(No Model.) 7 Sheets—Sheet 1.

W. S. BURROUGHS.

CALCULATING MACHINE.

No. 388,116. Patented Aug. 21, 1888.

Fig. 1.

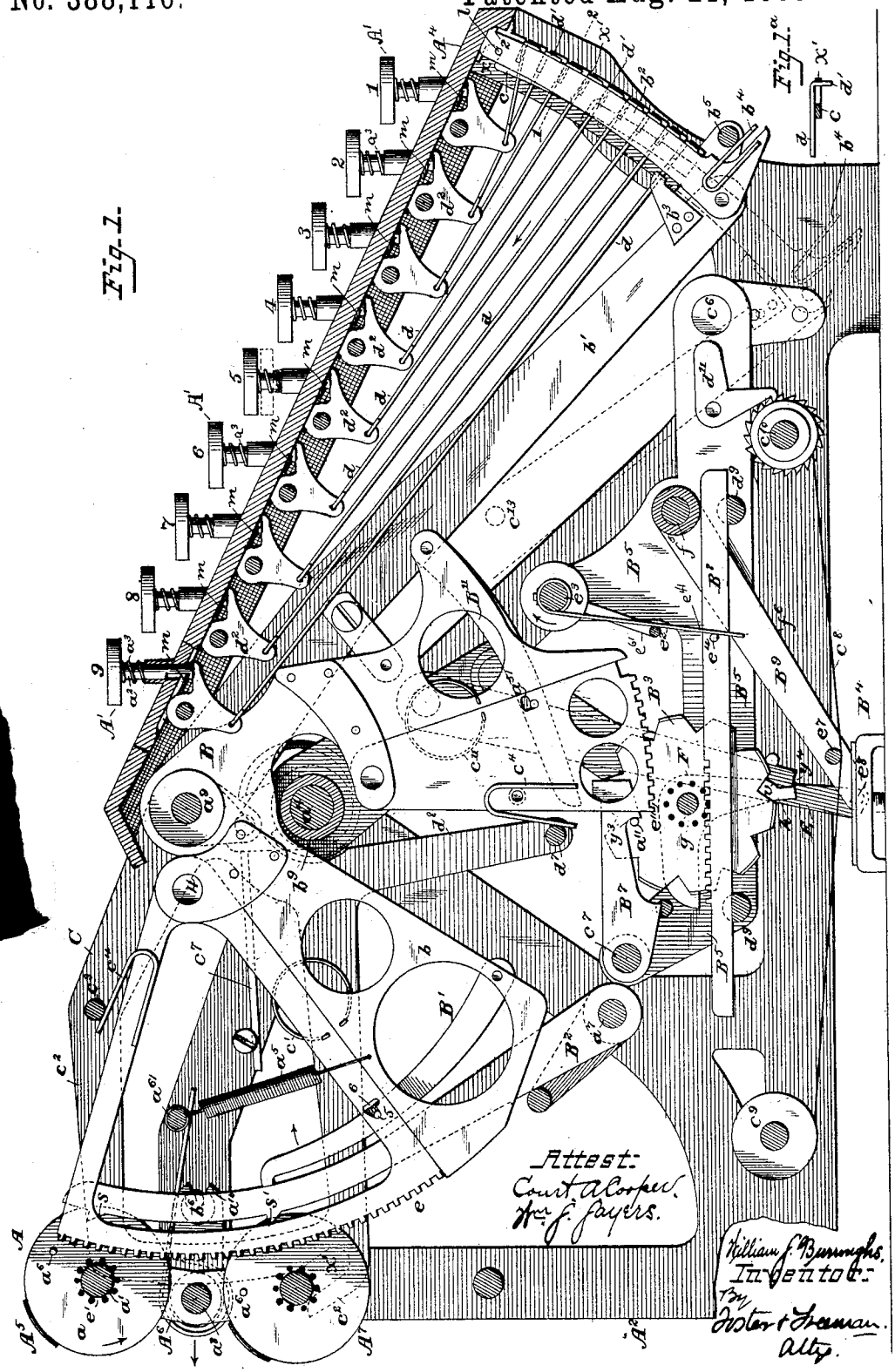


Fig. 1a.

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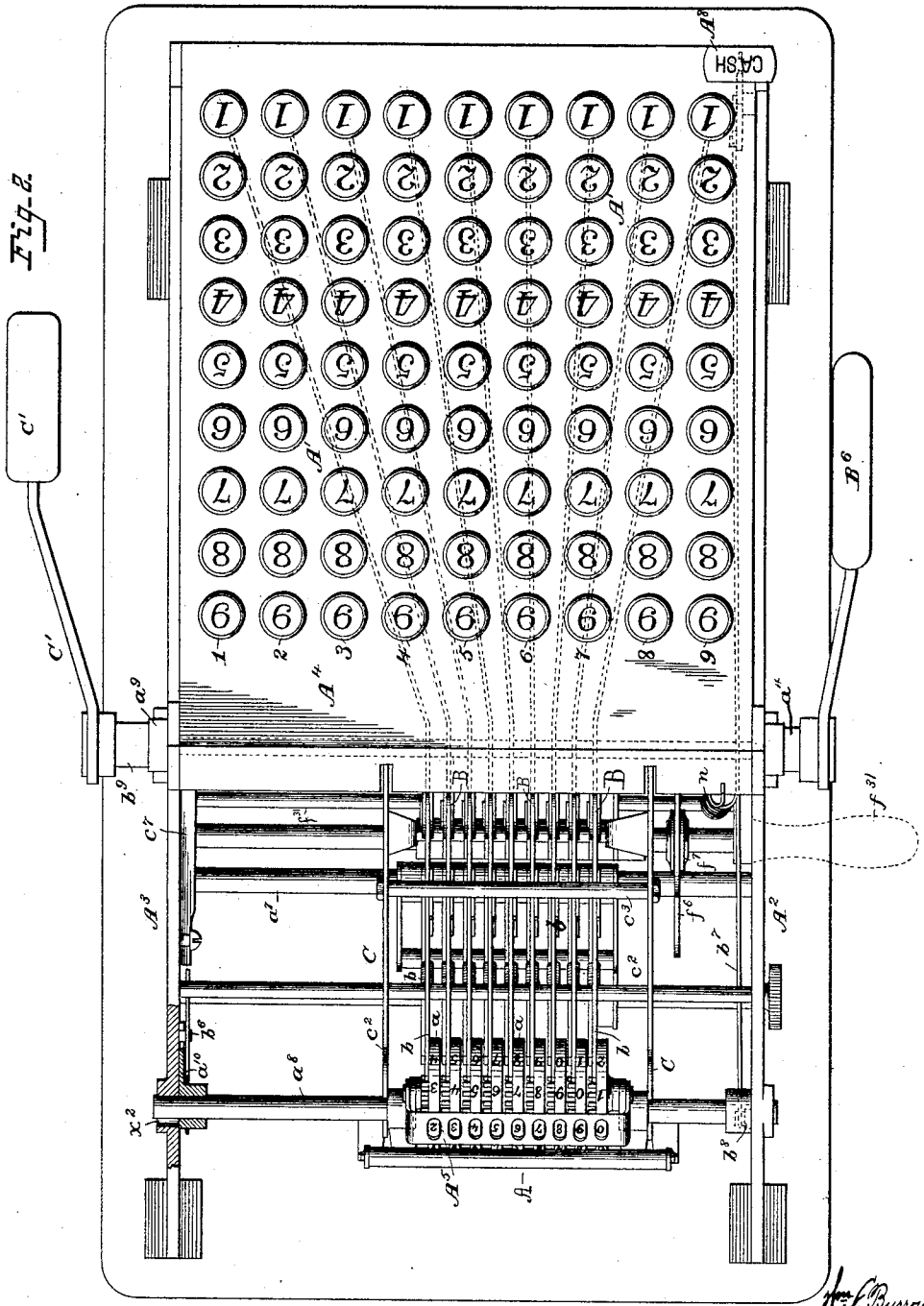
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Fig. 2.



