No. 748,039. PATENTED DEC. 29, 1903.

C. D. BAIRD.

CALCULATING AND RECORDING MACHINE.

APPLICATION FILED JAN. 13, 1902.

NO MODEL. 6 SHEETS—SHEET 1.

Fig. 1.

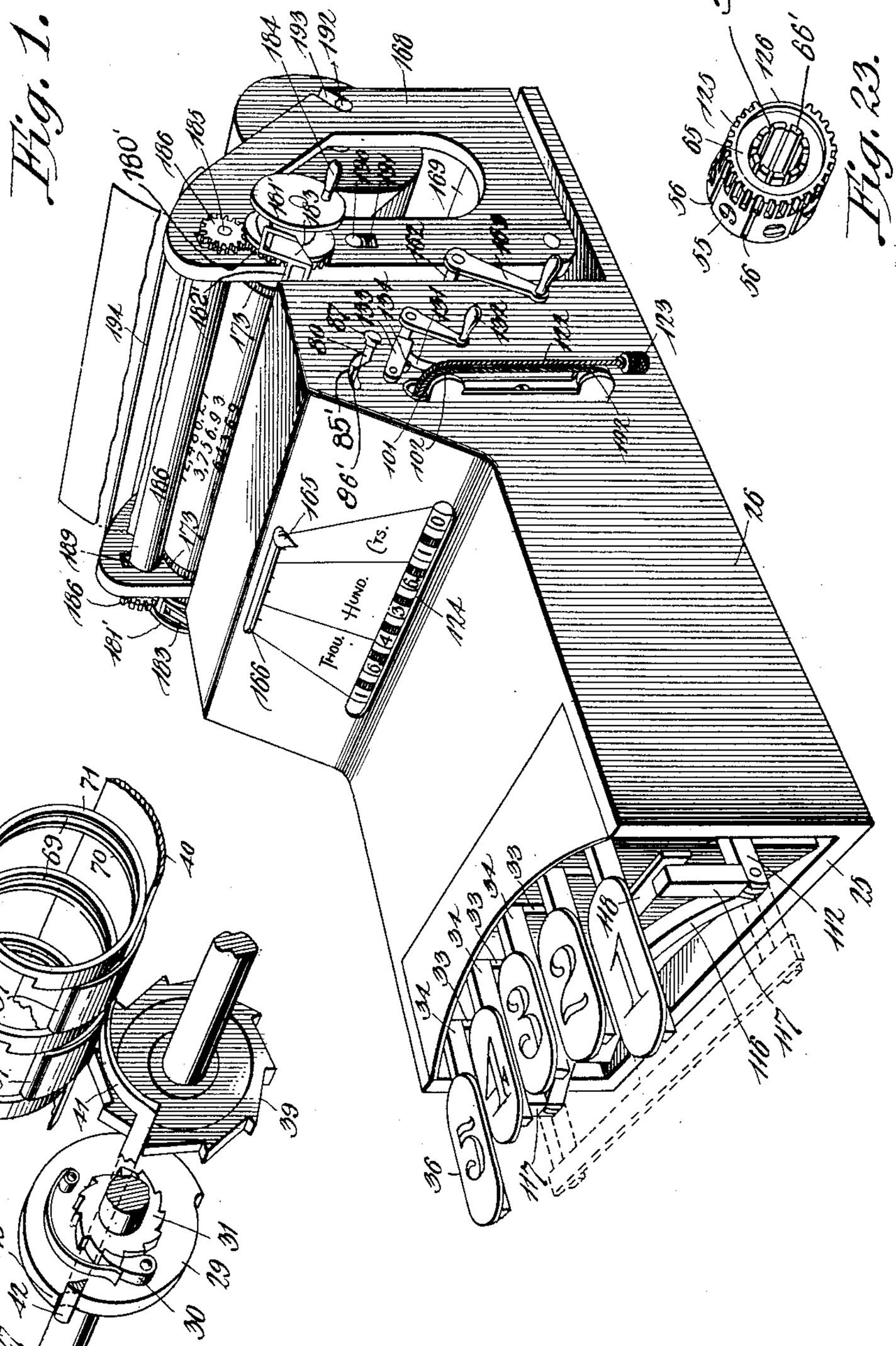

Fig. 15.

Fig. 23.

Witnesses
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NO MODEL. 6 SHEETS—SHEET 2.

Fig. 2.

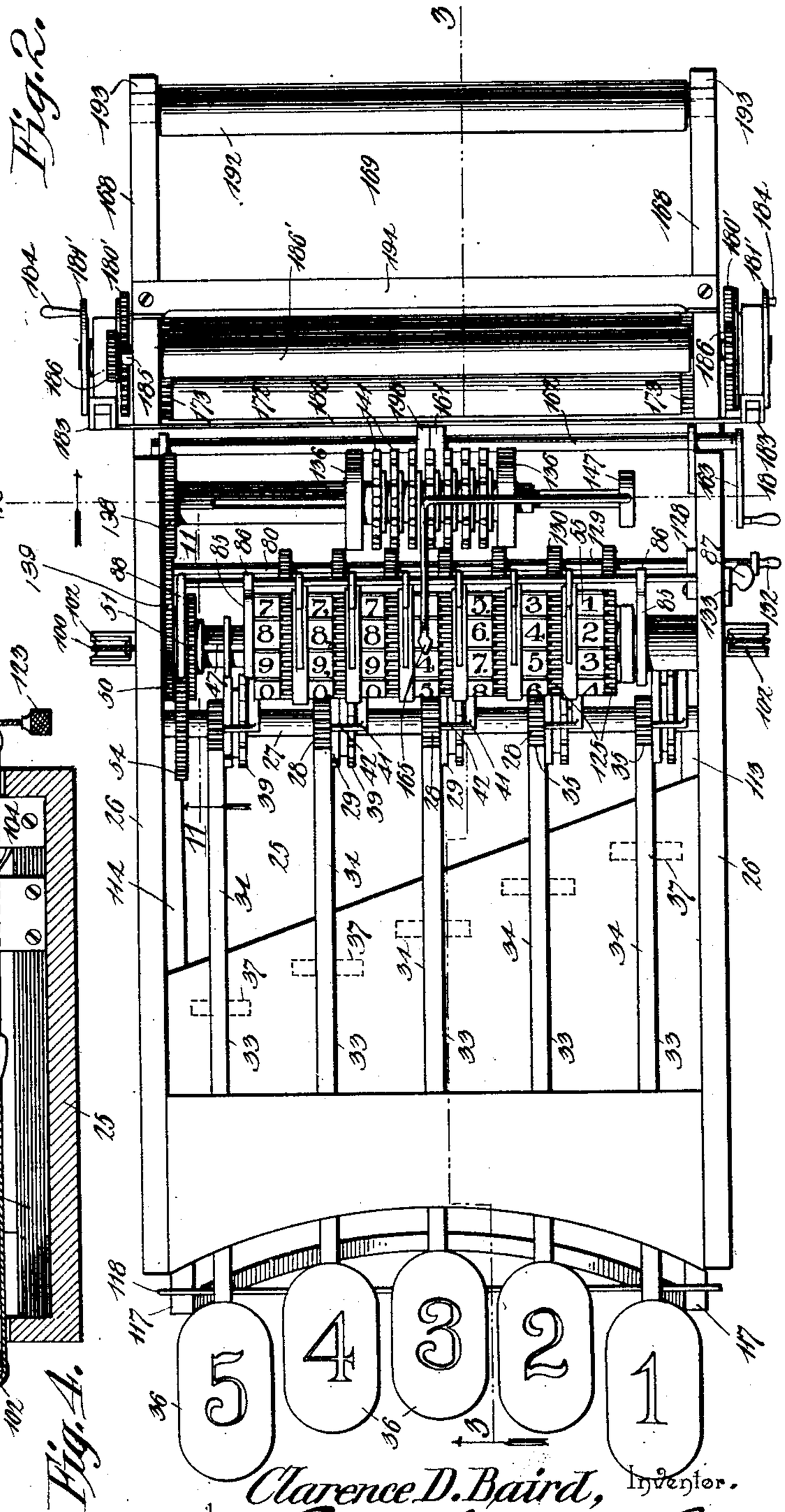
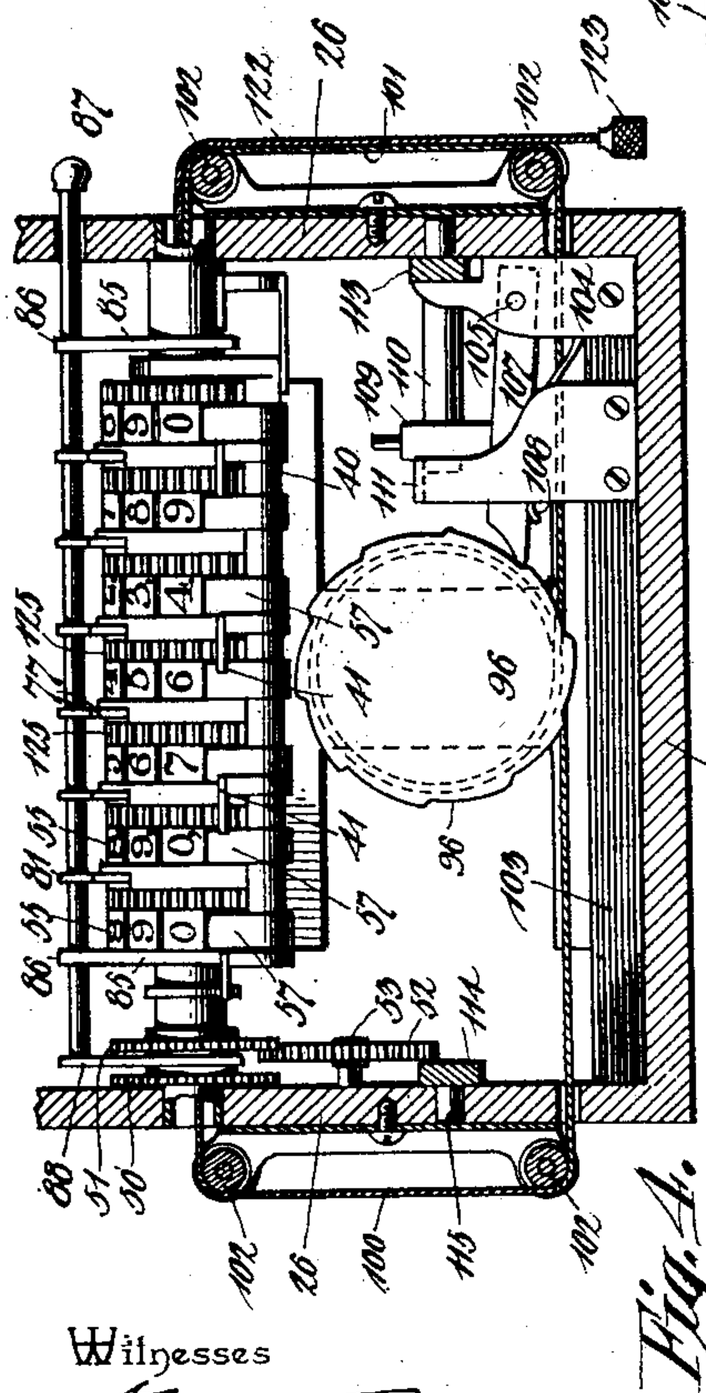


Fig. 4.



