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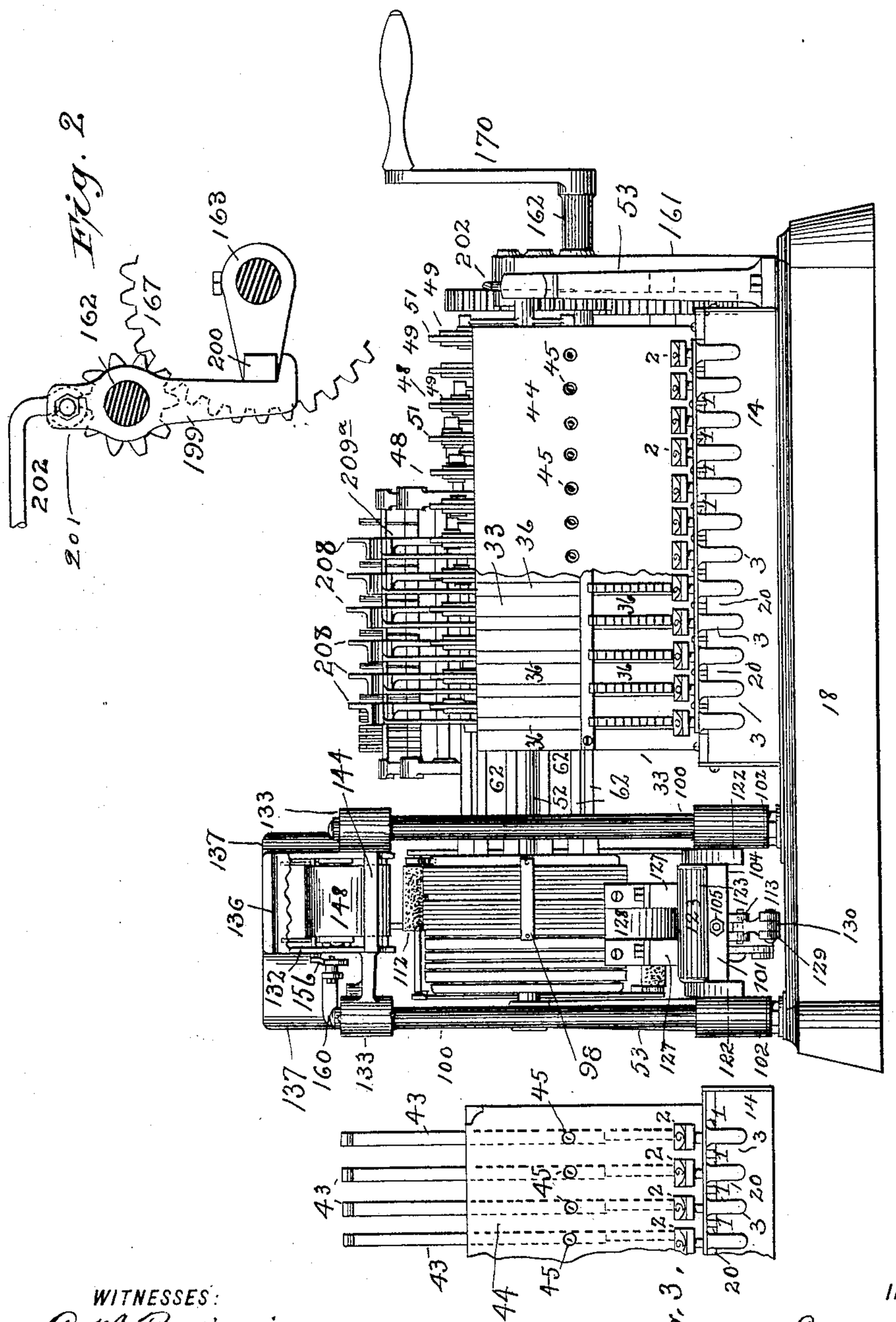
MACHINE FOR BOOKKEEPING AND REGISTERING CASH.

No. 570,620. Patented Nov. 3, 1896.



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(No Model.) 9 Sheets—Sheet 2.

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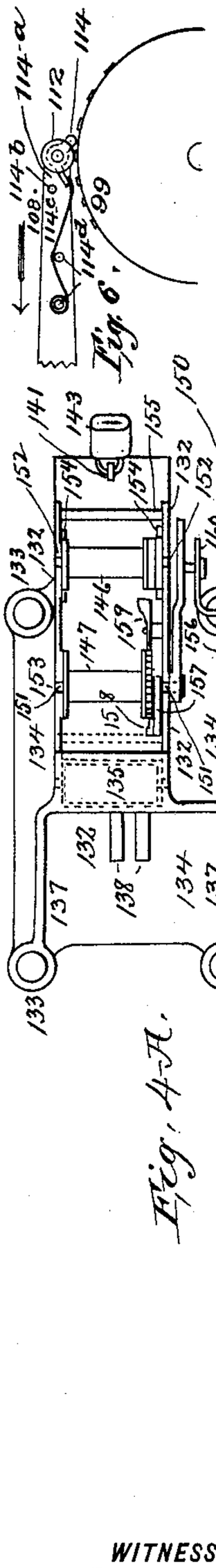

Fig. 6.

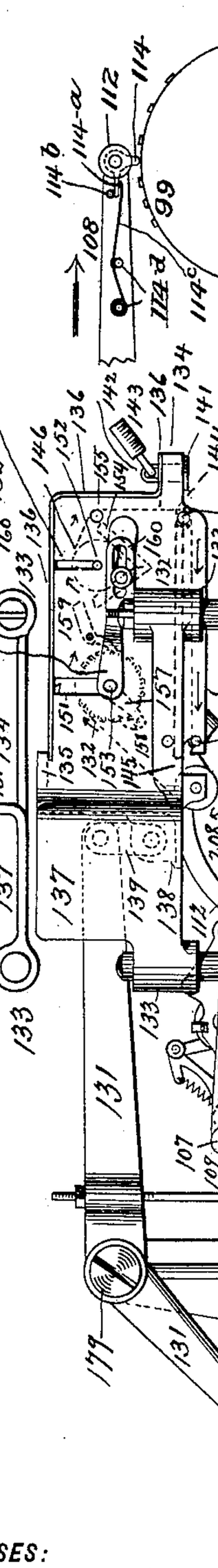

Fig. 5.

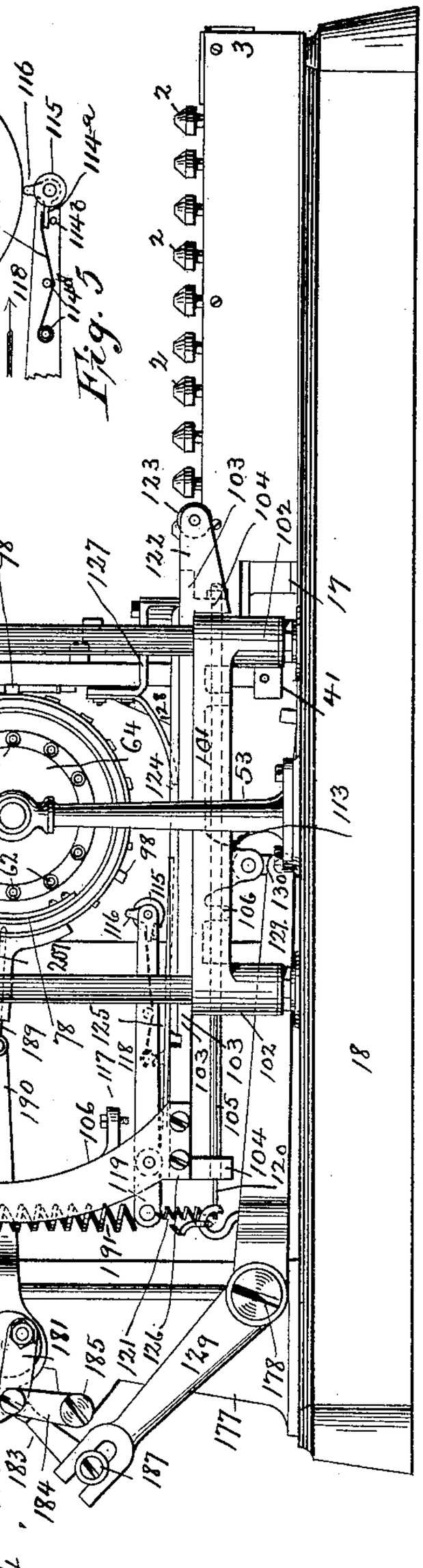

Fig. 4-A.