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Atty's

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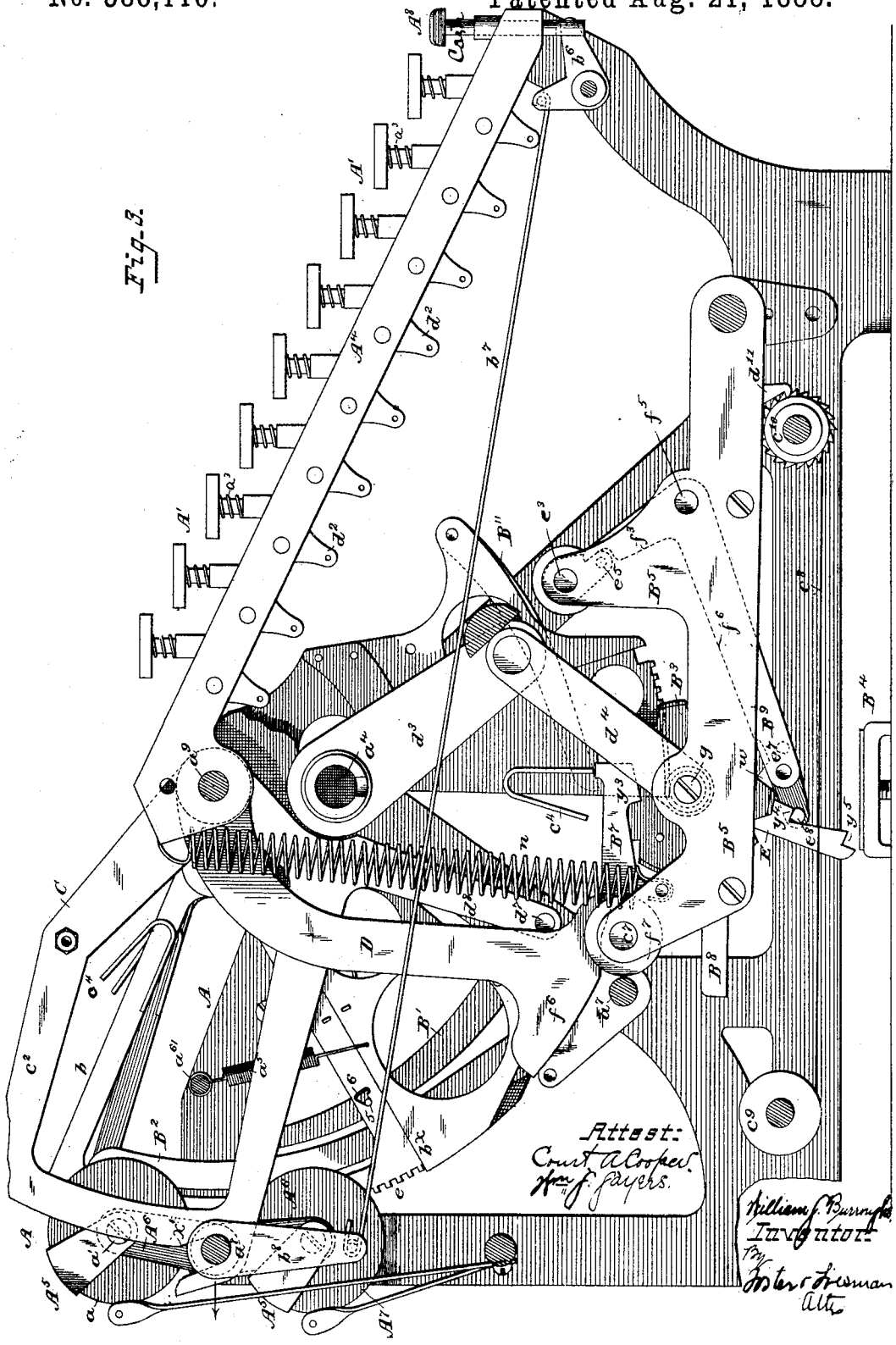
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Fig. 3.



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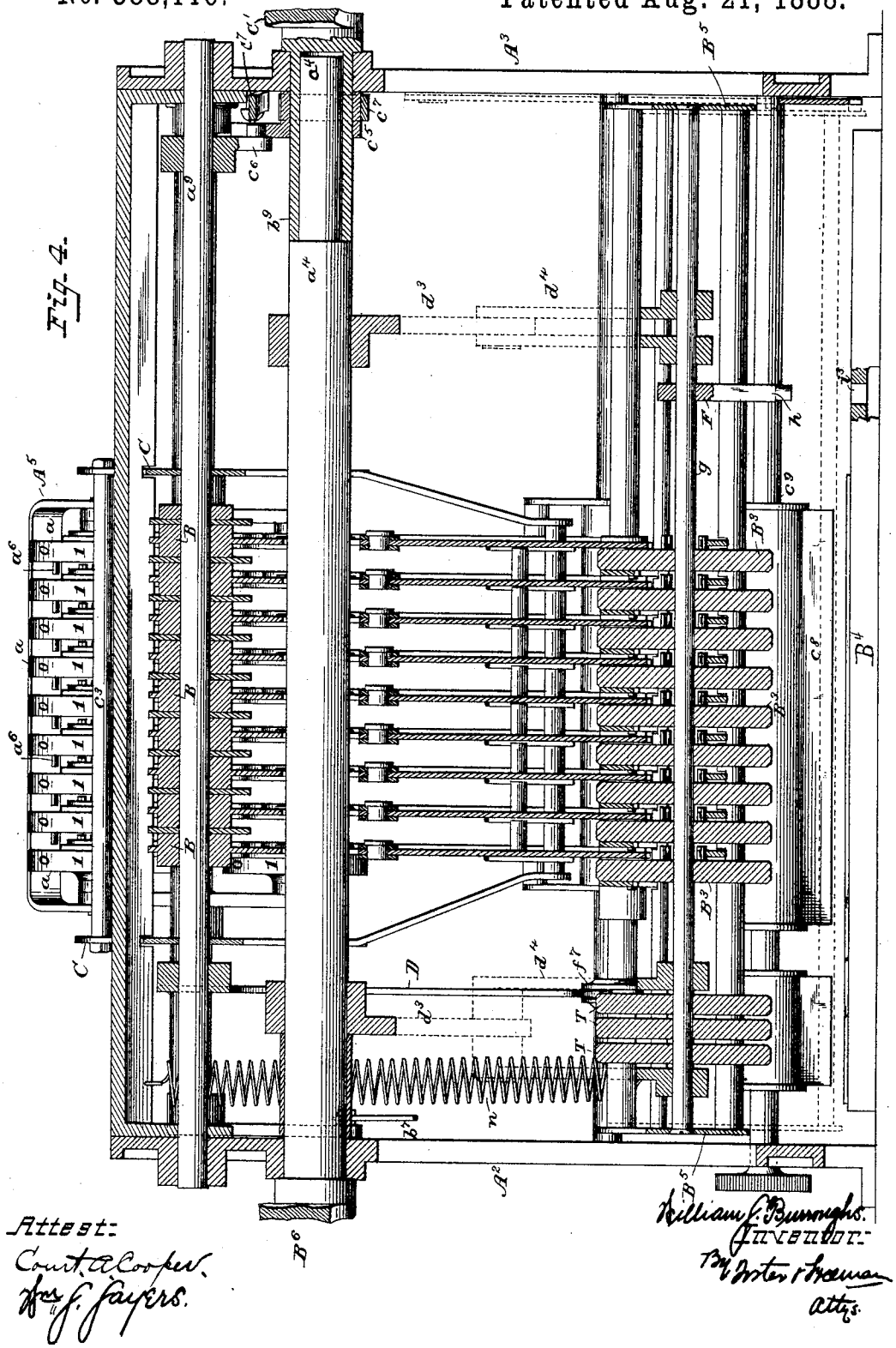
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Fig. 4.



