicating-disks, means for controlling the imprinting movement of the types carried by the segments, a ribbon mechanism, ratchet-feed devices for the ribbon, and a main shaft having an operative connection with the spring-drum, the type-imprinting mechanism, and the ratchet-feed of the ribbon mechanism.

56. In a calculating-machine, a hollow shaft, a plurality of indicating-disks mounted thereon, a locking-key for engaging and locking successive disks to the shaft, a spring-drum imparting a step-by-step movement to the key, a main crank-shaft, a beveled gear-segment mounted loosely thereon, a bevel-pinion intermeshing with the segment and connected to the spring-drum, and a radial arm rigidly secured to the main shaft and adapted to engage said segment to effect a winding movement of said spring-drum.

57. In a calculating-machine, a plurality of indicating-disks, each having a mutilated gear, restoration-disks, a hollow shaft, restoration-pinions mounted on said pinions and adapted to engage the mutilated gears, a main shaft having an operating-gear, a longitudinally-movable rod disposed within the hollow shaft and provided with pinion-locking keys, a pinion carried by the hollow shaft and adapted for operative connection with the gear of the main shaft, and means for automatically shifting said longitudinal rod to lock the restoration-pinion and to intermesh the pinion with the connecting-gearing of the main shaft when the recording mechanism of the machine is to be adjusted for imprinting a grand total.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

CLARENCE D. BAIRD.

Witnesses:

ROBT. L. TURNER,

ED BETHEL.