Witnesses
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NO MODEL. 6 SHEETS—SHEET 3.

Fig. 6.

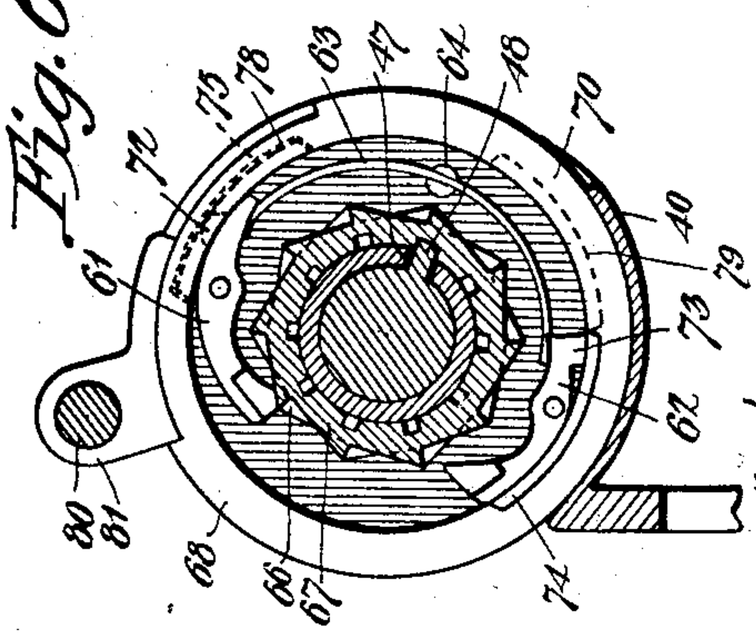

Fig. 7.

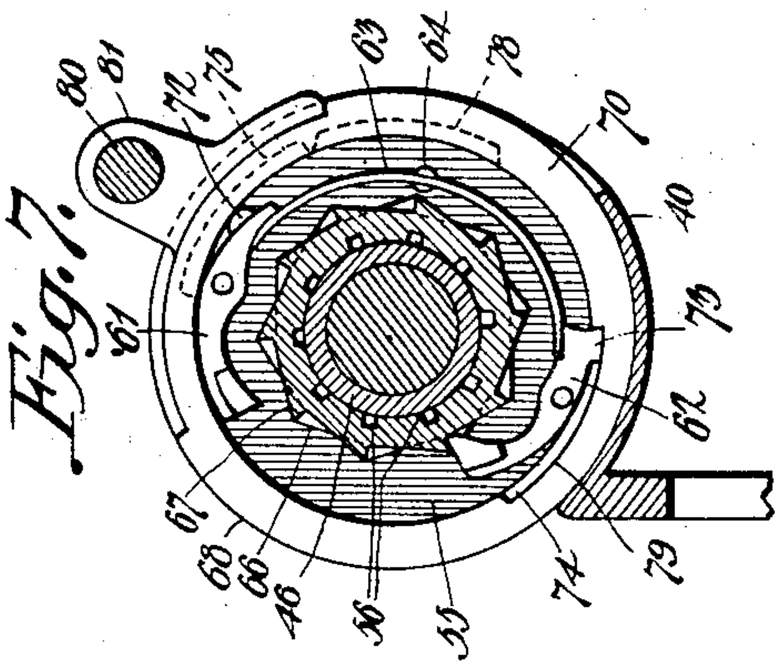

Fig. 10.

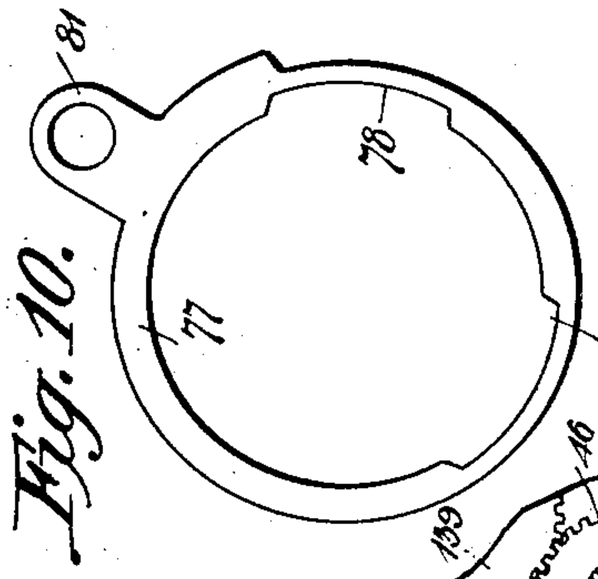

Fig. 21.

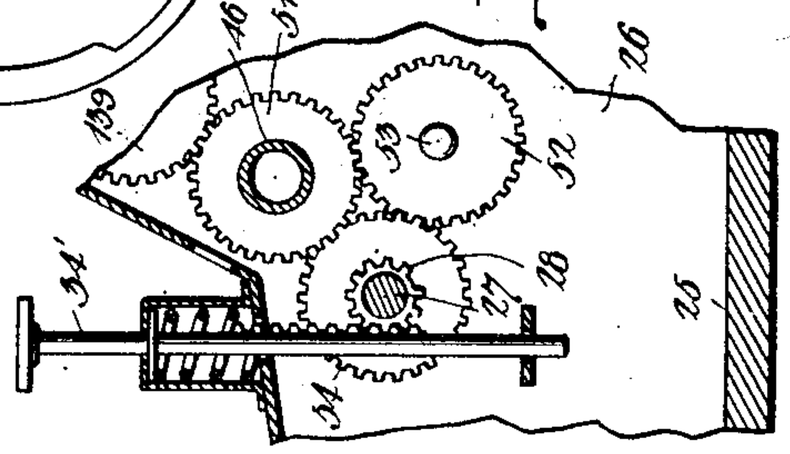

Fig. 3.

Witnesses
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NO MODEL. 6 SHEETS—SHEET 4.

Fig. 5.

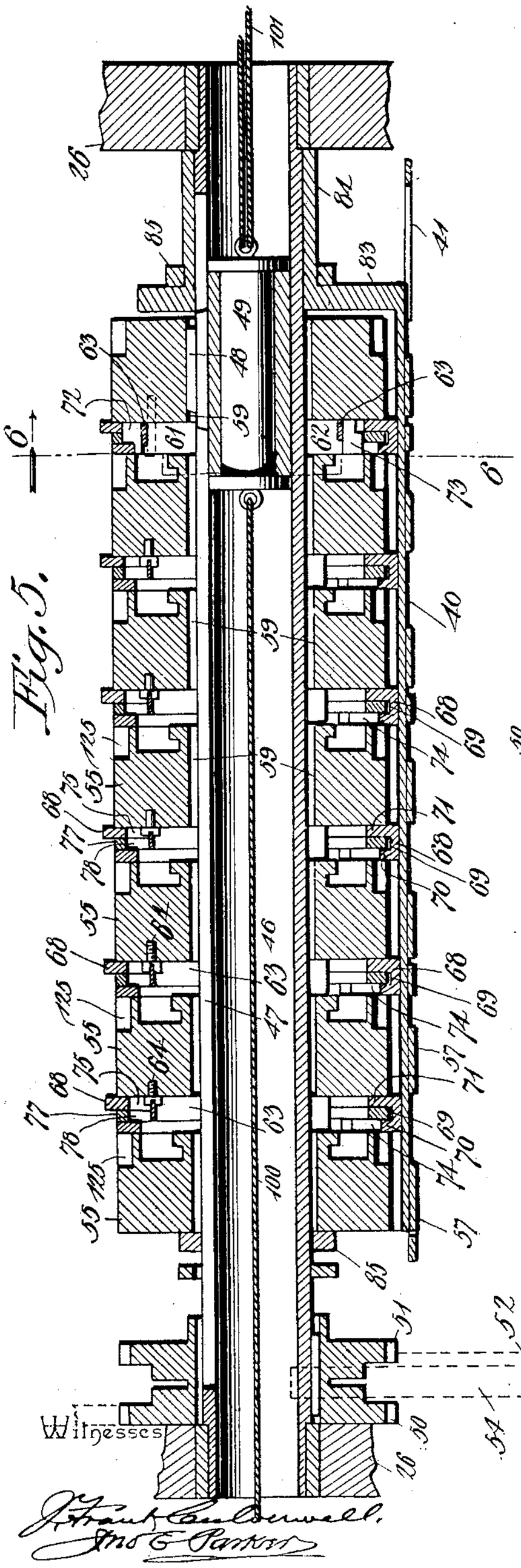


Fig. 8.

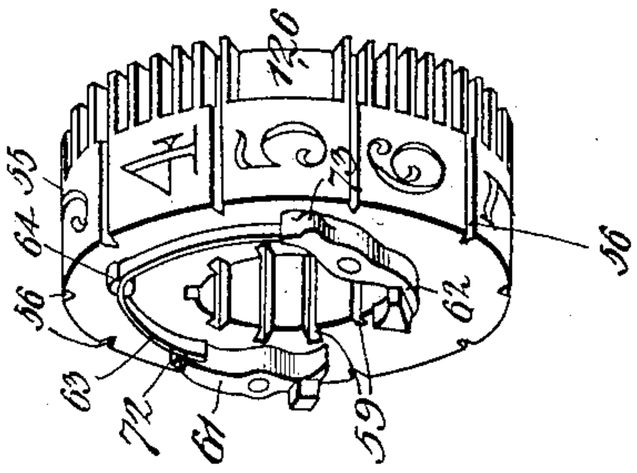


Fig. 9.

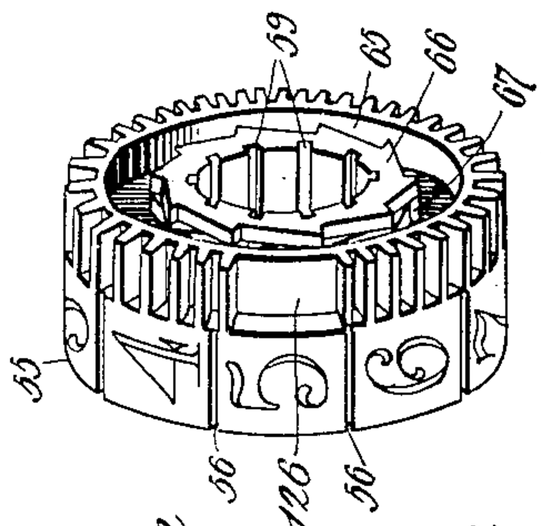


Fig. 12.