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Fig. 5.

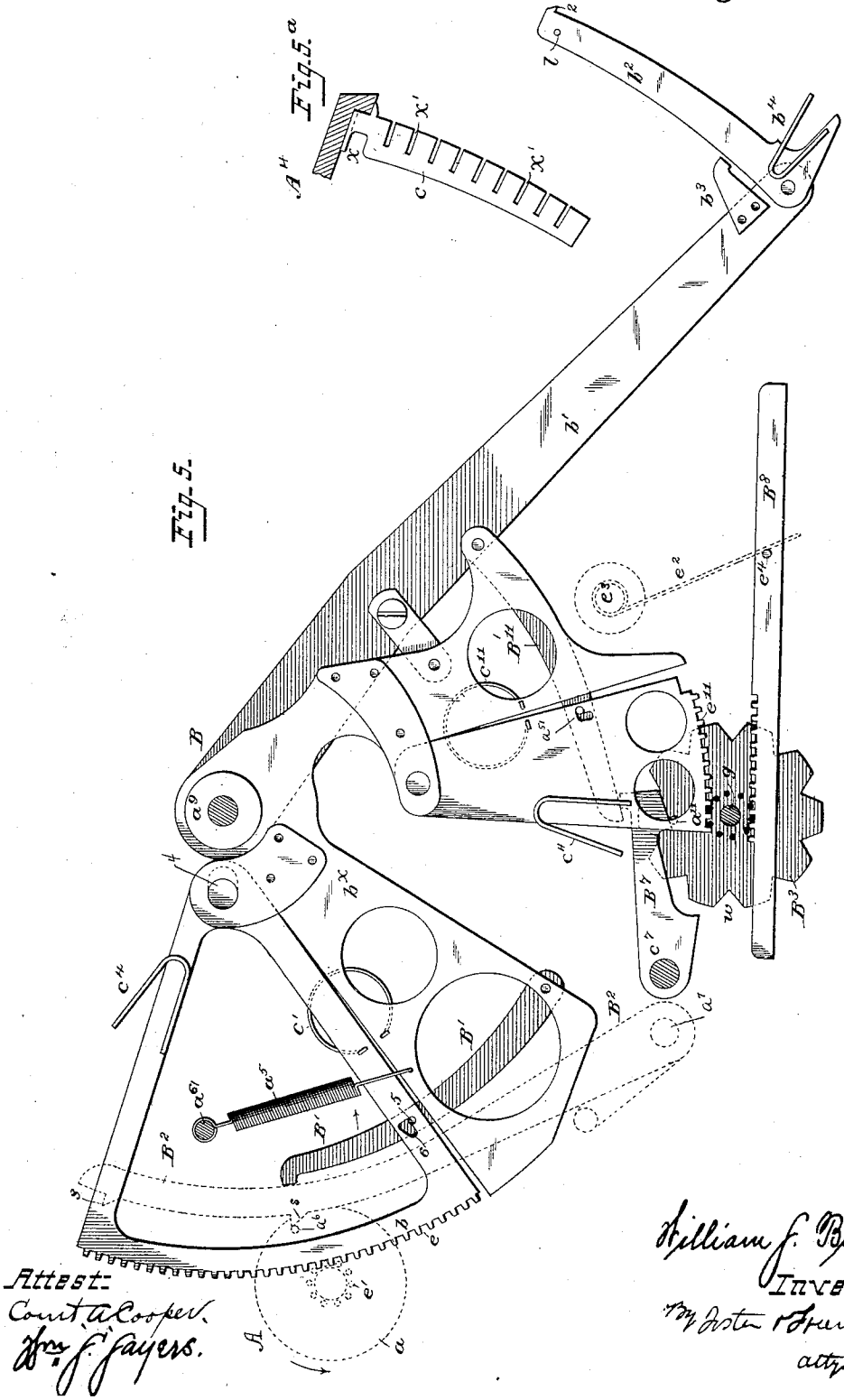


Fig. 5a.

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Fig. 7.

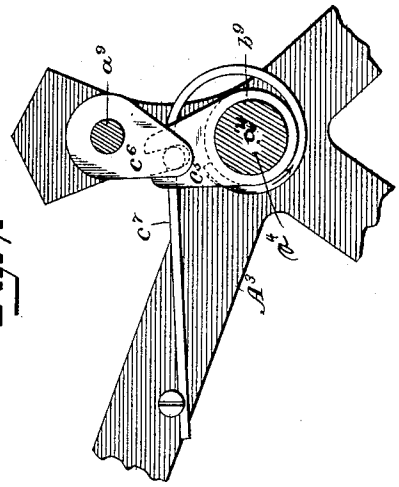
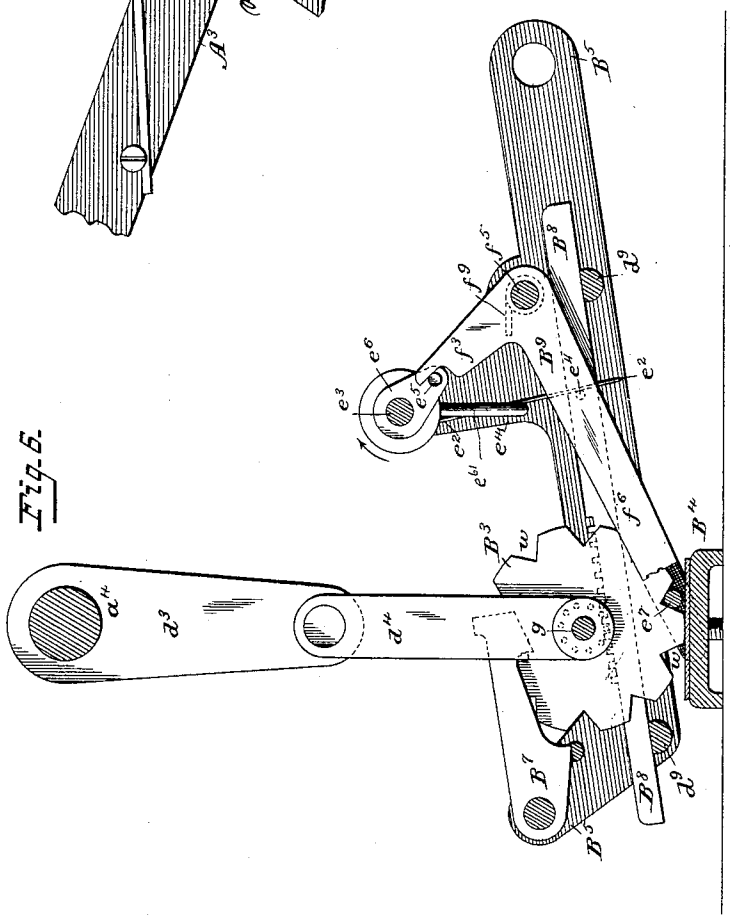


Fig. 6.



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CALCULATING MACHINE.

No. 388,116. Patented Aug. 21, 1888.

Fig. 1.