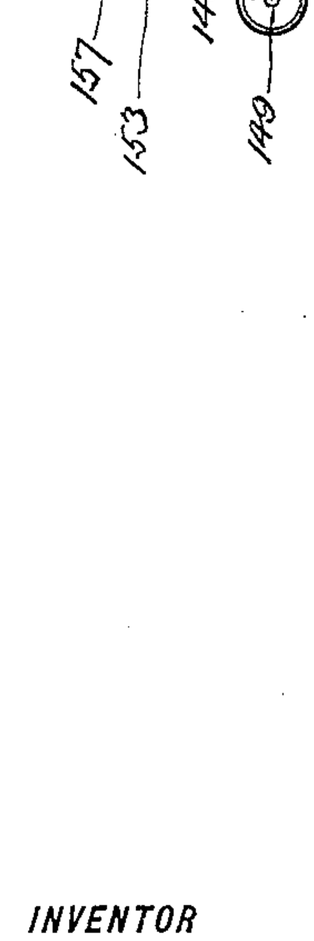

Fig. 7.

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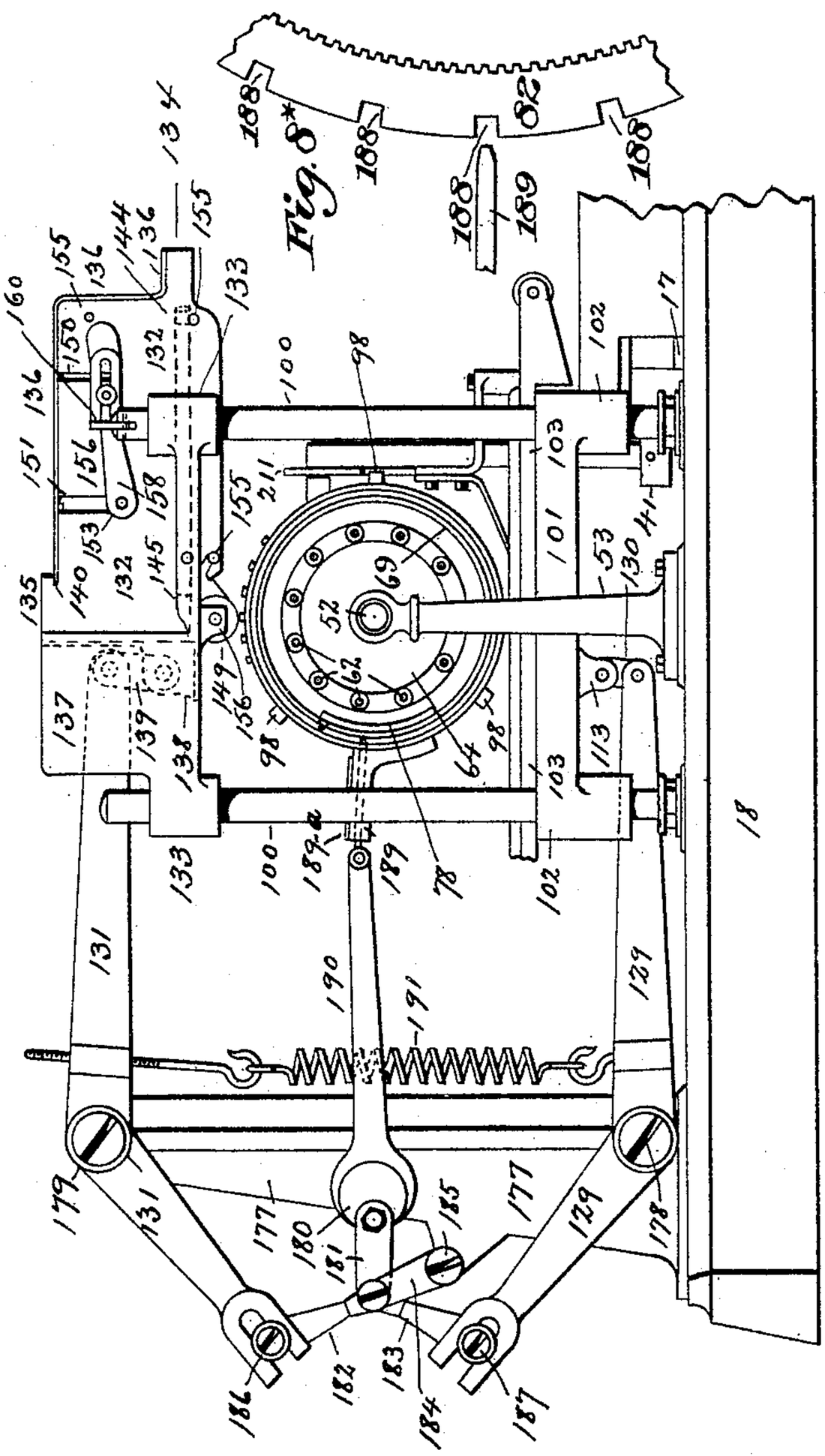

Fig. 8.