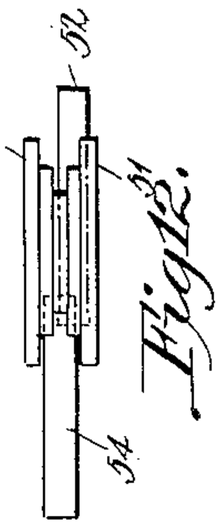


Fig. 13.

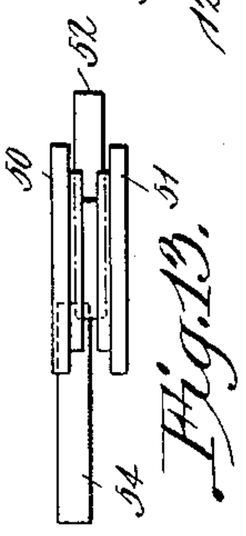


Fig. 14.

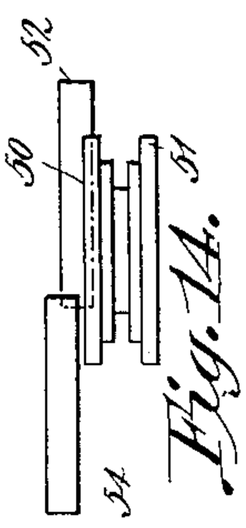
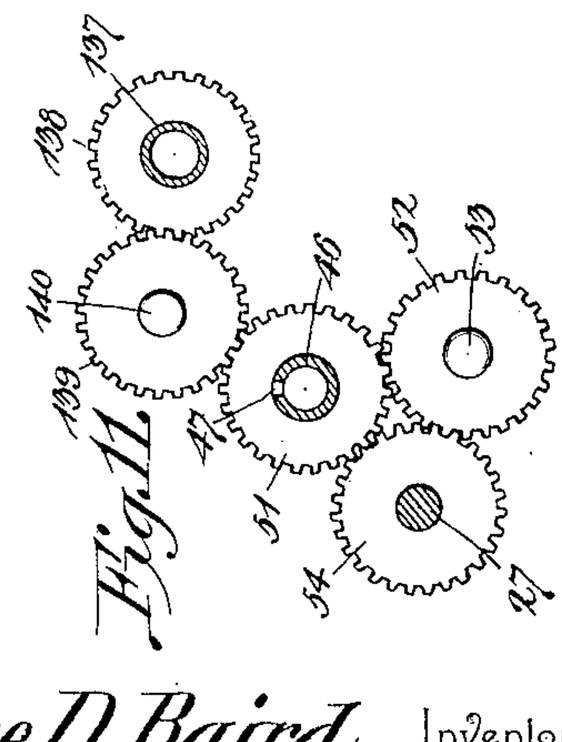


Fig. 11.



Witnesses

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NO MODEL. 6 SHEETS—SHEET 5.

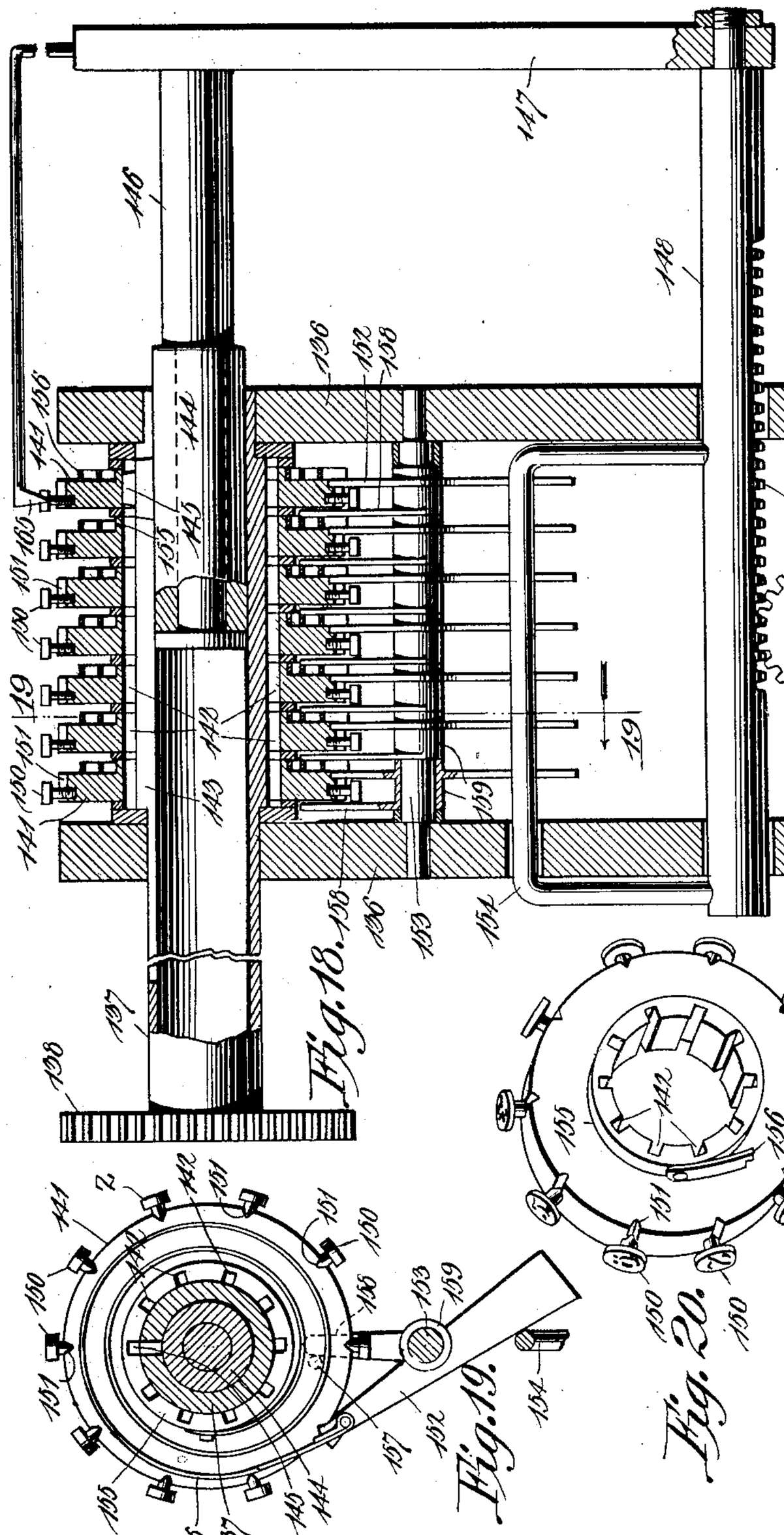

Fig. 18.

Fig. 19.

Fig. 20.

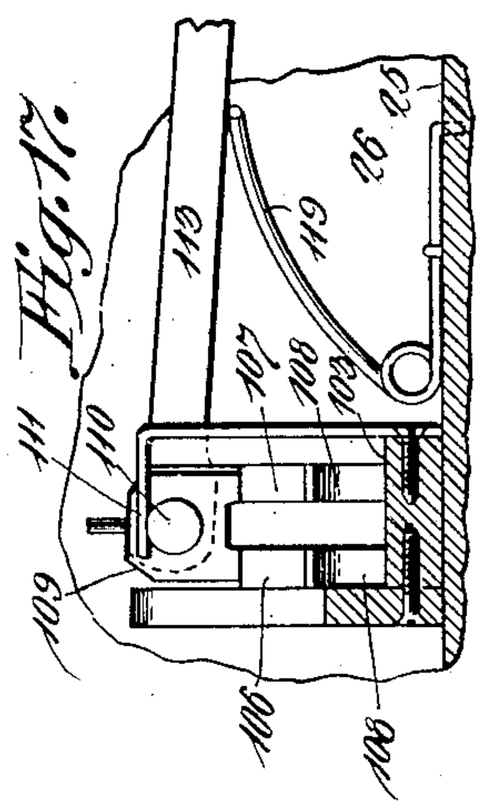

Fig. 17.

Fig. 16.

Witnesses
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No. 748,039. PATENTED DEC. 29, 1903.

C. D. BAIRD.

CALCULATING AND RECORDING MACHINE.

APPLICATION FILED JAN. 13, 1902.

NO MODEL. 6 SHEETS—SHEET 6.

Fig. 28.

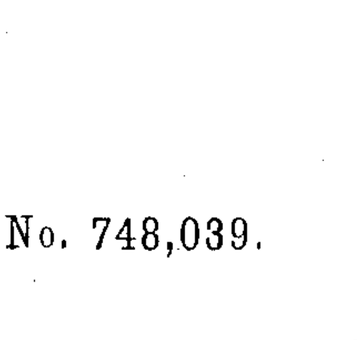


Fig. 27.

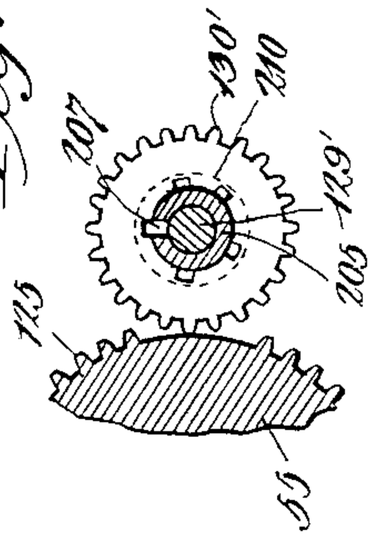


Fig. 26.

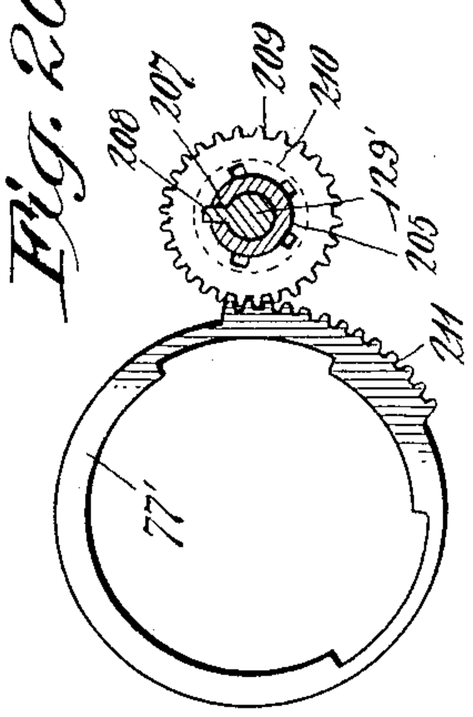


Fig. 25.