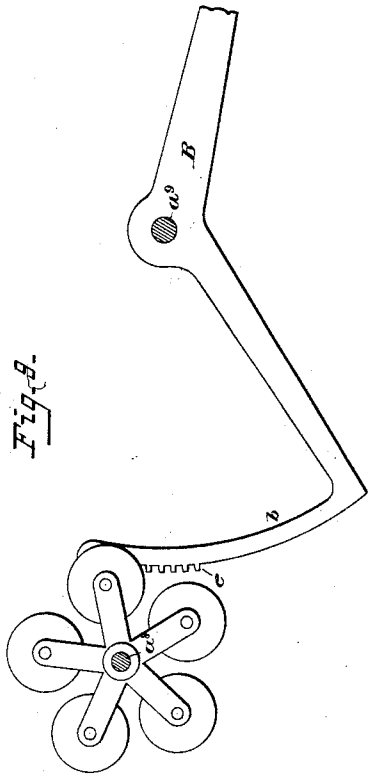


Fig. 1I.

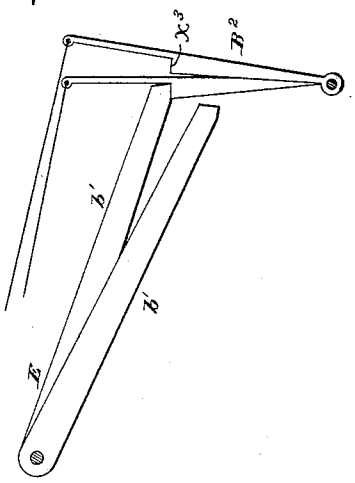
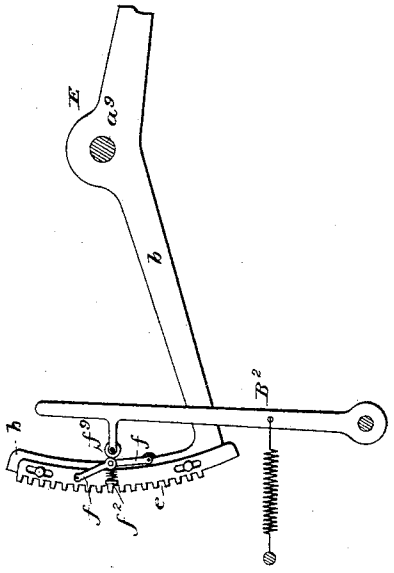


Fig. 8.



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William S. Burroughs
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By Foster & Freeman
Attys.

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UNITED STATES PATENT OFFICE.

WILLIAM S. BURROUGHS, OF ST. LOUIS, MISSOURI, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE AMERICAN ARITHMOMETER COMPANY, OF SAME PLACE.

CALCULATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 388,116, dated August 21, 1888.

Application filed January 10, 1885. Serial No. 152,485. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM S. BURROUGHS, a citizen of the United States, residing at St. Louis, in the State of Missouri, have invented certain new and useful Improvements in Mechanical Accountants, of which the following is a specification.

My invention relates to that class of apparatus used for mechanically assisting arithmetical calculations; and my invention consists in the combination, with one or more registers, of a series of independent keys and intervening connections constructed, arranged, and operating, as fully specified hereinafter, so as to indicate upon the register the sum of any series of numbers by the proper manipulation of the keys, and also so as to print or permanently record the final result.

In the drawings, Figure 1 is a longitudinal sectional elevation of an apparatus embodying my invention. Fig. 1ª is a cross-section on the line 1 2, Fig. 1. Fig. 2 is a plan view of the apparatus in part section. Fig. 3 is a longitudinal elevation in part section. Fig. 4 is a transverse sectional elevation. Fig. 5 is a detail view showing the connections between the keys and the registers, with the exception of the "regulating devices." Fig. 5ª is a detail view of part of the regulating devices. Fig. 6 is a detail view of the printing-register and its immediate connections. Fig. 7 is a detached view showing the connections between two of the shafts. Fig. 8 is a view showing a modified form of registering operating device. Fig. 9 is a view illustrating a mode of adjusting a series of registers. Fig. 10 illustrates a modification of the regulating devices.

The indicating-register A consists of a series of movable numbered pieces—as plates, disks, wheels, or segments—indicating by their position the sum added at each operation of the machine, and I therefore term them the "indicators." Each indicator is shown as consisting of a disk, a, revolving freely upon a shaft, a', and having upon its periphery a series of figures from 0 to 9; but it may be a plate or segment suitably supported and graduated in the same manner as the disk. Each indicator derives its movement from the operation of a series of nine keys, A′, of any suitable construction, marked separately with a series of numbers from 1 to 9, and between the indicator and each key, and governed by the latter, intervene a series of devices, which may be of any suitable construction to transmit the motion of the key to the indicator, and regulate the adjustment of the latter, and which I include under the general terms of "connections" and "operating connections."

The registering device, the keys and connections, and other parts, hereinafter referred to, are supported in a suitable frame having side pieces, A^2 A^3, and connecting-bars, which latter also serve as supports for the intervening mechanism, and the frame supports a key-board, A^4, provided with recessed nipples, through which slide the shanks a^2 of the keys A′, a spiral spring, a^3, tending to keep each key in its elevated position, and a lip at the bottom of the key striking a detachable strip, m, which bears against a flat side of the key and prevents the turning thereof, limits its movement, and facilitates its ready detachment when necessary.

The series of keys which operate in connection with each indicator is arranged upon a line parallel to the sides of the frame, and a lever, B, supported by a transverse shaft, a^9, when released by the action of any one of a series of keys operates automatically the indicator pertaining to that series.

Each lever B consists of a segmental "head," b, and an arm, b', the heads of all the levers being parallel to each other and in close proximity, and the arms diverging from the fulcrum a^9, so that the rear end of each arm will be below the key of one of the series farthest from the head.

Teeth at the edge of each head b constitute a rack, e, which engages with a pinion, e', at the side of one of the indicator-disks, and the movement of the lever is so limited that the indicator-disk will be turned nine-tenths of a revolution at each full movement of the lever, a perforated plate or gage, A^5, serving as an index to expose or designate the figure indicating the number added.

It is necessary that the indicator be moved

as each key is depressed to an extent proportioned to the position of the key and the number indicated upon the latter, and in order to effect this without varying the movements of the keys or the power applied to operate the latter I employ devices between each series of keys and the lever operated thereby, which constitute part of the "connections" between the keys and indicator, and which I term the "regulating devices."

The arms b' may be weighted so as to normally fall to their lowest position when released; but I prefer to secure a more positive action by means of springs a^5, connected to a cross-bar, a^{61}, of the frame and to the heads of the levers, so as to lift the latter.

The regulating devices are so constructed that when a key is depressed the lever will be released, and will then fall to an extent corresponding to the position of the operating-key, which, therefore, instead of acting directly upon the lever, operates the latter intermediately through said regulating devices, so that the key may recover its position at once after being struck.

In the construction shown the regulating devices connected with each series of keys consist of a lock which holds the arm b' of the lever normally in its highest position and a movable stop operated by the key, which limits, when it is set, the descent of the arm b' of the lever.

The lock, as shown, consists of a strip, b^2, pivoted to the end of each arm b' and limited in its rear movement by stop b^3 and carrying a lug, l. Adjacent to each strip b^2 a fixed plate, c, Figs. 1 and 5^a, is secured to the key-board A^4 and pendent therefrom and provided with a notch, x, near its upper end, into which the lug l enters as the arm b' is brought to its highest position and the strip b^2 falls forward. This forward movement of the strip b^2 is insured by the contact of a spring projection, b^4, extending from the strip b^2, with a stationary cross-bar, b^5, supported by the sides of the frame.