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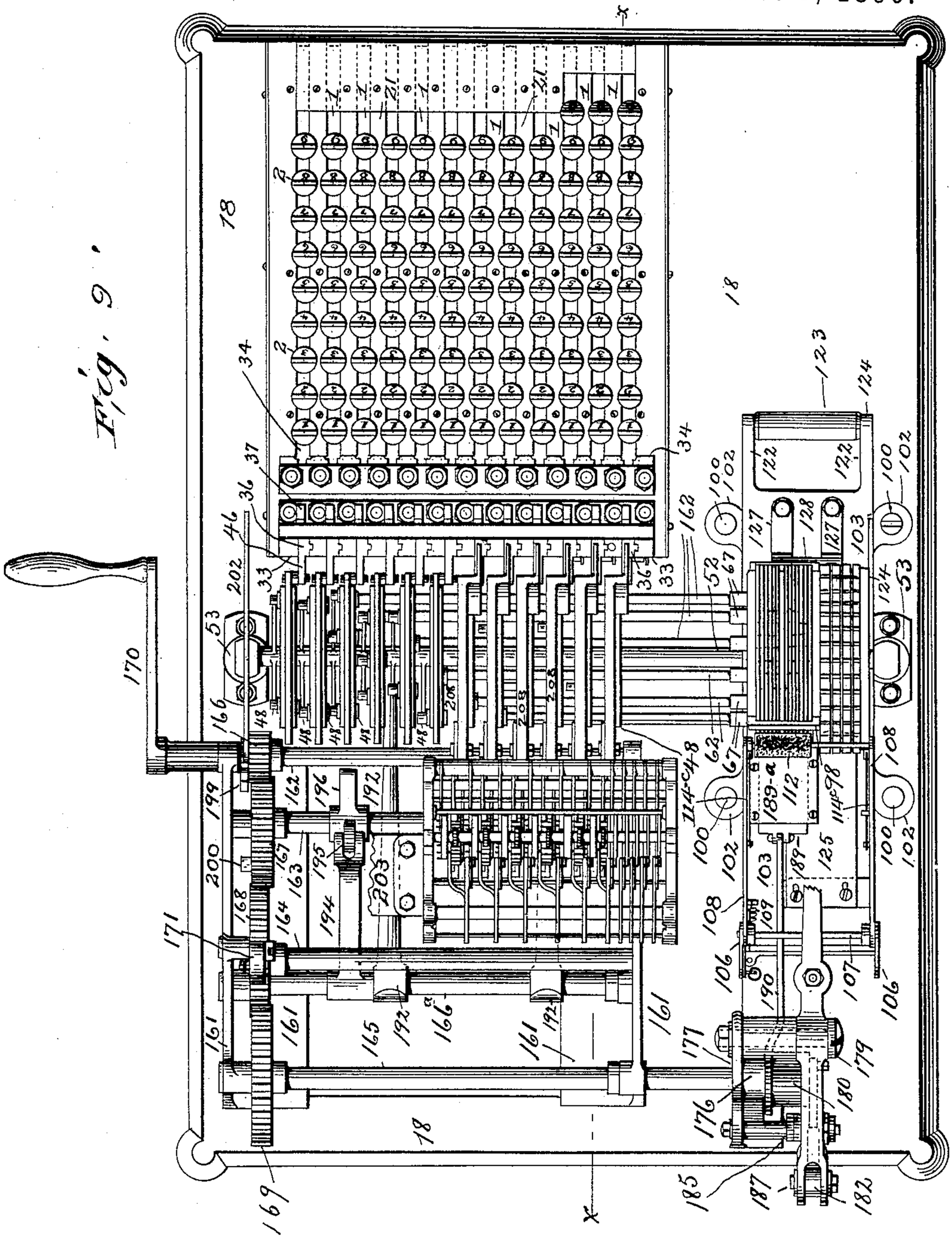
Fig. 9.



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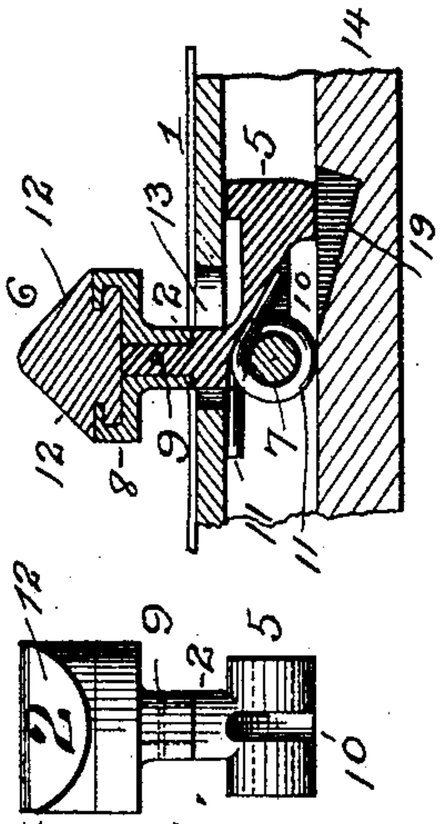

Fig. 12.

Fig. 11.

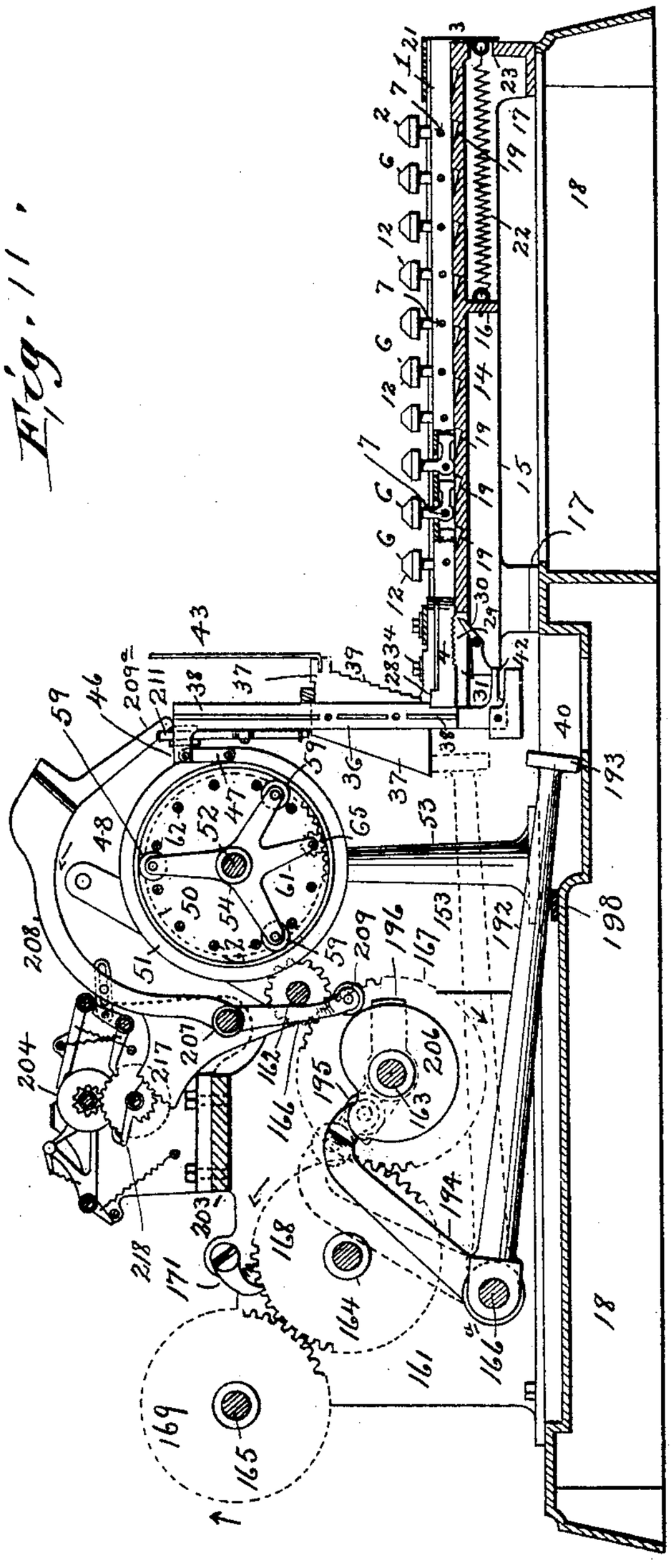

Fig. 10.