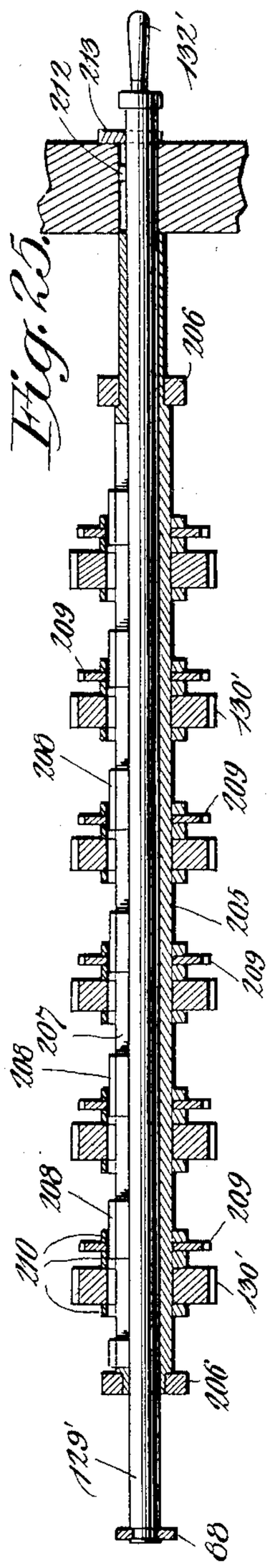
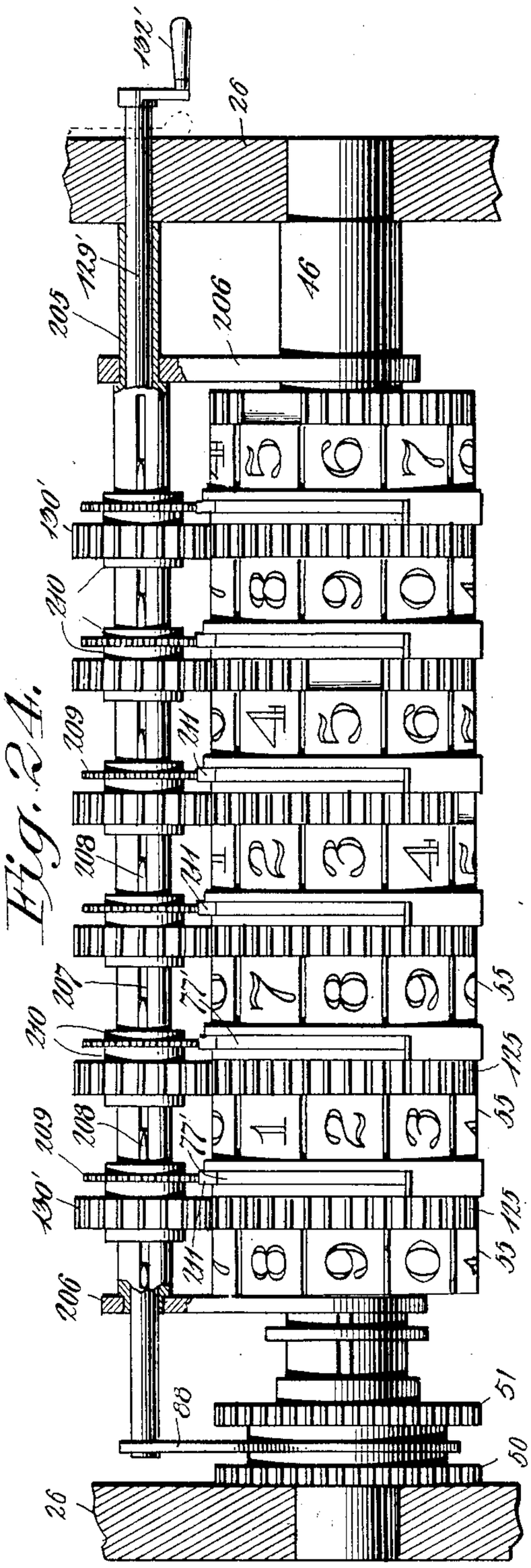


Fig. 24.



Witnesses

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Jno. C. Parker.

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Attorneys

No. 748,039. Patented December 29, 1903.

UNITED STATES PATENT OFFICE.

CLARENCE DEAN BAIRD, OF ALEXANDRIA, TENNESSEE.

CALCULATING AND RECORDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 748,039, dated December 29, 1903.

Application filed January 13, 1902. Serial No. 89,526. (No model.)

To all whom it may concern:

Be it known that I, CLARENCE DEAN 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, and has for its principal object to construct a machine of simple character by means of which a column or columns of figures may be added together, and each row of numerals will be independently recorded, so that they may be afterward compared with the original.

A further object of the invention is to materially reduce the number of keys ordinarily employed in machines of the class, the number preferably used being five and the machine being designed to be operated by one hand, so that each of the fingers will have a separate key to depress, reducing the mental strain and permitting of the more accurate and rapid manipulation of the keys.

A further object of the invention is to so construct the machine as to enable the operator to readily correct any errors which may occur at any time during the progress of the problem.

A still further object of the invention is to provide for the adjustment of the machine to permit the successive addition of a number of separate columns or to permit of the simultaneous addition and registration of any number of columns and to permit of the transfer of figures from either right to left or from left to right, as may be preferred.

Further objects and advantages of the invention will be apparent from a reading of the following description.

In the accompanying drawings, Figure 1 is a perspective view of a calculating and registering machine constructed in accordance with my invention. Fig. 2 is a plan view of the same with the cover or casing removed. Fig. 3 is a longitudinal sectional elevation of the machine on the line 3 3 of Fig. 2. Fig. 4 is a transverse sectional elevation of a portion of the machine on the line 4 4 of Fig. 3. Fig. 5 is a longitudinal sectional elevation of the indicating-shaft and the disks carried thereby. Figs. 6 and 7 are transverse sectional elevations on the line 6 6 of Fig. 5, illustrating the construction of the mechanism for transferring the movement of one disk to the next succeeding disk, as from a units to a tens disk or from a tens to a hundreds disk. Figs. 8 and 9 are perspective views of a pair of adjacent disks, illustrating the mechanism carried by each disk. Fig. 10 is a detail view of the cam-ring for moving or shifting the transferring mechanism to enable the disks to be moved either forward or backward. Fig. 11 is a longitudinal sectional elevation on the line 11 11 of Fig. 2, illustrating the arrangement of the train of gearing for transmitting the movement of the primary shaft to the indicating and type disk shafts. Figs. 12, 13, and 14 are plan views in the nature of diagrams illustrating different positions of the gears for effecting different movements of the parts. Fig. 15 is a detail perspective view of a portion of the mechanism for preventing excessive movement of the indicating and type disk shafts. Fig. 16 is an elevation, partially in section, of the spring-drum and its releasing mechanism, which effects the coupling of successive indicating and type disks to their respective shafts. Fig. 17 is a sectional elevation of a portion of the same on the line 17 17 of Fig. 16. Fig. 18 is a transverse sectional elevation, on an enlarged scale, on the line 18 18 of Fig. 2. Fig. 19 is a sectional elevation of the same on the line 19 19 of Fig. 18. Fig. 20 is a detached perspective view of one of the type-disks. Fig. 21 is a sectional elevation illustrating a slightly-modified construction of the machine. Fig. 22 is a detail view of a portion of the carriage-operating mechanism. Fig. 23 is a detail perspective view of a modified form of indicating-disk. Fig. 24 is a plan view, partially in section, illustrating a modification of the mechanism employed for adjusting the indicating-disks. Fig. 25 is a transverse sectional elevation of a portion of said mechanism. Figs. 26, 27, and 28 are details of the modified structure more particularly referred to hereinafter.

Similar characters of reference are employed to designate like and corresponding parts throughout the several views.

Referring first to Figs. 1, 2, and 3, 25 designates a suitable base, on the opposite sides

of which are standards or plates 26 for the support of the various operating parts of the machine. Mounted in suitable bearings in the side plates is a transversely-disposed shaft 27, on which are loosely mounted pinions 28, equal in number to the number of key-levers employed in the machine, there being five in the present instance, although a greater number may be employed, if desired. Rigidly secured to each of the pinions is a disk cam 29, carrying a pivoted pawl 30, adapted to engage with a ratchet-wheel 31, rigidly secured to the shaft, the movement of the pinion in one direction being transmitted through the pawl and ratchet-wheel to the shaft and in the opposite direction, the pawl sliding freely over the ratchet-wheel without effecting any movement of said shaft. The shaft 27 is the primary shaft of the machine, and its movements are transmitted through suitable gearing to an indicating-shaft carrying numbered disks, which are turned through an angular distance, dependent upon the degree of movement imparted to said primary shaft.

In the front portion of the machine is a frame 32, which for convenience is preferably removable from the frame of the machine in order that access may be had to the parts for examination or repairs. In the frame 32 are formed a series of parallel slots 33, each adapted to receive and guide a key-lever 34, the inner end of each lever terminating in a toothed segment 35, adapted for engagement with one of the pinions 28 and the outer ends of the levers being provided with finger-keys 36, preferably arranged on a slightly-curved line, as shown in Figs. 1 and 2, in order to be in convenient position for manipulation by the fingers. As illustrated more clearly in Fig. 2, the fulcrum-pins 37, on which the levers are mounted, are arranged at different distances from the toothed ends of the lever, so that a depression of all of the key ends of the levers to the same extent will result in a different degree of movement of the toothed ends of said levers and the consequent difference in the extent of rotative movement imparted to the primary shaft through their several intermeshing pinions 28. The keys bear on their upper surfaces numerals running from "1" to "5," and the object in arranging the fulcrums of the levers at different points is to give each key a different relative value in proportion to the value of the numeral which it bears. In other words, the key-lever marked "1" will impart through its toothed segment 35 a movement to the primary shaft equal to one-tenth of a revolution, the key-lever marked "2" will revolve the shaft to the extent of two-tenths of a revolution, and the key-lever marked "5" will impart a half or five-tenths of a revolution to said shaft.

To prevent excessive downward movement of the key-levers, I provide suitable posts 38 in the several slots 33, the posts being arranged at different distances from the pivotal points of the lever or being of different vertical heights, so as to form a fixed stop for the lever and prevent any excessive movement which might result in the whirling of the primary shaft.

As an additional precaution against excessive movement of the primary shaft I secure to the shaft at a point adjacent to each cam-disk 29 a ratchet-wheel 39, having ten teeth, and secured to a fixed plate 40 are a series of spring-pawls 41, adapted to engage with said ratchet-wheels. From one side of each pawl there extends a finger 42, arranged in operable relation to the cam-disk 29, each cam-disk being of a shape corresponding to the value of the finger-key and its connected pinion with which said cam-disk coöperates. By referring to Fig. 15 it will be seen that each cam-disk is provided with a shoulder 43, and said shoulder is situated when in normal position at a distance in advance of the finger 42 proportionate to the distance through which its adjacent pinion moves under the impulse of the finger-key. The cam-disk to the extreme right of the machine, or that which coöperates with the key-lever marked "1," will have its shoulder one-tenth of a revolution in advance of the pin 42, and when said cam is revolved through this distance the pin will fall and the pawl 41 will engage in the ratchet-wheel 39 and positively stop the movement of said shaft. When the cam-disk is returning to its initial position under the impulse of the returning-spring 44 of the key-lever, the shoulder 43 will engage with the pin 42, and thus raise the pawl 41 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 No. 2 lever, will normally be arranged two-tenths of a revolution in advance of the pawl-pin 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 pins.