In the outer edge of the plate c is a series of notches, x', corresponding in number to the keys of the series, and through each notch extends the bent end d' of a rod, d, which is connected to the lower arm of a crank-lever, d^2, one of which is pivoted to a lug under the key-board beneath each key, and has its other end or arm projecting below the end of the key. The bent ends d' of the rods d constitute the stops. When one of the keys (say, the key 5, Fig. 1) is depressed, the rod d of the lever d^2, below said key, will be drawn in the direction of its arrow, and the end d', bearing upon the edge of the strip b^2, will carry the latter inward until the pin 1 is carried out of the notch x, when the action of the spring a^5 will cause the arm b' and strip b^2 to fall until a lip, 2, at the upper end of the strip b^2 strikes the bent end d' of the rod d, which acts as a stop, limiting the further movement of the lever downward. As the inward movement of each stop end d' carries the strip b^2 inward the lip 2 of the strip will escape contact with all of the stops above the one which has been so set by the movement of the key, so that the said stop only will be struck by the lip; and as the stops, beginning at the top, are connected with the keys in the order in which the latter are numbered, the movement of the lever will be greater in proportion as the stop operated is lower down, and the movement of the indicator will be proportionately increased.

As in other registering devices, it becomes necessary when the number added exceeds the highest number upon the indicator operated to also adjust the adjacent indicator accordingly. Thus, if one of the indicators is set to display the figure 8 and the number 5 or any number greater than 1 is to be added and indicated, the said indicator must be turned until it exhibits the figure 3, while the adjacent indicator must also be turned to disclose the figure 1, the sum of the two numbers being 13, which requires the adjustment of two indicators to show it.

To effect the turning of the second indicator without operating two keys, I construct the parts which I term the "connection" between each indicator and its key, so that a portion of said connection geared with the indicator is capable of a slight movement independently of the other parts of the connection. I lock these two parts together so that ordinarily they will operate as one, and provide means whereby the movable part is unlocked and moved to turn the indicator the extent of one figure whenever the adjacent indicator is brought to a position to necessitate such movement. Thus, the head of each lever B consists of the arm or portion $b^\times$, connected rigidly to the arm b', and the toothed segment b, pivoted at 4 to the arm $b^\times$, and a spring, c', is connected to the two parts, $b\,b^\times$, so as to tend to separate them, and a lever, B', is pivoted to the part $b^\times$, and is provided with a pin, 5, which enters an L-shaped slot, 6, in the part b and holds the latter in proximity to the part $b^\times$ until the lever B' is swung in the direction of its arrow, Figs. 1 and 5, when the pin will enter the vertical portion of the slot and permit the portion b to rise under the action of the spring c', and thereby turn the indicator to which said portion b is geared one-tenth of a revolution in the direction of its arrow. The lever B' is moved to unlock the part b by a pin, a^6, projecting from the side of the indicator next to that to which the part b is geared, which pin, as the figure 0 is brought toward the index-plate A^5, strikes a projection, s, on a lever, B^2, pivoted to a cross-bar, a^7, and swings it so as to bear against the end of the lever B' and carry the latter with it to unlock the swinging segment, which will then rise under the action of its spring c' and turn the indicator next adjacent to that indicator whose pin acted upon the lever B^2.

All the indicators are operated by the move-

ments of the respective keys in the manner above described, and after a series of keys has been struck to register one of the numbers to be added together it becomes necessary to bring the parts to their normal positions, so as to permit any additional number to be added, inasmuch as after a lever, B, has been adjusted by the action of one key its head must be depressed before it can respond to the action of another key. Thus, if the number 72,842 is to be added, all the heads are depressed to bring the parts to an operative position, and the keys 7 2 8 4 2 in the series 5 4 3 2 1 are successively struck, thereby releasing the corresponding levers, which move to different degrees, according to the positions of the keys and the positions to which the stops d' are set, and the indicators show by the figures visible through the index-plate A^5 an increase corresponding to the sum added. If, now, the sum 234 is to be added, the heads of the levers are all again depressed to restore the parts to position, so that when the keys 2 3 4 in the series 3 2 1 are struck the corresponding levers can move each to an extent necessary to insure the required adjustment of the indicator and the exhibition of figures indicating an increase of 234.

The adjustment of the levers is effected by pressure upon the upper sides or edges of the segments b, which has the effect of moving such of the latter as have been separated from the portions $b^\times$ into contact therewith, when they will be locked in place by the arms B' falling back and carrying the pins 5 into the horizontal portions of the slots. The combined movement will then carry down all the segments until the arms b' are all elevated to their highest positions.

As the depression of the segments while in gear with the pinions e' would turn back the indicators, I provide means for throwing the segments and pinions out of gear prior to any downward movement of the segments. One means of effecting this is shown, and consists in journaling the shaft a' in a swinging frame, A^6, pivoted upon the cross-bar a^8, and in swinging the frame back to throw the pinions and racks out of gear prior to the descent of the segments. One means of effecting this adjustment is shown, and consists of a frame, C, carried by the shaft a^9, Fig. 4, and consisting of side pieces, c^2 c^2, and a cross-bar, c^3, each side piece having near its lower edge an inclined slot, x', Figs. 1 and 3, adapted to receive the cross-bar a^8, sliding in slots in the side pieces of the main frame, when the frame C is raised, the inclined edge x^3 of the slot serving to thrust the bar a^8 back in the direction of the arrow as the said frame C begins to swing downward, which backward motion of the cross-bar a^8 will be effected before the cross-bar c^3 is brought in contact with the upper edges of the segments.

The frame C is operated by a hand-lever, C', which is connected to operate the shaft a^9, as described hereinafter, and when the end of the lever which is toward the operator is depressed the frame C will be swung downward and will force out the cross-bar a^8, with the frame A^6 and the indicators, until the pinions e' are free from gear with the racks, and the edges of the frame will then remain in contact with the cross-bar a^8 and hold it in position, the cross-bar c^3 being then brought against the upper edges of the segments and depressing the latter. After the levers B are brought to their normal position the hand-lever C' is released, when it will rise and the frame C will swing upward and the cross-bar a^8 will enter the slots x', and the pinions will be brought into gear with the racks as the frame C reaches the limit of its upward movement.

To permit the return movement of the cross-bar a^8, the ends thereof enter slots x^2 in the side pieces of the frame, and an arm, a^{10}, projecting from the cross-bar a^8, is slotted to receive a pin, b^6, on one of the side pieces, which prevents the turning of the cross-bar as it slides back and forth.

To prevent objectionable shocks and jars in bringing the cross-bar c^3 against the segments, I place springs c^4 upon the segments so as to be struck by the cross-bar.

It will be seen that by the construction above described each indicator is operated upon the depression of any one of the keys of a single series, and that it has the effect when turned beyond a complete revolution of moving the adjacent indicator one step; that all the keys have the same extent of movement and are operated by the same amount of pressure, but that while the movements of the keys are the same, the extent of the movement of the connections between the keys of each series and each indicator will vary according to the position of the key which is operated, with a corresponding variation in the motion of the indicator. It will be apparent that these effects may be secured by the use of keys and intermediate connections differing to some extent from those described. For instance, each series of keys may operate upon a shaft suitably geared with the corresponding indicator instead of through the medium of a rocking-lever. The register may of course be of any usual or suitable character. The indicators may be differently connected, as is common in registering devices, so that each will be moved one step as the adjacent indicator completes its entire movement, in which case the rack must be thrown out of gear with the second indicator until the latter has moved one step.