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Fig 10.a

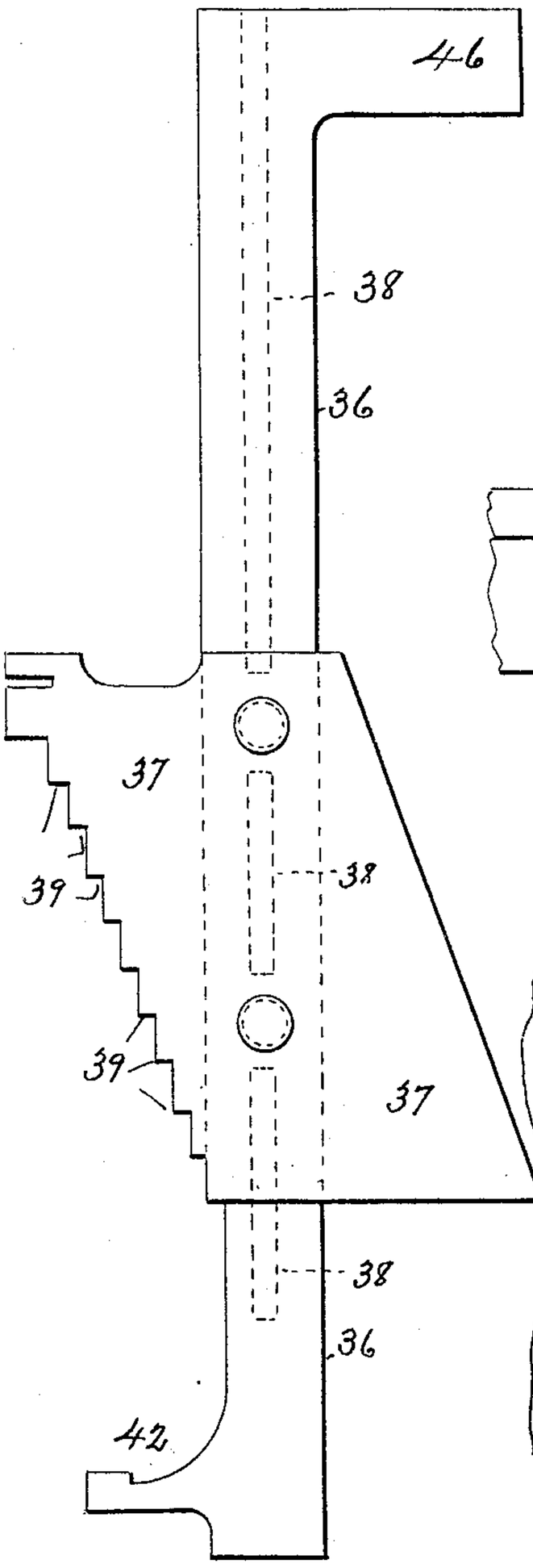

Fig 12.b

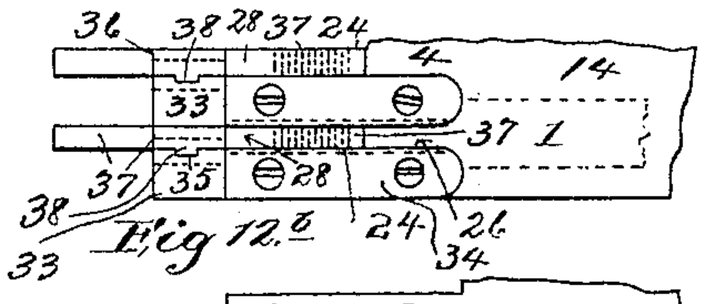

Fig 12.a

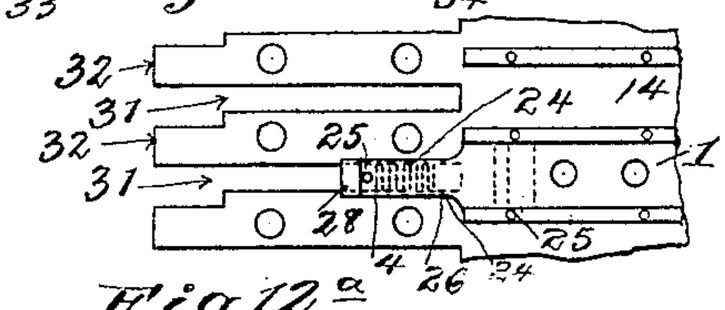

Fig 10.b

Fig 10.c

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MACHINE FOR BOOKKEEPING AND REGISTERING CASH.

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Fig. 14.

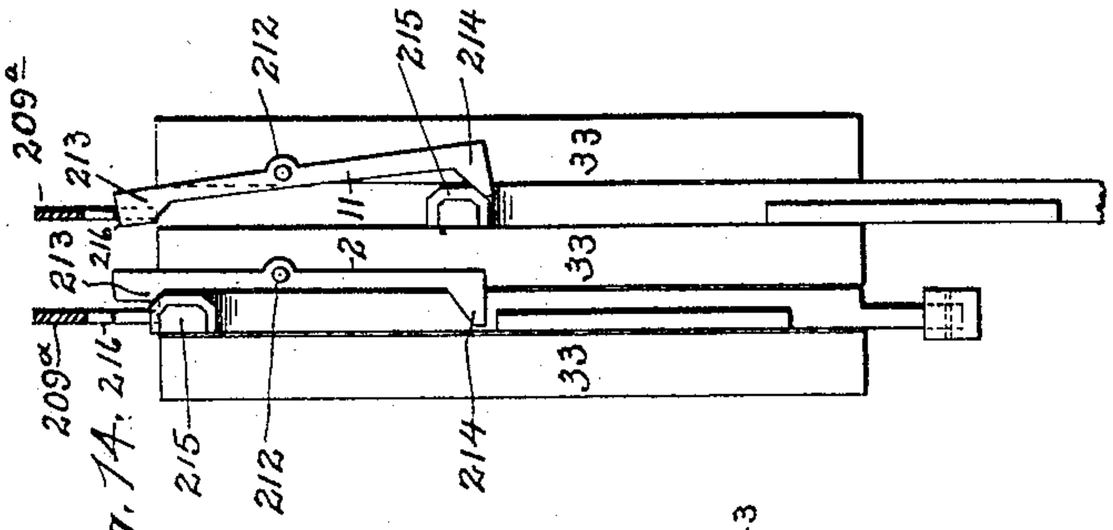

Fig. 13.

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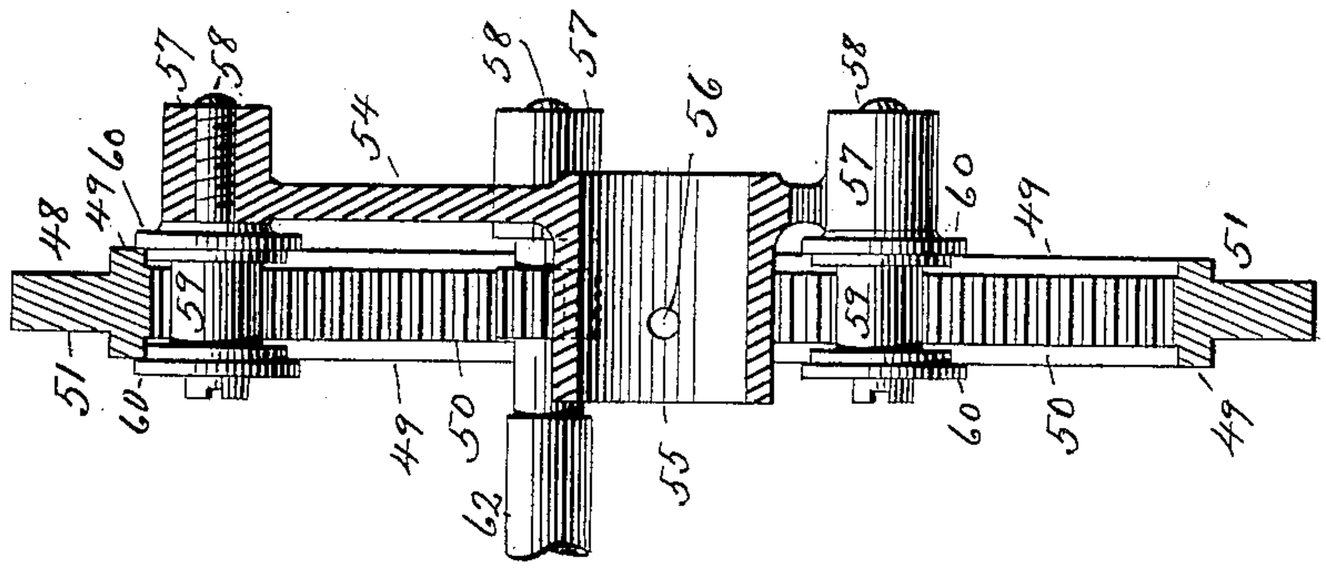

Fig. 16.