Before proceeding with the description of further portions of the machine it may be noted that in lieu of the pivoted key-levers I may employ vertically-disposed levers or bars 34′, provided with toothed racks for engagement with the respective pinions of the primary shaft, as illustrated in the modified structure, Fig. 21.

46 designates a hollow shaft mounted in suitable bearings and provided with an elongated key-slot 47, through which extends a locking-key 48, carried by a block or carriage 49, which may be reciprocated within the hollow shaft either by hand or by the automatic mechanism hereinafter described. For effecting the movement of the carriage suitable chains are connected to its opposite ends, the chains extending out through the ends of the shaft, as shown in Fig. 5. On this shaft 46 is keyed a double-gear wheel 50 51, the two parts of which are secured together or are formed integral, the wheels being duplicates

of each other in all respects. This double gear may be adjusted longitudinally of the shaft for a number of purposes, but normally are disposed in the position illustrated in Fig. 12, the gear 51 being in engagement with an intermediate gear 52, mounted on a stud 53, and said gear 52 is in engagement at all times with a gear-wheel 54, rigidly secured to one end of the primary shaft 27. The three gears 51, 52, and 54 are preferably the same size and serve to transmit the rotations of the primary shaft to the indicating-disk shaft 46, the movements being to the extent of one-tenth or two-tenths or more of a revolution in accordance with the degree of movement imparted to the primary shaft by one or other of the key-levers.

On the shaft 46 are mounted a number of indicating-disks 55, each of the same construction and each normally loosely mounted on said 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, with which engages a spring catch or pawl 57, secured to the aforementioned fixed bed 40, the pawl dropping into each notch or groove as they pass and offering but slight resistance to the movement of the disk in either direction.

In the simplest possible construction of the machine the carriage 49 is moved to engage the key 48 in any one of a series of ten keyways 59, formed in each of the indicating-disks, thereby to lock said disk to the shaft 46, the disk engaged being the units, the tens, or the hundreds or other disk, as may be desired. On the depression of any one of the numbered keys the degree of movement imparted by said key to the primary shaft will be transmitted through the gear-wheels to the shaft 46 and to that one of the disks locked to said shaft by the key 48, the movement of the lever No. 1 moving the indicating-disk to the extent of one-tenth of a revolution and bringing the numeral "1" on 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 the other and any suitable degree of movement be imparted thereto. In the present machine there are only five keys employed. The registration of seven or eight or any number higher than five necessitates the successive depression of two keys, the first key being held down during the depression of the second, of which the sum shall be equal to the desired number—as, for instance, the depression of the "5" and the "2" key will move the indicating-disk to the extent of seven-tenths of a revolution, or the successive depressions of Nos. 4 and 3 will produce the same result, any suitable combination of keys being operated for the purpose.

In order to transfer a partial rotation from a units 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 the mechanism best shown in Figs. 6, 7, 8, and 9.

On the left-hand side of each indicating-disk are two pivoted 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 pawls. 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 it 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 46 is reversed to move the disks backward for purposes of subtraction or to correct an error.

On the fixed bed 40 are secured a number of rings 68, 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 flange 70 bears a lug 73 on the rear face 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 a tenth of the circumference of the flange and the recesses being situated at different points in the flanges, as shown in Figs. 6 and 7. If these recesses were open at all times, the lugs on the pawls would enter and permit the toothed end 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, 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 on their respective flanges the lug 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 disk to which said pawl is secured. 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. The rings are all secured to a shifting bar 80, extending through suitable ears or lugs 81 on the various rings, and when said rings are in the position

illustrated in Fig. 6, 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. 6, 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 ring 77 is shifted to the point illustrated in Fig. 7, 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 disk backward in order to correct an error or for purposes of subtraction, and the reversing and shifting mechanism is operated by the movement of the bar or rod 80.

To the stationary bed 40 is secured a vertically-disposed plate 83, from which projects a horizontally-disposed sleeve 84, Fig. 5, forming a supporting-bearing for one end of the shaft 46, the opposite end of said shaft being preferably provided with a suitable bearing in one of the side frames 26. On the shaft 46 and sleeve 84 are mounted two disks 85, having perforated ears 86 for the reception of the shifting bar 80, one end of the latter projecting out through a segmental slot 86′ in the side of the casing, as shown in Figs. 1 and 4, and being provided with a suitable operating knob or handle 87. The rod 80 extends through all of the lugs 81 on the rings 77, so that the latter may be simultaneously moved to the position illustrated in Fig. 6 or that illustrated in Fig. 7. On the extreme inner end of the bar 80 is a forked arm 88, which extends between the gears 50 and 51, so that by pulling said bar outwardly the twin gear may be moved from the position shown in Fig. 12 to that shown in Fig. 13, and by a forward movement of said bar the various rings may be shifted from the normal position (illustrated in Fig. 6) to that shown in Fig. 7. When the gears assume the position shown in Fig. 13, the gear 51 is moved out of engagement with the gear 52 and the gear 50 is so moved that its teeth will directly intermesh with the teeth of the gear-wheel 54 on the primary shaft 30, the result of this movement being that the rotations of the primary shaft are imparted directly to the indicating-disk shaft instead of through the intervening counter-gear 52, the direction of rotation of the indicating-disk shaft being thus reversed. This mechanism is of value in the event of the operator striking a wrong key and registering on the indicating-disk a higher number than that called for. Thus if the number "9" be registered in place of "7" the parts are moved to the reversing position, and the locking-key 48 being engaged with the proper indicating-disk the number "2" key is struck and effects a backward movement of the said disk to the extent of two numerals and corrects the error. Should the error have been carried by the disk to the next succeeding disk by reason of the engagement of the addition-pawl during the erroneous recording movement, the subtraction-pawl 62 will enter the alining recesses 79 and 75 and its toothed end will engage with the ratchet-wheel 67 and cause a backward movement of the disk to which said ratchet-wheel is secured. An error of this kind may of course be corrected without shifting the mechanism by mentally subtracting the desired number from the next numbers to be recorded.

The machine as thus far described is of value in the addition of single columns, where the locking-key may be held continuously in engagement with the units-disk until the entire column 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 value, in accordance with the number of figures in the row. To accomplish this automatic shifting, I employ a spring-drum of the character illustrated in Figs. 3, 4, 16, and 17.

From a point about the center of the base extends a vertical standard, which forms a support for the fixed bed 40. In this standard is formed a threaded opening for the reception of the threaded end of a sleeve-arbor 91, having a lug or catch 92 for engagement with the inner end of a spiral spring 92′. On the arbor is loosely mounted a drum 93, to the inner surface of which is secured the outer end of the spring 94. (Indicated by full lines in Fig. 16.) On each side of the barrel of the drum is secured a toothed wheel, one of which, 95, may be permanently secured to the drum and the other, 96, being secured to a shaft 97 and removably attached to said drum. The shaft 97 extends through the arbor 91, as shown in Fig. 16, and at its rear end is provided with a pinion 98 for transmitting the movement to the drum to a portion of the recording mechanism, hereinafter described. To the barrel of the drum are secured the opposite ends of chains or cords 100 101, extending, respectively, from opposite sides of the key-holding carriage 49 in the hollow shaft 46, suitable guiding-wheels 102 being arranged on the exterior of the side plates 26 for the purpose. Extending transversely of the base is a bar 103, to the opposite sides of which are secured plates 104,

forming a support for a pin 105, on which are fulcrumed two pawls 106 and 107, adapted to engage, respectively, the toothed wheels 95 and 96 of the spring-drum, the rear pawl 106 being a trifle shorter than the front pawl 107, for a purpose hereinafter described. On the bar 103 are plate-springs 108, adapted to engage with the under sides of the pawls and normally tending to force the same upward, a movement which is resisted by a rocking block 109, arranged on the outer end of a stud 110, pivoted or fulcrumed in a suitable opening in one of the side plates. The inner end of the pin 110 is held in the depressed position by a spring 111, carried by the bar 103, and normally the parts will be held in a position shown in Fig. 17 and in full lines in Fig. 16, with the pawls in horizontal alinement, both pawls being engaged with alining teeth of the drum-wheels and resisting any turning movement of the drum under the stress of its actuating-spring.

112 designates a frame constituting a spacing-lever and comprising opposite side bars, one of which, 113, is rigidly secured to the pin 110, the opposite bar 114 being fulcrumed on a suitable pin or stud 115, arranged on the opposite side plate 26. The outer or front ends of the bars 113 and 114 are connected by a transversely-disposed bar 116, which may be curved to conform to the contour of the frame 32. To the outer ends of the bars 113 and 114 are pivoted short arms 117, connected by a transversely-disposed finger-piece 118, and these arms may be turned to assume a substantially horizontal position, such as indicated in Figs. 1 and 3 by dotted lines, or may be moved to the vertical positions illustrated in full lines in said figures to present a finger-piece directly under and in operable relation to the various key-levers. The spacing-bar is normally held in elevated position by a spring or springs 119, so that when the arms 117 are turned to the vertical position the finger-piece will bear against the under sides of the key-levers, and any movement of the latter will effect a corresponding movement of the spacing-bar. When the arms 117 are in the dotted-line position stop-pins 120 are provided to limit the upward movement, as shown in Fig. 3. In the operation of this portion of the mechanism any depression of the spacing-bar either by an independent movement or by a movement imparted to it through the depression of one of the key-levers will result in a slight turning of the pin 110 and the block 109, carried thereby. The pawl 107 will be depressed to the dotted-line position shown in Fig. 16 until it has moved beyond the line of and out of engagement with the teeth of the wheel 96. The shorter pawl 106 will be elevated to the dotted-line position shown in Fig. 16 partly by its spring 108 and partly by the stress of the drum-actuating spring, the pawl moving upward until it comes into contact with the surface of the block 109. This movement has permitted a slight rotative movement of the drum, and when pressure on the spacing-bar is removed the strong springs 119 of the latter will move the bar to its initial position and permit the pawls to reassume the position illustrated in Fig. 17. The effect of this movement will be to cause the shorter pawl 106 to move from engagement with the tooth of the wheel 96 before the longer pawl 107 can reëngage the wheel 6 and permit the latter to move under the influence of its spring to the extent of a single tooth, the pawls having reassumed their normal positions engaging with the next succeeding tooth and stopping the movement of the drum. The movement of the drum is transmitted through the chain 100 to the key-carriage 49, the latter being moved from a position in alinement with one of the indicating-disks to a position in alinement with the next succeeding disk, the rotative movement of the spring-drum to the extent of one tooth being sufficient to move the key-carriage from a locking position on one disk to a locking position on another disk. In this manner the key may be engaged with any desired disk by the independent movement of the spacing-bar, or in the addition of a series of columns of figures the key may be first engaged with the units-disk to the extreme right of the machine, and on the depression of the proper key to move the disk the desired distance the spacing-bar will also be depressed and will effect the movement of the key to a position in alinement with the tens-disk. As the recording movement of the indicating-disk takes place on the downward movement of the finger-key and the spacing movement takes place on the upward movement of the spacing-bar, the movement of the parts will not interfere with each other and will take place in proper sequence.