Instead of withdrawing the register from engagement with the racks the latter may be hung to pivots sliding in elongated openings, so as to be withdrawn from the register, as shown in Fig. 5, dotted lines, or the register and the rack may be kept in constant connection, each pinion having a ratchet-connection with the indicator, so as to turn the latter when the rack is raised, but to revolve independently of the indicator when the rack descends.

It will be obvious that any suitable locking mechanism may be employed for connecting the rack portion of the segment with its support, so as to permit a limited independent movement of the rack portion, and that such locking mechanism may be actuated from the indicators in a different manner from that described. Thus the segmental rack e may be guided to slide upon the head b, as shown in Fig. 8, and be moved thereon to a limited extent by straightening or bending the toggle-levers $f\,f$, which may be effected by bringing a roller, f^9, to bear against the same in one direction and by a spring, f^2, forcing them in the opposite direction, the roller f^9 being carried by levers operated in like manner as the levers B^2, or in any other suitable manner.

Different forms of regulating devices may be employed for determining the extent of the movement of the connections according to the key operated. Thus the keys may be connected to operate arms B^2, Fig. 10, with shoulders x^3 arranged to hold the arms b' of the levers B in their elevated position until the arms B^2 are swung forward.

Instead of restoring the levers B to their position by means of the cross-bar c^3 bearing upon the levers, they may be moved by a cross-bar, c^{13}, extending beneath the arms b', as shown in dotted lines, Fig. 1, or in any other suitable manner.

In some kinds of calculations it is necessary to indicate the sums of different kinds of articles or money. For instance, in a bank it is sometimes necessary to ascertain the aggregate amount of a series of checks and also the amount of money represented by notes or coin and pertaining to the same transaction. In order to permit this to be done with facility, I provide two or more registering devices in connection with one set of keys and intermediate mechanism, and means whereby either register may be thrown into operative connection with the keys. Thus the second register, A^7, is hung to the same frame, A^6, that carries the first register, A, and this frame is vibrated so as to bring the pinions of either register into gear with the racks e. This vibration is effected by means of a key, A^8, actuating a crank-lever, b^6, connected by a rod, b^7, with an arm, b^8, upon the shaft a^8. The upper register is held in connection with the keys while the sum of the checks is being taken, and after this is done the key A^8 is depressed and the lower register will be swung into gear, and the amount of cash is registered thereon, and if additional cash or checks are then received the additional amounts may be added upon either register by swinging it into operative connection with the key and without any alteration of the other register.

Where, as in custom-houses and other places, it is necessary to indicate the value or number of a series of different articles, a series of registers may be employed to be operated from the same series of keys. One mode of arranging the registers in such case is shown in Fig. 9, which shows five registers carried by an armed frame, revolving upon or with the shaft a^8, and capable of being turned so that either register may be brought at will in operation with the connecting devices between the register and the keys.

When two registers are arranged one above the other, so that either may be brought into connection with the racks, the latter are necessarily longer than would be required if the arrangement shown in Fig. 9, or if but one registering device, was used.

When the arrangement shown in Figs. 1 to 7 is employed, the slot in the arm a^{10}, which receives the pin b^6, is widened, as shown in Fig. 1, so as to permit the swinging of the arm a^{10} required by the vibration of the shaft a^5.

As it is necessary that each indicator of the lower register shall upon the completion of its revolution move the succeeding indicator one step, as in the upper register, I effect this by extending the levers B^2 or projections s' thereof, so as to be struck by the pins a^6 of the lower indicators to unlock the segments in the same manner as they are unlocked by the upper indicators when the upper register is in use and with like effect.

The movement of the frame C is effected from the handle C' by connecting the latter to a sleeve, b^9, receiving and turning upon the shaft a^4 and carrying a slotted arm, c^5, receiving a pin upon the end of an arm, c^6, extending from the shaft a^9, and a spring, c^7, secured to the side frame, is coiled around the hub of the shaft b^9 and secured thereto at the end and serves to turn the sleeve in the direction of the arrow, Fig. 7, the sleeve being turned in a reverse direction to depress the frame C whenever the handle C' is depressed.

It is frequently desirable to secure a permanent indication of the sum shown upon the register, but this cannot always be well done without so covering the register as to prevent the figures upon the latter from being seen. In order to secure a visible representation as well as a permanent indication of the number registered, I employ, in addition to the registering devices described, recording devices, one arranged so as to be readily inspected and the other constructed and combined with means whereby to also print the numbers registered upon a strip of paper. Thus the second register, A^7, may be combined with gears throwing it into connection with the register A and with an inked ribbon and platen whereby the row of figures in line upon the lower register may be transferred to the paper, while those on the upper register are exposed. I prefer, however, instead of using the register A^7, to use an independent printing-recorder, B^3, preferably arranged beneath the shaft a^4 and above a platen, B^4, upon the base-plate of the machine. When this arrangement is employed the shaft g of the recorder B^3 is carried by a frame, B^5, hung to studs c^6 upon the side frames of the machine, and combined with devices whereby the said frame may be raised

to bring the recorder into connection with the devices for operating it from the keys, and lowered to bring the lower row of type or figures against the paper upon the platen.

The adjustment of the indicators or wheels of the printing-register is effected by connections precisely similar to those employed for adjusting the upper register, each lever B carrying a second head or segment with a rack, e'', which gears with the corresponding pinion of the adjacent indicator of the lower register and operates the same in the same manner as has been described in connection with the register A. In the operating device for the printing-recorder the movable section of the head or segment is provided with an L-shaped slot to receive a pin, a^{51}, upon a locking-arm, B'', operating in the same manner as the locking-levers B' and operated from the pins a'' on the indicators through the medium of levers B^7, each of which is hung to a cross-bar, e^7, on the frame, and as a pin, a''', is brought beneath its inclined lower edge the lever is raised, strikes the end of the locking-lever B'', and thereby releases the adjacent segment to permit it to swing out under the action of a spring, c'', to move the adjacent indicator one step.

The frame B^5 may be depressed to bring the printing-recorder in contact with the platen by means of the arm f^{31}, (dotted lines, Fig. 2,) extending from the frame and adapted to be operated directly by hand, the frame being raised by a spring, n, or otherwise. I prefer, however, to employ devices operating more positively, and consisting, as shown, of toggle-levers d^3 d^4, the former secured to the shaft a^4 and the latter jointed to the levers d^3 and also to the frame B^5, as shown, so that by depressing a handle or arm, B^6, on the shaft a^4 to rock the latter in one direction the frame B^5 will be carried downward and the printing-indicators will be brought against an inked ribbon, c^8, while the spring n lifts the frame, when pressure upon the arm B^6 is removed. The inked ribbon is carried by rollers c^9 c^{10}, the latter provided with a ratchet with which a pawl, d^{11}, upon the frame B^5 engages, so as to move the ribbon slightly at each movement of the frame.

As in the devices operating with the register A, it is necessary to restore the movable parts of the segments to their position after each operation upon the keys; and this I effect by means of a cross-bar, d^7, carried by arms d^8 of the frame C and brought against springs at the edges of the heads of the segments of the recorder, as the cross-bar c^7 is brought against the corresponding parts of the segments operating the register A.

It is of course necessary to throw the pinions of the register B^3 out of gear with the racks e'' before each readjustment of the levers B. This is effected at the same time that a like operation is effected with the register A by means of an arm, D, Fig. 3, connected to the shaft a^3, having a cam end, f^6, which bears upon a grooved wheel, f^7, upon the cross-bar c^7 of the frame B^5, and when the frame C is depressed the cam end of the arm forces downward the end of the frame B^5 to carry the pinions from gear with the racks.