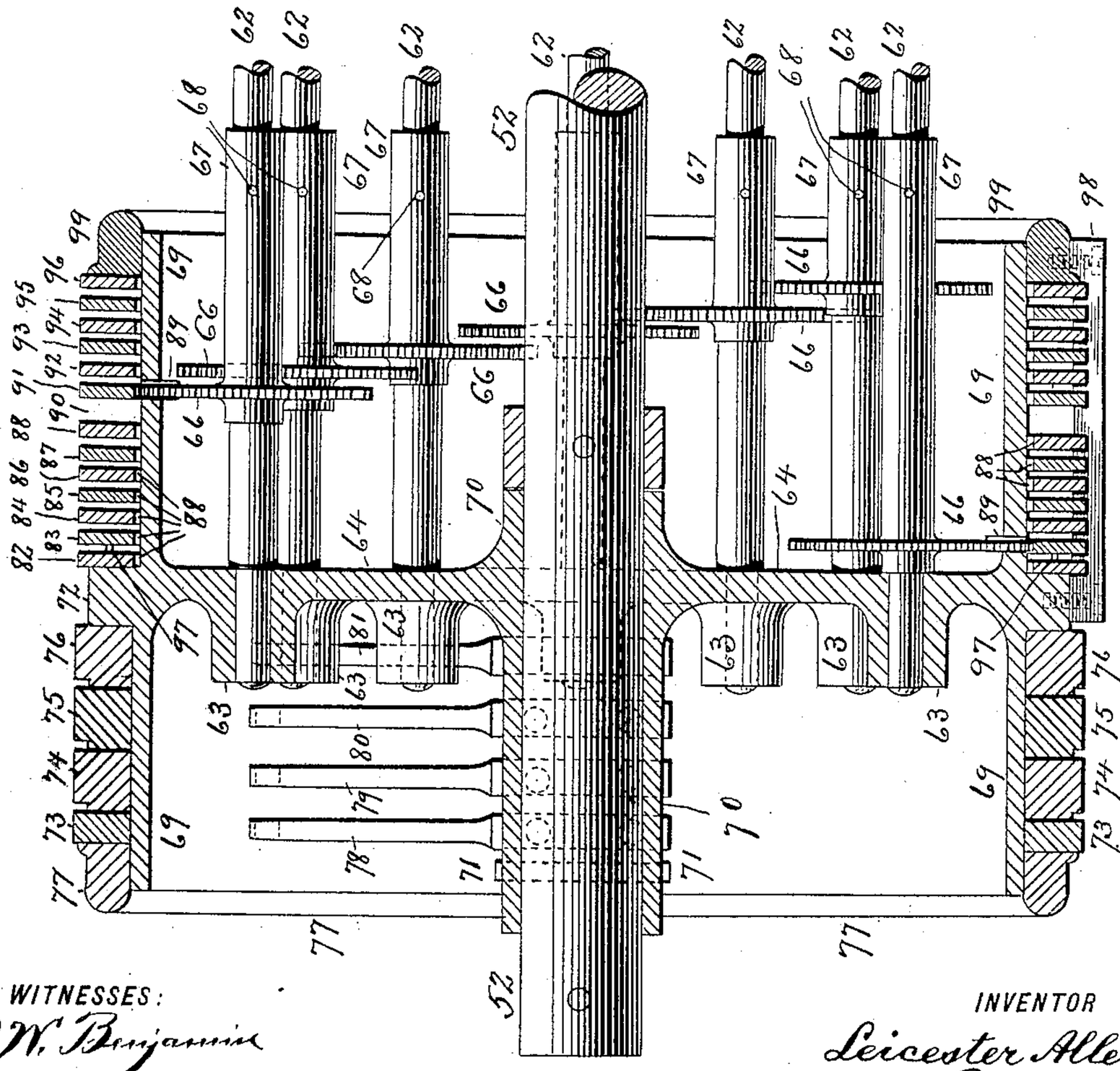

Fig. 15.

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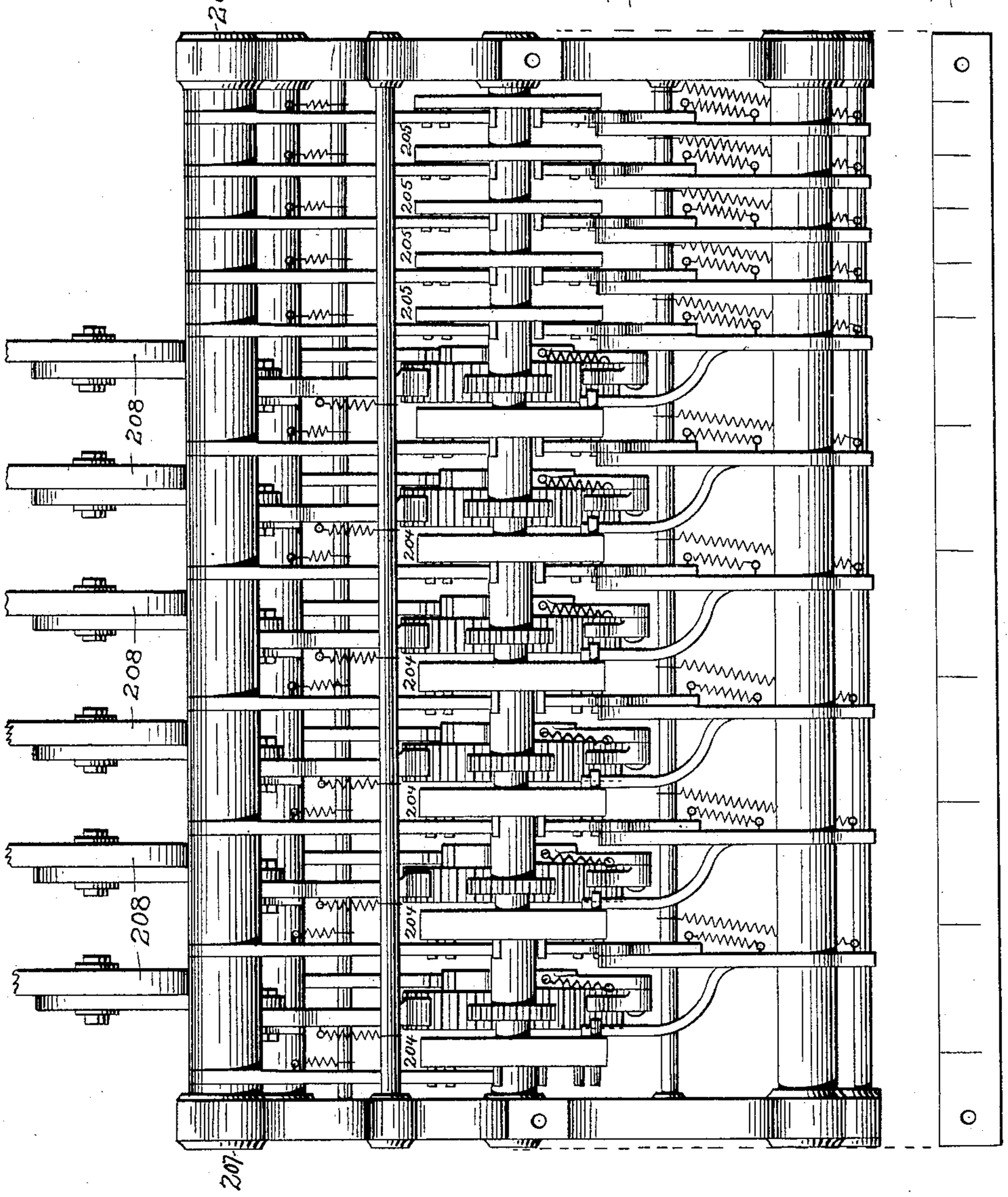