After the carriage of the locking-key has been traveled to engage with any desired number of disks it is returned to normal position, one step to the right of the units-disk, by means of a suitable chain or cord 122, having a suitable handle or knob 123, the movement serving also to rewind the spring in the spacing-drum, so that the spring will at all times be under practically the same tension.

After finishing the calculation it is necessary to move all of the indicating-disks to such position that the ciphers will be in alinement with the visual opening 124 in the casing, and to accomplish this I provide each indicating-disk with gear-teeth 125, having a spaced portion 126, as illustrated in Figs. 8 and 9. On the inner side of each of the plates 26 is pivoted an arm 128, the outer ends of the arms being provided with bearings for the reception of a transversely-disposed shaft 129, having a series of pinions 130, one of which is arranged in alinement with each of the indicating-disks. The shaft 129 extends out through a segmental slot 131 in one of the side plates and is provided with

an actuating-crank 132. The pivoted arms 128 are normally held in such position that the gear-teeth are out of mesh by a catch 133, pivoted on the outside of the casing and engaging with the shaft 130, a pin 134 being employed to prevent excessive downward movement of the catch. When the catch is raised, springs 135 act to force the shaft forward and effect the engagement of the pinion with the gear-teeth on the several indicating-disks. By turning the crank 122 the disks will be revolved until the pinions reach the spaced portions 126, at which time the zero-marks of the disks will be in alinement with the visual opening.

In Fig. 23 I have illustrated a modification of a portion of the mechanism for transferring the movement of one disk to the next higher disk. In this case the double ratchets are dispensed with, and the disk is provided with an integral hub 66′, through which extend all of the key-slots 59, the slots taking the place of the several teeth on the ratchet-wheels and affording a contact equally good in both directions and for engagement with the oppositely-disposed pawls. At a point to the rear of the actuating-drum the base is provided with vertically-disposed standards 136, in which is mounted a hollow type-disk shaft 137, Figs. 18 and 19, having at one end a gear-wheel 138, which receives motion from the gear-wheel 50 through the medium of a counter-gear 139, mounted on a stud 140 on one of the side plates. The shaft is provided with a number of loosely-mounted type-disks 141 equal in number to the indicating-disks, and in each disk are ten key seats or slots 142, one of which is always in alinement with a slot or keyway 143, extending for nearly the full length of the type-disk shaft. In the hollow shaft is a carriage 144, to which is secured a key 145, which may be moved into engagement with any one of the type-disks and lock said disk to the shaft. The carriage is connected by a rod 146 to a plate or bar 147, the lower end of which is secured to a shaft 148, guided in openings formed in the standards 136. The shaft 148 has a rocking movement for a purpose to be presently described and on its under side is provided with gear-teeth 149, which are at all times in engagement with the teeth of the pinion 98 on the shaft 97 of the spring-actuated drum, so that each time the drum is revolved the shaft 148 will be moved and the carriage 144 will be traveled to effect the engagement of its key 145 with successive type-disks. The type-disks are smaller than the indicating-disks, and the degree of movement imparted to the type-disk key 145 is correspondingly less than that imparted to the indicating-disk key 48; but both are operated upon simultaneously and receive their motion from the same source, and when the chain or cord 122 is pulled to return the indicating-disk key to an initial position the movement is transmitted through the spring-drum and the pinion 98 to the type-disk key.

On the periphery of each type-disk are formed ten openings for the reception of type-bearing numerals from "0" to "9," the type 150 being arranged at one side or near the edge of the disk, and at the opposite side thereof are formed ratchet-teeth 151 of a number equal to the number of type and adapted to be engaged by a pawl 152, which is pivotally mounted on a bar 153, held in the standards 136. The lower end of the pawl is enlarged and extends for some distance below its pivot-point partly for the purpose of forming a counterbalance to retain its tooth end in engagement with the ratchet-teeth, but principally for engagement with a bar 154, carried by the shaft 148 and movable with said shaft by mechanism hereinafter described for the purpose of effecting the disengagement of the pawls from the ratchet-teeth. Each type-disk has a projecting hub 155, to which is secured one end of a light spiral spring 156, the opposite end of which is secured to a pin on the pawls and serves to maintain the pawls in engagement with the ratchet-teeth, the spring being wound to a greater or less extent by the rotative movement of the type-disk and serving to return said type-disk to an initial position when the pawl is disengaged by the movement of the bar 154. On one side of each disk is a projecting pin 157, adapted for engagement with an arm 158, which is secured to a sleeve 159, formed integral with the pawl 152. For each of the disks there is a pawl and a stop-arm, the pawl and arm of each disk being rigidly secured together and movable with each other, but independent of the movement of the pawls and arms of the remaining disks. Initial and zero positions of the type-disk are that illustrated in Fig. 19, where the pin 157 is resting against the stop-arm 158 and the cipher or zero type (indicated at Z) is in printing position.

The function of the type-disks is to record the line of numerals singly, while the indicating-disks will show the progressive totals until the calculation is complete. To transmit the proper movement from the primary shaft to the type-disk shaft, all of the connecting-gears illustrated in Fig. 11 are of the same size, so that the type-disk shaft will receive the same degree of angular movement as that imparted to the primary shaft by the key-levers, and as the disk-engaging key 145 is moved by the spacing-bar to successively engage disks representing gradually-increasing values the disks are turned successively to record the line of numerals from left to right in the same manner as previously described with reference to the indicating-disks. When a disk is rotated to present a desired numeral to the imprinting position Z, such movement takes place against the stress of the spring 156, and the pawl 152 is held in close engagement with the ratchet-teeth of

the disk and positively locks the same in the selected position. Owing to the pin 157 and stop-arm 158 it is impossible to effect a complete rotation of the type-disk, and as a matter of fact this is unnecessary, as nine-tenths of a revolution is sufficient to bring the highest numeral to imprinting position, while if a cipher is to be recorded the spacing-bar is depressed and the locking-key moved on to engagement with the next disk, leaving the cipher in its initial position, as indicated in Fig. 19. As the spring-drum effects the step-by-step movement of the shaft 149 and the locking-key, the bar 154 is traveled in similar manner and gradually moves from contact with the pawls 152 of the successive disks. The movement toward the left of Fig. 18 of the bar 154 will be in accordance with the length of the line of numerals to be recorded, and if three type-disks are moved to imprinting position the bar will be clear of the pawls of those disks, but will remain in contact with the pawls of the remaining disks, and all of the zero-marks of the remaining disks will still be in printing position. To prevent the printing of the unnecessary ciphers of the said remaining disks, the shaft 148 receives a rocking movement, and the bar 154 being in engagement with the pawls of the unselected disks moves said pawls to the rear and by the engagement of the stop-arms 158 with the pins 157 moves all of said unselected disks to the extent of one-twentieth of a revolution, moving all of the ciphers from imprinting position, the imprinting line or the horizontal line, to which the selected imprinting type have been adjusted, being half-way between the types "0" and "1." On the return movement of the bar 154 to initial position all of the pawls 152 are engaged and released from the ratchet-teeth of the disk, permitting the disks to return to initial position under the influence of their springs 156.

To effect the rocking movement of the shaft 148, said shaft is provided with a bar 160, adapted to be engaged by a cam 161, carried by a shaft 162, adapted to suitable bearings in the side plates 26 and provided with an operating-crank 163 at a point outside the casing of the machine. This bar is normally held up in engagement with the cam by a spring 164, as illustrated in Fig. 3.

To facilitate the operation of the machine and to show the exact position of the disk-locking keys, I provide a pointer 165, carried by the plate 147, and projecting through a slot 166 at a point above the slot 124, lines being drawn from indicating-marks at the edge of the upper slot to points between the several disks to indicate the denominational divisions of a line of figures, as indicated in Fig. 1.

Where the machine is employed for the addition of figures representing monetary values, certain of the type-disks are provided with indicating-points, as illustrated, for instance, in Fig. 20, the third type-disk from the right being provided with a period mark in order to indicate that the figures printed by the units and tens disks represent cents. The sixth disk in similar manner would be provided with a comma following each numeral to divide off the hundreds, and so on throughout the remaining disks.

In the rearwardly-extending base portions of the standards 136 is mounted a bar 167, which forms the fulcrum of a paper-carriage carrying a suitable platen, paper-roll, ribbon, and actuating mechanism for the ribbon and the platen.

The frame of the carriage, Figs. 1 and 3, comprises opposite side plates 168, connected by a base 169, in which is mounted a roller 170, which may travel transversely of the base of the machine when the carriage is moved to bring different portions of the length of the platen opposite the type-disks. Near the upper portion of the front of the carriage is mounted a shaft 171, on which is secured a platen 172, formed of any suitable material, and at each end of the platen are gear-wheels 173, with which engage suitable detents 174, adapted to hold the platen in printing position, but of such character as not to interfere with the movement of the platen in either direction. On the inside of the plate 168 are pivoted levers 175, carrying at their upper ends pawls 176, which are normally pressed in the direction of the teeth of the gears 173 by suitable springs 177. Each pawl 176 is provided on its upper face with a pair of cams or lugs 178, adapted for engagement with a stationary pin 179, carried by the side plate at a point adjacent to the gear-teeth. The arms 175 are connected by a cross-bar 180 and are maintained in normal position against stop-pins 181 by suitable springs 182, the normal position of the pawl 176 being that indicated in Fig. 3, with one of the lugs, the outer, in engagement with the pin 179, the pawl being thus held out of engagement with the gear-teeth. When the carriage is swung forward on its fulcrum-bar 167, the bar 180 will come in engagement with the rear faces of the side plates 26 or the standards 136, causing a movement of said arms on their pivots, each pawl 176 being moved forward until the outer lug 178 passes beyond the pin 179 and engages with the teeth of the gear-wheel, rotating the latter to the extent of one or more teeth, as may be required. As the movement of the pawl continues the inner lug will engage with the pin 179 and will move said pawl out of engagement with the teeth, so that at all times except during the actual travel of the pawl the platen will be free and may be moved by hand in either direction.

On the shaft 171 at points outside the plates 168 are secured gear-wheels 180', which may form part of ribbon-reels 181', on which is wound an ink-ribbon of the character ordinarily employed in type-writing machines. The ribbon is guided through a slotted plate

182′, extending across the face of the platen and provided at each end with turning-guides 183 to direct the course of the ribbon between the horizontal guide and the reels. To turn the ribbon-reels by hand, suitable handles or knobs 184 are arranged on the outer faces of the reels, as indicated in Fig. 1.