It is generally desirable that the printing-wheels shall be restored with all the indicators at zero after any number has been registered and printed, in order that it may be in position to be properly reset to indicate any number to be subsequently registered and printed, although the register A may indicate the sum of both numbers; and to secure this result I combine with each indicator a rack-bar, B^8, sliding in bearings d^9 d^9 upon the frame B^5, and each gearing with the pinion of one of the indicators, and a spring, e^2, upon a cross-bar, e^3, is arranged to be brought to bear upon a pin or bearing, e^4, upon each rack-bar B^8, so as to throw it inward to bring the pin a'' of the adjacent indicator against a shoulder, y^3, of one of the levers B^7, when the sign "0" will be the lowermost sign upon the indicator.

When the indicators of the printing-recorder are to be operated from the keys, they should be left perfectly free to turn without resistance, and the shaft e^3, which carries the springs e^2, is therefore hung in the frame B^5, so as to swing freely, and each spring e^2 will swing forward without resistance as the rack-bar B^8 is moved forward. When the indicators are to be restored to position, the shaft e^3 is turned in the direction of its arrow, Figs. 1 and 6, so as to cause the springs e^2 to bear against the pins e^4, when each bar B^8 will be moved until the indicator connected therewith is brought to the zero position, the extent of the movement of course depending upon the extent to which the indicator has been previously turned from such position. The movement of the shaft e^3 requisite to bring the springs to bear upon the pins e^4 results from the swinging by hand of a crank-lever, B^9, pivoted upon a shaft, f^5, carried by the frame B^5, and one arm, f^3, of which lever bears upon a pin, e^5, projecting from an arm, e^6, upon the shaft e^3, the long arm f^6 of the lever extending downward and forward and in conjunction with a similar arm at the opposite side carrying a cross-bar, e^7. A spring, f^9, Fig. 6, dotted lines, coiled upon the shaft f^5, tends to raise slightly the lower end of the arm f^6, and a lug, e^8, at the end of said arm is arranged to engage with shoulders y^4 y^5 upon an arm, E, pivoted to one of the side frames of the machine and swinging freely upon its pivot. Arms e^{61}, projecting from the shaft e^3, carry a cross-bar, e^{11}, Fig. 1, upon which the springs e^2 bear, and which when carried from the springs by the rocking of the shaft e^3 in the direction of the arrow permits the springs to move independently in acting upon the rack-bars B^8. When the frame B^5 is depressed to effect the printing, the lug e^8 is carried beneath the shoulder y^5 of the lever E, and when the frame B^5 again rises the lever B^9 will be retained in its position, Fig. 1, and its arm f, bearing upon the lug e^5, will swing the shaft e^3 in the direction of its

arrow, Fig. 6, and carry the cross-bar e^{11} away from the springs e^2, which will then move inward the bars B^8 and restore the indicators to their zero positions. The parts remain in the position described until the frame B^5 is about horizontal; but as it rises higher the lever B^9 will be slightly retracted and the lug e^8 will be withdrawn from the shoulder y^5, and the lever B^9 will be lifted by the action of the spring f^9 until the lug e^8 strikes the shoulder y^4, Fig. 3, the lever B^9 being then free from contact with the pin e^5, so that the shaft e^3 can swing freely and the springs e^2 will exert no action upon the bars B^8.

The cross-bar e^7 acts as an equalizing-bar to bring the wheels into line and hold them in place. As the printing-recorder descends upon the said cross-bar the latter passes into the notches w of the wheels B^3, and, bearing against the inclined sides of the latter, brings all the indicators into line and holds them in place, and as the register rises (the bar e^7 being held in place by the action of the lever E) the wheels pass from the bar and are then free to turn under the action of the devices set in motion by the keys.

It is desirable in many instances to prevent duplicate printing—that is, after the recorder has once been pressed upon the paper to prevent it from again being forced down to make a print until a new number has been registered. To effect this an L-shaped dog, F, Figs. 1 and 4, is hung loosely to the shaft g of the printing-recorder, so that one arm will extend over the bar d^9, while the other arm, h, is pendent and is provided with an inclined edge, v, so arranged as to be struck by the cross-bar e^7 when the latter enters the notches w.

In the platen B^4 is an opening or notch, i^3, so arranged that when the cross-bar e^7 is in the lowest notch, w, to its greatest depth, the dog F will be held in such position that its end will enter the opening i^3, and the frame B^5 can descend to such an extent as to effect the printing. When, however, the printing has been effected and the cross-bar e^7 is held by the action of the lever E in the position shown in Fig. 1, the dog F will swing to such a position that its lower end will strike the face of the platen and prevent the contact of the type with the paper if the frame is depressed. This arrangement also prevents the battering of the type, which might result if any one or more of the wheels was turned so that the face of the type would not be presented absolutely parallel to that of the platen. If one of the wheels was thus out of adjustment, the cross-bar e^7 could not travel as far as the bottoms of all of the notches w, and the dog F could not therefore be moved by the cross-bar to its full extent, and consequently would not be in position to enter the opening i^3 and would prevent the descent of the frame and the battering of the type.

I do not limit myself to the mode described of restoring the indicators to their normal positions, as other means might be adopted. For instance, they might be weighted so as to normally hang with the figure 0 lowermost, to take this position whenever the indicators are free from contact with suitable friction devices. Other means than those described may be employed for bringing the springs to bear upon the rack-bars when the indicators are to be adjusted, leaving them free at other times, and other stop-motions may be used to prevent the full descent of the printing-indicators after one impression or when any of said wheels are out of adjustment.

In some instances it is desirable to print the date upon each slip upon which the number is printed. This I effect by arranging dating-wheels T upon the shaft g, or otherwise supporting them on the frame B^5, so as to operate in connection with the other printing-wheels when the frame B^5 is depressed.

I do not here claim any of the features shown herein and also shown and claimed in my applications Serial No. 174,593, filed August 17, 1885; Serial No. 195,583, filed March 17, 1886, and Serial No. 256,566, filed November 30, 1887; nor the printing devices herein described and forming the subject-matter of my application, Serial No. 279,609, filed July 11, 1888.

I claim—

1. The combination of a series of numbered independent indicators, a series of independent keys to each indicator, connections between each of the series of keys and each indicator, said connections being arranged to insure the movement of each indicator upon the movement of any key of its series and including a series of stops to each series of keys adjustable by but independent of the keys, arranged to vary the extent of movement of the indicator according to the position of the key struck, substantially as described.

2. The combination of a series of independent indicators, a series of keys to each indicator, connections whereby each indicator is operated on the movement of any key of its series, connections whereby each indicator on completing a revolution turns the adjacent indicator of higher order one step, and means for disconnecting the indicators from the connections after each number is registered to permit the connections to assume a position to operate the indicators to register another number, substantially as described.

3. The combination of the series of independent numbered indicators and a series of independent keys having uniform movements connected with each indicator and constructed to operate two or more of the indicators simultaneously when released by the action of two or more keys, and locking and releasing devices operated by but independent of the keys for releasing and regulating the movement of the indicator-operating devices, substantially as described.

4. The combination, with the series of indicators and with a series of keys connected with

each indicator, of a series of levers each connected to turn the indicator by its movement, and locking and releasing and regulating devices arranged between each lever and its keys, whereby the lever is released and its movement regulated according to the position of the key struck, substantially as set forth.

5. The combination, with the indicators and pinions and independent keys arranged in series, of actuating-levers carrying racks engaging with the pinions and regulating devices between each lever and each series of keys, the keys capable of movement independently of said devices, substantially as specified.

6. The combination, with the keys, indicators, and intermediate operating-connections between each key and each indicator, of means, substantially as described, for moving the indicators to throw them out of gear with the said connections upon their return motion, substantially as set forth.