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UNITED STATES PATENT OFFICE.

LEICESTER ALLEN, OF BROOKLYN, NEW YORK.

MACHINE FOR BOOKKEEPING AND REGISTERING CASH.

SPECIFICATION forming part of Letters Patent No. 570,620, dated November 3, 1896.

Application filed October 15, 1895. Serial No. 565,773. (No model.)

To all whom it may concern:

Be it known that I, LEICESTER ALLEN, of the city of Brooklyn, county of Kings, and State of New York, have invented a new Machine for Bookkeeping and Registering Cash; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

My invention is designed more especially for use in savings-banks or institutions of like character for insuring accuracy in and facilitating the recording of deposits and of amounts paid out on account of depositors, and to enable the proper officers at all times to ascertain in briefest possible manner, and without the trouble of footing, the amounts which have been received and paid out from any prior time or date to the time or date of their examination of the state of the bank, within any prescribed practical limit of time; but, while thus stating the primary object of the invention, it is not intended to limit its scope to savings-banks alone, as it may find a useful application in banks of deposit, life-insurance offices, and, in general, in any business office or counting-room where frequent cash payments are received and disbursed and recorded on pass-books or paper slips. The example of the invention herein described is, however, that designed for the special use of savings-banks, for which purpose it performs the following functions:

First. It prints on the pass-book of the depositor the date and amount of his deposit or the amount drawn by him, the same general form of the machine being used by the paying-teller as by the receiving-teller, and the only difference being in the use of the words "received" and "paid" impressed on the book by the printing mechanism of the machine, this use of either word entailing only a different adjustment of one of the type wheels or rings hereinafter described. The form preferred for printing receipts of money is as follows: "June 30, 1894, Rec'd $ * * * 9.50;" and for payments on account, "June 30, 1894, paid $ * * 30.25." The use and purpose of the asterisk preceding the significant figures in these forms will be hereinafter explained. Any other desired form may be used.

Second. Simultaneously with printing the pass-book the machine prints on a concealed tape in a locked box the number of the pass-book and the amount credited or debited on the book, the date of the transaction being written or stamped on the tape, once for all, at or prior to the beginning of the day's business. This record constitues a second entry, and the tape can be removed by any authorized official at the end of each day for use the next day in transferring the entries to the books of the institution, and can then be preserved for future reference.

Third. By means of an adding mechanism or register correlated with the other mechanism, whereby the previously-named records are made, each sum deposited or paid out is added to the total previously received or paid out, say from the first beginning of the business of the bank to the date of such transaction, so that at any time or date by simply subtracting from the total exhibited by the register the total previously deposited or paid out the amount received or paid out since such previous time or date is determined. In regular business this enables the proper officer to ascertain in a very brief time, without waiting for footing, and by simple inspection, the amount of money which the receiving-teller has taken in and the amount which the paying-teller has paid out on account, and, in case of a run on the bank, enables the officers, with very little trouble, to ascertain hourly or half-hourly the amounts which have been withdrawn and compare these with amounts deposited.

The invention consists in various mechanisms and combinations of mechanism, which may generally be classified as follows: First, key mechanism or manual, consisting of a keyboard, key-slides, keys, key-slide stops, mechanism for restoring keys and key-slides to the normal or first position, pawl mechanism for holding the key-slides in the position where they are placed by the operator until they are automatically released after printing and registering each amount received or paid, and key-buttons of peculiar form and function; second, drop-slide mechanism related with the key mechanism, whereby, through the action preferably of gravity, (but it may be by the action of springs,) the ad-

justment of the type wheels or rings is effected for the printing of any amount within the scope of the machine and a limit for the action of the adding mechanism is fixed in such manner that precisely the amount printed is added to the previous total; third, a peculiar construction of type wheels or rings and of mechanism for supporting and operating them, directly connected and related with the drop-slides, whereby, through the primary movement of the keys and key-slides in the manual, the type wheels or rings are automatically brought to the right position for printing the amounts corresponding with the keys and key-slides manipulated by the operator; fourth, the adding mechanism or register related with the drop-slides, though not directly connected therewith, and cams, shafts, levers, and gearing for operating this mechanism by power applied to a hand crank or shaft; fifth, a platen for supporting the pass-book to be printed, with peculiar mechanism thereunto attached for receiving, adjusting, and holding the book in right relation with the type-wheels, and also supporting and operating attached mechanism for inking said wheels in a peculiar manner hereinafter set forth; sixth, an inking mechanism comprising inking-rollers for receiving, holding, and distributing ink to the types during the motion of the platen; seventh, a locked box for containing the aforementioned tape and mechanism for bringing the tape into relation with the type wheels or rings to print it simultaneously with the printing of the book; eighth, a system of graduated lifters attached to the drop-slides, whereby the operator may see whether he has operated the key mechanism properly before printing, and whereby, if he chances to have set the wrong types in position, he may set any key-slide which is in a wrong position back again independently to its zero position and reset it prior to printing, thus enabling him to readily detect any errors in setting and correct them quickly; ninth, mechanism whereby, when the crank which operates the register-cams is turned by a hand-crank, the platen and the tape-box are both actuated simultaneously for printing, and an automatic compensating mechanism for printing on different thicknesses of pass-books; tenth, mechanism whereby, through the motion of the crank that operates the printing and registering mechanism, all parts, except the platen, are restored to the normal or zero position after the printing and registering have been done; eleventh, a bed-plate of peculiar construction, which supports the working parts, and other minor constructions hereinafter described; twelfth, a printing-head which carries type-rings of peculiar construction, each of which is automatically moved, in a manner hereinafter described, by its proper drop-slide mechanism whenever the latter is set free to move by the movement of its proper key-slide, and other type-rings for printing the words "Rec'd" or "Paid" and the dates; thirteenth, lining mechanism which acts automatically, in combination with the crank-shaft of the printing mechanism and the type-rings on the printing-head, to bring the types, when about to print, into line and hold them in line during the act of impression.