Journaled in the side frames 168 at a point above the platen is a shaft 185, having at each end a pinion 186, either one of which may engage one of the loose gear-wheels 180′, the shaft being longitudinally adjustable, so that one or other of the pinions and gears may be intermeshed to effect a movement of the ribbon in the desired direction. This shaft carries a roller 186′, having a longitudinal slot 187, in which may engage a pin 188, projecting radially from the shaft 185, so that the movement imparted to the roller from the platen may be transmitted to the shaft and from thence to the ribbon-actuating gears. In order to keep the roller and platen in intimate frictional contact, suitable springs 189 are placed in recesses in the side frames and exert downward pressure on the shafts 185.

At a point under the platen is a roller 190, the ends of which are pressed upwardly by springs 191 and serve to more firmly hold the paper in place. The paper is wound on a roller 192, which may be inserted in suitable slots 193 in the side frames, and its end is led up between the pressure-rollers and platen and between the upper roller and a cutting-knife, where the printed paper may be cut from the roll.

The fulcrum-bar 167 of the paper-carriage passes through a block 195, which is held from longitudinal movement by the base portions of the standards 136, and said rod is provided with a pair of arms 196, extending downwardly and rearwardly and connected to the base-plate of the carriage-frame. From the block also extends an arm 197, which projects into the path of a cam 198, secured on the shaft 162 at a point adjacent to the cam 161, so that when said shaft is turned the cam will depress the arm 197 and through the arms 196 force the platen forward against the type-disks.

In some instances where it is desired to shift the carriage transversely of the machine to print figures in different columns at different points in the width of the paper provision is made for the proper registration of the columns by forming in the fulcrum-bar 167 a series of notches 198′ at suitable intervals along the length of the bar, and the block 195 is provided with a pawl 199, adapted to be operated on by a spring 200 and forced into locking engagement with any one of the recesses moved into alinement therewith.

To provide for the proper operation of the printing-disk and carriage, the cam 161 is arranged a trifle in advance of the cam 198, so that the bar 160 will be depressed and the unselected type-disks will be moved out of printing position in advance of the movement of the platen toward the types.

In some cases it may be desired to operate the indicating-disk without effecting a corresponding movement of the type-disk, and in such cases the bar 80 is pulled outwardly to effect a movement of the double-gear wheel to the position shown in Fig. 14, the gear 50 being thus moved out of engagement with the counter-gear 139 and preventing any movement of the type-disk shaft. This may also be accomplished by moving either of the gears 138 or 139 out of engagement with the other.

In the operation of the machine the single rows of figures are imprinted on the paper by the type-disks, while the gradually-increasing total is indicated by indicating-disks until the calculation is completed, when the key-levers are actuated to transfer the total to the type-disks and print the same below the column of figures.

The construction of the mechanism for adjusting the cam-rings 77 may be modified, and this mechanism may be combined with the mechanism for returning the indicating-disks to zero position, as illustrated in Figs. 24, 25, 26, 27, and 28.

In a modified construction the hollow shaft 46, the double-gear wheel 50 51, and the indicating-disks 55 are all of the construction previously described. The shaft 129′ extends through a hollow shaft 205, adapted to bearings in standards 206, the latter being supported by the fixed bed 40. The shaft 205 is provided with a key-slot 207, through which projects a number of keys 208, adapted to engage in key slots or seats formed in a double series of gear-wheels 130′ and 209, both sets of gears being loose on the shaft and turning therewith only when the keys 208 are engaged in their key-seats. Longitudinal movement of the gear-wheels is prevented by fixed collars 210, secured to the hollow shaft 205 and having suitable slots in alinement with the shaft-slot for the passage of the keys. The pinions 130′ are at all times in mesh with the gear-sections 125 of the indicating-disk, but being loosely mounted on the shaft 205 offer no resistance to the movement of said indicating-disks during the operation of the machine.

The cam-rings 77′ are provided with toothed segments 211, which are at all times in engagement with the pinions 209, the latter being normally locked to the hollow shaft by the keys 208, so that the operator by turning the crank-handle 132′ may turn said cam-rings to adjust either the addition or the subtraction pawls to operative position.

On one end of the shaft 129′ is a forked arm 88, engaging between the double gears 50 and 51′, and at a point near the opposite end of said shaft is a stop-pin 212, adapted to engage with the inner face of a pivoted latch 213, carried by one of the side frames 26.

While the machine is being employed for

purposes of addition the locking-keys 208 are in engagement with the shifting-pinions 209, the pinions 130′ being free to rotate on the hollow shaft. When the cam-rings are to be shifted to adjust the subtraction-pawls to operative position, the crank-handle 132′ is turned slightly, causing the pinions 209 to engage with and rotate the cam-rings through the segments 211. The shaft 129′ is then drawn outward until the stop-pin 212 comes into engagement with the latch 213, this movement being sufficient to move the twin gears 50 and 51 to the position illustrated in Fig. 13, the gear being then properly intermeshed to turn the indicating-disk in reverse direction. This outward movement of the shaft 129′ is not sufficient to move the keys 208 from engagement with the pinions 209, the latter being still locked to the shaft and in position to again turn the cam 77′ to the normal position, while the pinions 130′ remain free on the shaft and permit free rotative movement of the indicating-disk.

To restore the zero-marks on the indicating-disks to alinement with the visual openings in the casing, the latch 213 is raised to permit the passage of the stop-pin 212, while the shaft 129 is pulled outwardly to an extent sufficient to adjust the twin gears to the position shown in Fig. 14. This movement is sufficient to bring the right-hand key 208 of the series into contact with the end of the slot 207 in the hollow shaft, all of the pinions 209 being disengaged and all of the pinions 130′ being locked to the shaft. The indicating-disks can then be rotated by turning the crank 132′ until the zero-marks are in alinement with the visual opening, at which time the pinions will be in positions opposite the spaced portions 126 of the gears 125.

The indicating-disks are preferably turned in the direction as when subtracting in order to restore the zero-marks to alinement, as the subtraction-pawls of one disk only engage with the disks of next higher denomination when the zero is indicated through the visual opening, and when the zero is indicated the pinion 130′ is in the spaced portion of the gear 125 and cannot move the latter any farther, so that no movement will be imparted to the disk of next higher denomination. In this manner the indicating-disk can be turned to adjust all the zero-marks in alinement with fewer rotations of the shaft 205 than when turned in the opposite direction, for the reason that the addition-pawls engage with the disks of next higher denomination when "9" is indicated by the preceding disk, and it becomes necessary to revolve the indicating-disks until the whole series have made a sufficient number of revolutions to move the final disk to zero.

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

Having thus described my invention, what I claim is—

1. In a calculating-machine, a hollow shaft, a plurality of normally loose disks mounted on the shaft and bearing designating-marks, a locking-key carried by the shaft and movable longitudinally thereof to engage and lock said disks thereto, character-bearing finger-keys operatively connected to the shaft and adapted to revolve the same on the depression of said keys, a normally locked spring operatively connected to the locking-key, mechanism under the control of the finger-keys for releasing the same to permit a step-by-step movement of the locking-key, and a manually-operated means for restoring the key to initial position and simultaneously rewinding the spring.

2. In a calculating-machine, a hollow shaft, a series of disks mounted loosely thereon and bearing designating-marks, a locking-key carried by the shaft and movable longitudinally thereon to lock the disks to said shaft, a spring-drum, means for connecting the keys to said drum, a finger-key-operated escapement mechanism for controlling the operative movement of said drum, and a manually-operated mechanism for simultaneously restoring the key and drum to initial position.

3. In a calculating-machine, a series of finger-keys each having a toothed rack, a primary shaft having a series of pinions, one of which intermeshes with each rack, said pinions being clutched to the shaft in one direction of movement and turning freely in the opposite direction, a disk-carrying shaft, gearing connecting the primary shaft to the disk-carrying shaft, a series of disks mounted loosely upon the disk-carrying shaft, and a longitudinally-movable locking-key controlled by the movement of the finger-keys and adapted to successively engage and lock the disks to said disk-carrying shaft.

4. In a calculating-machine, a series of finger-keys each having a toothed rack, a primary shaft having pinions in mesh with said racks, said pinions being clutched to the shaft in one direction of movement and turning freely in the oposite direction, means for preventing excessive movement of said shaft, a disk-carrying shaft, gearing connecting the primary shaft to the disk-carrying shaft, a series of disks mounted loosely upon the disk-carrying shaft, and a longitudinally-movable locking-key controlled by the movement of the finger-keys and adapted to successively engage and lock the disks to said disk-carrying shaft.

5. In a calculating-machine, a series of finger-keys each having a toothed rack, a primary shaft having pinions in mesh with said racks, said pinions being clutched to the shaft in one direction of movement and turning freely in the opposite direction,

ratchet-wheels secured to said primary shaft at points adjacent to the pinions, pawls adapted to engage with said ratchet-wheels to prevent movement of the shaft in one direction, disk-cams secured to the pinions and adapted to free the pawls from the ratchet-wheels, and means for clutching the pinions to the shaft.

6. In a calculating-machine, a series of finger-keys each having a toothed rack and each having a different extent of movement, a primary shaft having pinions in mesh with said racks, each pinion being adapted to impart to the shaft a rotative movement through an angular degree differing by that imparted from the remaining pinions, a ratchet-wheel and a revoluble disk-cam carried by said primary shaft at a point adjacent to each of the pinions, a pawl for engagement with each ratchet-wheel, each pawl being provided with a laterally-projecting pin for engagement with its disk-cam, a disk-carrying shaft, gearing connecting the primary shaft to the disk-carrying shaft, and a series of disks mounted upon said disk-carrying shaft and adapted to be rotated thereby.

7. In a calculating-machine, a series of key-levers arranged in parallel relation and in the same horizontal plane, each lever having a toothed rack, a primary shaft having pinions in mesh with said racks, each pinion being adapted to impart to the shaft a rotative movement through an angular degree differing from that imparted by the remaining pinions, a revoluble disk-carrying shaft, gearing connecting the primary shaft to said disk-carrying shaft, a series of disks mounted loosely on said disk-carrying shaft, means for transmitting the movement of the key-levers to the disk-carrying shaft, and means for locking a selected disk to said disk-carrying shaft.

8. In a calculating-machine, a hollow shaft, series of disks mounted on said shaft and bearing designating-marks, a series of key slots or seats formed in each disk and of a number equal to the number of designating-marks, a locking-key carried by said hollow shaft and movable longitudinally thereof to lock a selected disk to the shaft, a series of key-levers operatively connected to said hollow shaft, means controlled by the key-levers for imparting a step-by-step movement to the locking-keys, a spacing-bar for controlling the movement of the key, said spacing-bar being adjustable for independent operation or for operation by the depression of the key-levers.