7. The combination, with one or more keys, a series of levers, indicators, and pinions, of devices for throwing the indicators out of connection with the levers after the indicators have been operated by the movements of the keys, substantially as set forth.

8. The combination, with the indicators and pinions and with the operating levers and racks, of appliances for throwing the pinions and racks out of gear after the movement of the indicators, for the purpose specified.

9. The combination, with the indicators, a series of keys to each indicator, and a series of levers for operating the indicators, of appliances for throwing the indicators out of gear with the operating devices when the latter are moved in one direction, substantially as specified.

10. The combination, with the keys, a series of independent rack-levers and indicators, of a frame supporting the indicators and adjustable to and from the said levers, substantially as set forth.

11. The combination, with the series of operating rack-levers, the shaft a^3, and indicators supported by said shaft a^3, of a vibrating frame provided with edges bearing against the shaft and constructed to move the latter to and from the levers, substantially as specified.

12. The combination, with the indicators, keys, and a series of levers acting upon the indicators, of a cross-bar and means for moving the bar to restore the levers to their normal positions, substantially as specified.

13. The combination, with the indicators, a series of independent operating rack-levers, and series of keys, of a cross-bar arranged to move the levers to their normal position after they have been lifted by the action of the keys, substantially as set forth.

14. The combination, with the indicators and actuating-levers and independent keys, of a frame carrying a cross-bar arranged to strike the actuating-levers, and a handle connected to operate said frame, substantially as set forth.

15. The combination, with the indicators and a series of independent rack-levers, of a frame carrying a cross-bar for moving said levers, and devices whereby to throw the indicators in and out of gear with the levers, substantially as specified.

16. The combination, with the indicators, a series of independent keys to each indicator, and a series of independent intermediate connections, of a regulating device between the said connections and the keys, constructed to insure and determine the movement of the connections, substantially as set forth.

17. The combination, with the indicators and a series of independent keys to each indicator, of a separate connection for moving each indicator, and a lock connected to be operated by each key of the series, whereby each connection is held in its operative position, substantially as set forth.

18. The combination, with the series of keys, indicators, and intermediate connections, of a lock for securing each connection, and connections between each key and the lock, whereby said lock is operated by each key of the series, substantially as specified.

19. The combination, with the series of independent indicators, a series of keys to each indicator, and an operating-lever to each series of keys, of a locking-plate and connections between each key and said plate, substantially as set forth.

20. The combination, with the indicators, keys, operating-connections, and locks, of stops, each connected to be operated by one of the keys and arranged to limit the movement of the operating-connections according to the key depressed, substantially as specified.

21. The combination, with the indicators, keys, and operating-connections, of a series of stops for limiting the movements of said connections, each connected to and movable by one of the keys, substantially as set forth.

22. The combination, with the operating-lever and a series of keys, of a corresponding series of stops arranged to limit the movements of the lever, and connections between each key and one of the stops, substantially as specified.

23. The combination of the operating-lever carrying an arm provided with a lip, 2, a series of stops and connections between the stops and keys, whereby any one of the stops may be thrown into the path of the lip, substantially as specified.

24. The combination, with the operating-lever and a series of keys, of a lock for securing the lever in its elevated position, a series of stops for limiting the downward movements of the lever, and connections between each key and the lock and one of the stops, substantially as specified.

25. The combination of a frame having a

stationary shoulder, the operating-lever, keys, notched bar, stops connected to be operated by the keys, and a strip, b^2, pivoted to the lever, constructed to engage with said stationary shoulder on the frame, and provided with a lip, 2, arranged to engage with the stops, substantially as specified.

26. The combination, with each indicator and a series of keys to each indicator, of a series of independent intermediate connections, a spring for operating each connection to a limited extent independently of the key, a detent, and means for releasing the latter to permit the connection on one indicator to move independently of the key and operate its indicator when the adjacent indicator completes its revolution, substantially as specified.

27. The combination, with a series of indicators, a series of keys, and connections, of means for operating the latter upon the movement of any key or keys, the said connections being provided with parts capable of a limited movement independent of the other parts, with locking devices, and with means for releasing the latter as each indicator completes a revolution, substantially as set forth.

28. The combination, with a series of indicators, of a corresponding series of actuating devices, and connections whereby the actuating device of one indicator is moved one step, whether in motion or at rest, as the adjacent indicator completes its movement, substantially as set forth.

29. The combination, with the series of indicators and series of keys and series of independent actuating-connections between the keys and indicators, of means, substantially as described, for turning each indicator one step independently of the key action as the next lower indicator completes a revolution, substantially as described.

30. The combination, with the indicators and keys, of actuating-levers constructed to move the indicators under the action of the keys, and each lever consisting of two parts, one having a limited movement independent of the other under the action of a spring, a lock for holding the two parts in connection, and connections between the indicators and locks, whereby each movable portion is released to automatically actuate the adjacent indicator as the next indicator completes its revolution, substantially as set forth.

31. The combination, with the indicating-disks and keys, of levers, each provided with a part geared with one of the indicators and capable of a limited movement to turn the latter, with a locking-lever, and connections between the latter and the adjacent indicator, substantially as and for the purpose set forth.

32. The combination, with the indicators, of operating-levers in two parts, and locking-levers B′ and B², substantially as specified.

33. The combination, with a series of indicators, keys, and intermediate connections, of one or more additional series of indicators, and means for throwing either series into connection with the operating devices, substantially as set forth.

34. The combination of a series of indicators, a series of keys to each indicator, and connections whereby each indicator may be set by the action of any key of one series, and a device for restoring the connections to their normal positions at the will of the operator, substantially as set forth.

35. The combination, with the series of keys, of two or more registering devices, each consisting of a series of numbered indicators, and series of intermediate independent operating-connections, and means for turning the registering devices to bring either one of the same into connection with the operating devices, substantially as set forth.

36. The combination of a series of indicators, and operating-keys and connections for moving said indicators, and operating appliances independent of the keys and indicators, whereby each indicator is moved one step by said appliances independently of the keys as the adjacent indicator completes its revolution, and devices operated by the indicators for throwing said appliances into action as each indicator completes its revolution, substantially as described.

37. The combination, with two or more series of keys, of a series of printing indicators and independent connections, whereby each indicator is controlled by each key of one of the series, and means for throwing the indicators out of gear with the connections, substantially as set forth.

38. The combination, with the series of keys and registering device operated therefrom, of an independent printing-recorder, and connections whereby the latter is moved from the same keys and to the same extent as the said registering device, and means for throwing each register out of gear with the connections, substantially as described.

39. The combination, with the series of disks provided with lateral pins, of levers B, racks hung to said levers, and locking-levers B′, and springs c', substantially as described.

40. The combination of the disks provided with pins a^6, levers carrying racks pivoted thereto, springs c', locking-levers B′, and levers B², substantially as described.

41. The combination, with the register and the recorder, of levers each carrying two series of racks capable of independent movement, one gearing with the register and the other with the recorder, and rack-operating devices, substantially as described.

42. The combination, with the levers B, carrying racks pivoted thereto, and locking-levers B′, of two adjustable registers, and levers B², constructed to operate with the disks of each register, substantially as described.

43. The combination of the keys, indicating-register, intermediate connections, and printing-recorder, frame B⁵, carrying the same,

and toggle-levers d^3 d^4, substantially as described.

44. The combination, with the independent keys arranged in series, and indicators and connections, of levers d^2, slotted plate c, and rods d, connected to the levers and having terminal stops, substantially as described.

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

W. S. BURROUGHS.

Witnesses:
F. L. FREEMAN,
CHARLES E. FOSTER.