Figure 1 is a front view of the machine, a portion of the front plate being broken away and the drop-slide lifters being removed to show other parts. Fig. 2 is a detail view of stop mechanism whereby at a period nearly or quite simultaneous with that when the parts are brought to the zero position the motion of the crank actuating the mechanism is brought to a positive stop, so that it cannot be moved any farther till again released, as hereinafter more particularly described. Fig. 3 is a detail view showing the drop-slide indicators and their relation with the drop-slides and key mechanism. Fig. 4 is a view of that side of the machine on which the printing-head, platen, locked tape-box, liner, and inking mechanism are located. Fig. 4[A] is a top view of the tape-box with its cover removed to show interior mechanism. Figs. 5 and 6 are details of the inking mechanism, illustrating one feature of its action. Fig. 7 is a detail view of a tape-feed mechanism carried by the locked tape-box. Fig. 8 is another and a partial view of the side shown in Fig. 4, with the parts shown in the position assumed in the act of printing. Fig. 8* is a detail view, which will be hereinafter explained. Fig. 9 is a plan view of the machine with the tape-box removed, also with a part of the upper printing-lever removed and a part of the bridge which supports the register broken away. Fig. 10 is a longitudinal sectional view, the section being made on the line $x\,x$ in Fig. 9. Figs. 10[a], 10[b], and 10[c] are respectively a full-sized side view of a drop-slide, a partial side view of a drop-slide guide mounted on the keyboard, and an enlarged detail in plan of the rear margin of the keyboard on which the drop-slide guides are mounted. Figs. 11 and 12 are respectively a vertical section and a front elevation of a key, showing the form of the key-button and key-pawl and a spring, one of which is attached to each key. Figs. 12[a] and 12[b] illustrate a detail of the key-slide construction. Fig. 13 is an enlarged partial section on the line $x\,x$ in Fig. 9, but showing parts in a different position and exhibiting some details of construction that cannot be conveniently shown on the smaller scale of the similar section shown in Fig. 10. Fig. 14 is a detail view of mechanism attached to three of the drop-slides, whereby their action is modified, for a purpose hereinafter described. Fig. 15 is a section through the printing-head, made on a plane corresponding with the axis of the shaft which supports the head and showing the interior mechanism of this head. Fig. 16 is a vertical central section through one of a set of internally-toothed rings and its support, by

which ring, when actuated by one of the drop-slides attached thereto by a link, motion is imparted through a pinion to the corresponding one of a set of shafts carrying toothed wheels in the interior of the printing-head, each of which intermeshes with the teeth of its proper type-ring, as hereinafter explained. Fig. 17 is an enlarged top view of the adding mechanism or register with a part removed, the latter being shown separately in Fig. 18.

There are in this example of my invention twelve key-slides 1, Figs. 1, 3, 9, 10, 11, 12^a, and 12^b, each forming part of the manual or keyboard mechanism which the operator manipulates in setting the mechanism into position for printing the pass-book and the concealed tape and for registering the amount so printed; but the number of these key-slides may be more or less, according to the purpose for which the machine is designed, and I therefore do not limit myself to any particular number of them. Each of these key-slides carries a set of keys 2, Figs. 1, 3, 4, 9, 10, 11, 12, and 13. The key-slides are preferably made in the form of a hollow parallelepiped or rectangular tube, the bottom side being cut away, so that only three sides of the tube remain. On the front end of each key-slide (that is, the end before which the operator stands in using the machine) is formed an extension or tang 3, which is turned downward at a right angle with the body of the key-slide, as shown in Figs. 1, 4, and 10, and to the opposite end is fitted and attached by riveting or brazing, or both, a hardened steel block 4, Figs. 10, 12^a, and 12^b.

The keys 2 are shown in detail in Figs. 10, 11, and 12. Each is formed of a key-pawl 5 and key-button 6. The key-pawl works on a pivot 7, which connects it with the key-slide, as hereinafter described, and it has a horizontal extension toward the front, as shown in Fig. 10, and a vertical extention upon which the socket 8 of the key-button 6 is fitted, as shown in Figs. 11 and 12. The key-pawls and key-button sockets are of metal, and the bodies of the key-buttons are of celluloid or other suitable composition that can be molded into the proper form and pressed into the hollow part of the socket, so that when the molded bodies harden they become fixed in their sockets, as shown in Fig. 11. The key-button sockets are removably attached to the key-pawls by a pin 9, which is passed through a hole in the lower part of the socket and a corresponding hole in the upwardly-projecting part of the key-pawl. The pivots 7 are also removable, being fitted easily into the holes in the lateral walls of the key-slides without riveting or pinning and, when in use, being held in their places by rib-bars which hold the keys laterally in proper positions, as hereinafter described.

In the middle of the under side of the hub of each key-pawl through which the pivot 7 passes is milled out or otherwise formed a recess 10, Figs. 11 and 12, which is deep enough to allow a wire spring 11 (shown only in Figs. 11 and 12) to pass entirely around the pivot. One end of this spring bears against the under and inner side of the upper wall of the key-slide and the other against the inner surface of the recess 10. The key is thereby held in position relatively to the key-slide, as shown in Figs. 10 and 11, at all times when not operated, as hereinafter set forth.

The bodies 6 of the key-buttons are cylindrical at the base, but are cut away on the front and back to leave inclined facets 12. On each facet presented toward the front of the machine is placed a numerical figure, as shown in Fig. 12. The unnumbered facets which face away from the operator are those to which the fingers of the operator are applied in using the machine.

The upwardly-projecting parts of the key-pawls which support the key-buttons are cylindrical, and they pass through holes 13 in the upper wall of the key-slide, these holes being enough larger than the parts of the key-pawls that pass through them to permit a rocking motion of the key-pawls on their pivots 7.

The key-slides are fitted to slide longitudinally on the upper horizontal surface of a metal keyboard 14, Figs. 1, 3, 10, 10^b, 10^c, 11, and 13. This keyboard is preferably made of cast-iron and in one piece. It is stiffened with downwardly-projecting ribs 15 and 16, Figs. 10, 10^b, and 13, the rib 16, Fig. 10, being transverse. It is also provided with feet 17, Figs. 4, 8, 10^b, and 13, which support the keyboard on and are fastened by bolts to the bed-plate 18, Figs. 1, 4, 8, 10, and 13. In the top of the keyboard are planed or milled out accurately-spaced parallel transverse recesses 19, Figs. 10, 10^b, and 13. The recesses have inclined plane bottoms, the lower parts being toward the front of the keyboard, and their front sides form abutments for the engagement of the key-pawls. The centers of the pivots 7 of the key-pawls being spaced accurately a given distance apart, (in this instance one inch,) the abutments formed by the grooves in the keyboard are accurately spaced to a somewhat greater distance apart, (in this instance one and three thirty-seconds inches,) for a purpose soon to be explained.

The key-slides are arranged on the keyboard in parallel relation and held at equal distances asunder by rib-bars 20, Figs. 1 and 3, and flat plates 21, Figs. 9 and 10. These plates and the rib-bars are held fast by screws, (shown in Fig. 9,) which pass down through both the plates and the rib-bars into tapped holes in the keyboard. The key-slides therefore work in the spaces under the plates 21 and between the rib-bars 20, and the lower edges of their lateral walls rest and work upon the upper surfaces of the ledges on the top of the keyboard left between the transverse grooves 19. The entire upper surface of the keyboard is planed flat before the grooves are cut to allow the key-slides to bear fairly on

all of the ledges so formed. When so placed in position, the front extremities of the key-pawls which lie farthest from the front of the keyboard will need to be moved toward the front three thirty-seconds of an inch to coincide in position with the abutment of the groove farthest from the front. The front extremities of the next row of key-pawls will need to be moved six thirty-seconds of an inch to correspond in position with the abutment of the next groove, and so on, each transverse row of key-pawls, counting from the rear row, requiring to be moved three thirty-seconds of an inch farther than the next preceding row.