9. In a calculating-machine, a hollow shaft, a series of disks mounted loosely thereon and having key seats or slots, a locking-key carried by the shaft and adapted to engage with said key seats or slots, a spring-drum for actuating the key, an escapement mechanism normally locking the drum, character-bearing finger-keys, means connecting the same to the hollow shaft and to the escapement mechanism, and a manually-operated mechanism for restoring the locking-key to initial position and for simultaneously rewinding the spring-drum.

10. In a calculating-machine, a hollow shaft, a series of disks mounted loosely thereon and having key seats or slots, a locking-key carried by the shaft and adapted to engage with said key seats or slots, a spring-drum having an operative connection with the key and adapted to impart a step-by-step movement thereto in one direction, a manually-operated mechanism for rewinding said drum to the same tension each time the key is returned to an initial position, an escapement mechanism normally locking the drum, and character-bearing finger-keys having an operative connection with the hollow shaft and with said escapement mechanism.

11. In a calculating-machine, a hollow shaft, a series of disks mounted loosely thereon and having key seats or slots, a locking-key carried by the shaft and adapted to engage with said key seats or slots, a spring-drum, means connecting said drum to the locking-key to effect the movement of the key from the drum and the rewinding of the drum-spring on the manual return of the locking-key to an initial position, a series of escapement-teeth formed on the drum, detent-pawls mounted in operable relation to said teeth, and a spacing-bar for operating said pawls.

12. 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 with said key slots or seats, a spring-drum, mechanism connecting the drum to the key, escapement-teeth on said drum, a pair of pawls adapted to engage said teeth, a pivotally-mounted block for moving one of said pawls to releasing position and the other to engaging position, and a spacing-bar connected to said pivoted block.

13. 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 spring-drum, flexible connecting devices extending between the spring-drum and the locking-key, an escapement mechanism for controlling the rotative movement of said drum.

14. 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 spring-drum, chains or cords extending from the drum to opposite ends of the locking-key, an auxiliary hand chain or cord extending from one end of the key, and an escapement mechanism for controlling the rotative movement of said drum.

15. In a calculating-machine, a hollow shaft, a series of disks mounted loosely there-

on and having key slots or seats, a key-carriage arranged within the hollow shaft, a key carried by said carriage and projecting through an elongated slot in said shaft, a spring-drum, chains or cords extending from the drum through said hollow shaft and connected to the opposite ends of the carriage, an auxiliary hand chain or cord extending partially through the shaft and connected to one end of said carriage, and an escapement mechanism for controlling the rotative movement of said drum.

16. In a calculating-machine, a hollow shaft, a series of disks mounted loosely on the shaft, each disk having key slots or seats, a locking-key adapted to engage in said key slots or seats, a spring-drum having a pair of ratchet-teeth, a pair of pivoted pawls engaging said teeth, means for effecting the alternate depression of said pawls to move one of the pawls to releasing and the other to tooth-engaging position and for returning both pawls into engagement with alining teeth.

17. In a calculating-machine, a hollow shaft, a series of disks mounted loosely on the shaft, each disk having key slots or seats, a locking-key adapted to engage in said key slots or seats, a spring-drum, a pair of ratchet-wheels on said drum, a pair of spring-pressed pawls adapted to engage said teeth, a pivoted block having two actuating-faces for positively engaging with and moving said pawls, and a spacing-bar operatively connected to said block.

18. In a calculating-machine, a hollow shaft, series of disks mounted on said shaft and having key seats or slots, a locking-key carried by the shaft and adapted to engage in said key seats or slots, a spring-drum, mechanism connecting said drum to the locking-key, an escapement mechanism for controlling the movement of said spring-drum, a series of key-levers operatively connected to said hollow shaft, a spacing-bar operatively connected to said escapement mechanism, and a pivoted finger-bar arranged at the forward end of said spacing-bar and adjustable into operable relation to said key-levers.

19. In a calculating-machine, a shaft, a series of indicating-disks mounted on said shaft and bearing designating-marks, transferring mechanism disposed between adjacent disks, mechanism for adjusting the transferring mechanism for operation in either direction, a series of finger-keys, mechanism for operatively connecting any one of the finger-keys to any one of the disks, and means for reversing the direction of movement imparted to the disks by the keys.

20. In a calculating-machine, a shaft, a series of rotatable disks mounted on the shaft and bearing numerals, means for locking a selected disk to the shaft, an adjustable transferring mechanism disposed between each two disks, a series of finger-keys, mechanism operatively connecting the keys to the shaft to rotate the same in one direction, and means for reversing the direction of rotative movement imparted to said shaft by the same movement of said finger-keys.

21. In a calculating-machine, a shaft, a series of rotatable disks mounted on said shaft and bearing numerals, a primary shaft, gear-wheels connecting the primary shaft to the first-named shaft, one of said gears being adjustable to alter the direction of rotative movement imparted from said primary shaft, a series of finger-keys, and mechanism operatively connecting the finger-keys to said primary shaft.

22. In a calculating-machine, a shaft, a double gear-wheel keyed to said shaft and adjustable longitudinally thereof, a primary shaft having a gear-wheel, an intermediate gear intermeshing with the primary gear, means for adjusting the double gear-wheel to force one of its members into engagement with the intermediate gear or the opposite member into engagement with the primary gear, and a series of key-levers for imparting movement to said primary shaft.

23. In a calculating-machine, a shaft, initial and secondary 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, and means for rotating the initial disk.

24. In a calculating-machine, a shaft, a plurality of disks mounted on said shaft and bearing designating-marks, a slotted ring arranged between adjacent disks and having annular flanges provided at different points with recesses, a cam having a recessed portion movable into alinement with one or other of the recesses of said flanges, oppositely-facing pawls carried by the initial disk and bearing partially on the cam and partially on the flanges and means for rotating the initial disk in either direction.

25. In a calculating-machine, a shaft, a plurality of disks mounted on said shaft and bearing designating-marks, oppositely-disposed ratchet-wheels carried by one of said disks, a pair of pawls facing in opposite directions and adapted to engage with the respective wheels, a slotted wheel mounted between each pair of disks and having recessed flanges, a recessed cam-ring mounted between said flanges and adapted for engagement with both pawls, and means for imparting rotative movement to the initial disk.

26. In a calculating-machine, a shaft, a plurality of disks mounted on said shaft and bearing designating-marks, oppositely-disposed ratchet-wheels carried by one of said disks, a pair of oppositely-facing pawls adapted to engage with the respective wheels, a slotted stationary ring mounted between each pair of disks and having recessed flanges, a cam mounted in each ring and adapted to control

the operative position of the pawls, and means for operating said cams, substantially as specified.

27. In a calculating-machine, a series of disks having intervening pawl-and-ratchet mechanisms for imparting a movement of one disk to the disk of the next higher value, a series of cams for controlling the operative positions of said pawls, a primary shaft, a series of finger-keys for imparting movement thereto, a double gear-wheel mounted on the disk-shaft and adapted to be longitudinally adjusted thereon, gearing connecting the primary shaft to said double gear-wheel, and a shifting bar connected to said double gear-wheel and to all of the pawl-governing cams.

28. In a calculating-machine, a pair of hollow shafts, type-disks loosely mounted on one of said shafts and adapted to record successive rows of numbers, a series of numeral-disks loosely mounted on the remaining shaft and adapted to indicate the successive totals formed by the addition of such numbers, a locking-key for each shaft, means for simultaneously moving both of said keys to engage disks of corresponding value and position on both shafts, a series of key-levers, and mechanism for transmitting the movement of said levers to both shafts.

29. In a calculating-machine, a hollow shaft, a series of type-disks mounted loosely thereon, a platen, a stop-pin carried by each disk, a stop-lever for engagement with said pin, means for moving said lever to rotate the disk to inoperative position, a second shaft, a series of indicating-disks thereon, and mechanism mutually connecting said shafts to each other and to disk locking and rotating mechanisms.

30. In a calculating-machine, a hollow shaft, a series of type-disks mounted loosely thereon and provided with ratchet-teeth, pawls in engagement with said ratchet-teeth, springs for holding said pawls in operative position, said springs extending between the pawls and their respective type-disks, means for releasing said pawls, a second shaft, a series of indicating-disks thereon, disk locking and rotating mechanism and mechanism mutually connecting said shafts to each other and to said disk locking and rotating mechanisms.

31. In a calculating-machine, a hollow shaft, a series of type-disks mounted loosely thereon, a platen, a pawl adapted to engage with and hold the disks in an adjusted position, a coiled spring for returning each disk to initial position, a stop-arm connected to and movable with the pawl, a pin carried by each disk for engagement with the stop-arm, a locking-key carried by the shaft, a spring-drum for actuating said key, a second shaft, a series of indicating-disks carried thereby, a disk-locking key carried by said second shaft and also connected to said spring-drum, a series of key-levers for imparting rotative movement to both of said shafts, and means for shifting the positions of the pawls and stop-arms, substantially as specified.

32. In a calculating-machine, type-disks for recording a line of numerals, numeral-bearing disks for indicating successive totals, shafts carrying each set of disks, means for locking selected disks of each class to their respective shafts, finger-keys, and finger-key-actuated mechanism controlling the movement of the disk-locking mechanism.

33. In a calculating-machine, type-disks for recording a line of numerals, numeral-bearing disks for indicating successive totals, hollow shafts on which all of the disks are loosely mounted, movable keys carried by the hollow shafts and adapted to engage with and lock selected disks to said shafts, a spring-actuated mechanism connected to and adapted to operate both of said keys, key-levers for effecting the movement of the disks, and means operable by the movement of the key-levers for permitting a movement of said spring-actuated mechanism.

34. In a calculating-machine, a series of type-disks, means for rotating the same, a pivoted paper-carriage, a platen and paper-guiding mechanism carried thereby, means for imparting a step-by-step movement to the platen, means for moving the unselected type-disks to inoperative position, and means for oscillating the carriage to force the platen in the direction of the type-disks.

35. In a calculating-machine, a shaft, a series of indicating-disks mounted loosely on the shaft, pawl-and-ratchet mechanism arranged between successive disks, a cam for controlling the positions of said pawls, a toothed segment on each cam, a shaft, a series of segments mounted on said shaft for engagement with said pinions, and means for locking said pinions to said shaft.

36. In a calculating-machine, a series of indicating-disks each having a spaced gear, pawl-and-ratchet mechanism arranged between successive disks, cams for controlling the positions of said pawls, a hollow slotted shaft, a longitudinally-movable shaft disposed in said hollow shaft, a series of locking-keys carried by the movable shaft and projecting through the slot of the hollow shaft, a double set of pinions mounted loosely on the hollow shaft and adapted for engagement respectively with the indicating-disk gears and with teeth on the adjusting-cams, each of said gears being provided with key-seats for engagement with said locking-keys.

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

CLARENCE DEAN BAIRD.

Witnesses:
CHAS. WOMACK,
B. R. FLOYD.