To move a key-slide toward the front, the operator places the ball of a finger on the rear face of one of the key-buttons and presses thereon toward the front of the keyboard. This pressure tilts the key toward the front and draws the slide in the same direction till the front extremity of the pawl brings up against the abutment in the corresponding groove next toward the front, and thus limits the movement of the slide. As soon as the pressure of the finger is removed from the key-button the key-pawl spring 11, Fig. 11, restores the original position to the key-pawl and disengages it from its abutment in the groove on the keyboard, as shown in Fig. 11.

To restore the key-slides bodily to their first positions, after they have been operated as described, each one of them is provided with a spring 22, Fig. 10, connected by a hook formed on one end in an eye in the transverse rib 16, and by a similar hook at the opposite end to an eye attached to the extension or tang 3 of the key-slide. A hole 23 is drilled through the front part of the keyboard, which permits the necessary extension of the spring toward the front in operating the key-slide. By unhooking the springs any one of the key-slides and its entire mechanism may be withdrawn from the keyboard, as may be necessary for cleaning or replacement of worn parts. The pivots of the key-pawls are kept in place when the key-slides are in place by the abutment of their ends against the rib-bars 20, and when a key-slide is drawn out any of its keys may be detached by pushing out the key-pawl pivot and the key-socket pin. Thus the key-pawl springs may be replaced and other parts substituted with great facility. The comparatively slow motion of the drop-slides, hereinafter described, requires, however, that the key-slides, when drawn toward the front, should, notwithstanding the tension of the springs 22, be held in the position to which they are drawn until the drop-slides have time to fall to their respective positions, and for this (and for other purposes hereinafter set forth) the steel blocks 4, at the ends of the slides opposite the ends which carry the tangs 3, are constructed as shown in Fig. 12^a, which is a plan view, and in side elevation in Fig. 13. The construction is also partly shown in Fig. 10.

The key-slides are three-fourths of an inch in width in plan, and the blocks 4 are milled off equally on each side, leaving a thickness of three-eighths of an inch in plan at 24 from a point near the place where they are joined by rivets 25 to the body of the key-slide. A corresponding tongue 26 is formed on the body of each key-slide, extending over and upon the steel block 4, as shown in Figs. 12^a and 12^b, through which one of the rivets 25 passes. At the extremity of the block is an upward, flat-topped, case-hardened projection 28, upon which the drop-slide falls, as hereinafter described, and on the under surface of the block is cut a ratchet 29, Figs. 10 and 13, the teeth of which have in this case a pitch of three thirty-seconds of an inch, or in any case a distance corresponding to the unit distance of motion of the key-slide, or the distance the key-slide can be moved by the key whose finger-button has marked on it the figure "1". (Shown in Fig. 9.) Under each rib-bar 20 there is, on the under side of the keyboard 14, one of the longitudinal strengthening-ribs 15, and to this is pivoted a gravity-pawl 30, Figs. 10 and 13, (which may, however, be a spring-pawl, if desired,) that engages with the ratchet 29 in the corresponding key-slide and holds the latter in any position to which, by operating any one of its keys, it can be drawn forward by the operator, and until such time as it is automatically released in a manner hereinafter explained.

The drop-slide mechanism above alluded to is constructed substantially as follows: That margin of the keyboard farthest from the front side is constructed as shown in Figs. 9, 10, 13, 10^b, 10^c, 12^a, and 12^b. Fig. 10^c is an enlarged detail plan. Fig. 10^b is a side elevation showing one of the drop-slide guides mounted on the keyboard, and Fig. 12^b another detail plan showing two of the drop slides and their guides in position. Along the rear margin of the keyboard spaces 31 are milled out, as shown in Figs. 10, 10^c, 12^a, 12^b, and 13, to permit the free vertical movement of the drop-slides. On the solid steps 32, Figs. 10^c, 10^b, and 12^a, between the milled-out spaces, are bolted the drop-slide guides 33, Figs. 1, 4, 9, 10^b, 10^c, and 12^b, these guides each having a foot 34, extending toward the front and bolted to the said steps. The steel blocks 4, previously described, when the key-slides 1 are in their normal positions, occupy the position shown in Fig. 12^a, being wide enough to cover the milled-out spaces 31 in the keyboard and overlapping about three sixty-fourths of an inch beyond the sides of the milled-out spaces 31, thus resting upon and when operated sliding upon the margins of the steps 32. The spaces between the steps also permit the pawls 30, one for each drop-

slide, to engage with the ratchets 29 whenever the key-slides are pulled toward the front, as will be presently further explained.

In one side of each drop-slide guide 33 is formed a groove or guideway 35. (Shown in full outline in Figs. 10[b] and 10[c]. They are also shown in plan in Figs. 9 and 12[b], but are not there numbered for reference.)

The drop-slides are shown at 36, Figs. 1, 9, 10, 10[a], 12[b], and 13. One of these drop-slides is arranged in relation with each key-slide. Each drop-slide in the present example of my invention consists of a brass or composition body 36 (best shown in Fig. 10[a]) and a hardened steel step-piece 37, Figs. 10, 10[a], 12[b], and 13. The body 36 has longitudinal ribs or splines 38 formed on it, which ribs, being in line with each other, may properly be considered as one rib or spline, parts of which are removed to afford opportunity to rivet the step-plate to the body. The step-plate being cut away half its thickness on the side toward the body, and the body cut away similarly on the side toward the step-plate, the two parts are accurately fitted together and joined by riveting. The step-plate 37 has approximately a rhomboidal form, this being preferred for the reason that as the part of it projecting to the front of the body has its front edge inclined, as shown, the part projecting toward the rear, of similar form reversed, very nearly balances that projecting to the front, thus reducing the friction of the drop-slides when the latter are operated, as hereinafter explained. On the front edge of each step-plate are formed ten steps. (Best shown at 39, Fig. 10[a].)

In the normal position of the key-slides, which is that shown in Fig. 10, the lowermost steps of each step-plate rest on the ends of the steel blocks 4, as shown. The steps have a uniform horizontal depth equal to the distance to which any one of the key-slides can be drawn toward the front by operating its key whose button is marked with the figure "1" in Fig. 9. The steps have also a uniform rise of one-fourth of an inch in this case. When the key-slides are in the normal position, the operation of any key marked with a figure other than "1" moves the corresponding key-slide toward the front through a distance equal to that which operating its "1" key would move it multiplied by the figure marked on the key operated. It follows that when the drop-slides are in normal position the operation of a "1" key will allow the corresponding drop-slide to slide down between its adjacent drop-slides and descend a distance equal to the rise of one step. The operation of a "2" key will let the drop-slide fall through a distance equal to the rise of two steps, and so on. Thus in Fig. 13 the parts are shown in full outline in the position when the "4" key has been operated, and the corresponding position of the drop-slide after descending shows it to have dropped through a distance of four steps, being arrested from further dropping by the next step in order, which now rests upon the steel block 4. Thus by operating the keys as described the drop-slides may be caused to drop through distances the shorter of which may be called "unit" distance, and the other distances will be, respectively, multiples of the unit distance or the unit distance multiplied, respectively, by digits indicated on the keys operated. Thus operating the "3" key will allow the drop-slide to fall through three times the unit distance, operating the "5" key will allow the drop-slide to fall through five times the unit distance, and similarly for any key operated. In order that the drop-slides may fall freely as far as necessary, a recess 40 is formed in the upper side of the bed-plate 18, as shown in section in Figs. 10 and 13, this recess extending laterally across the bed-plate under all the drop-slides. To the bottom of each of the drop-slides is attached a weight 41, Figs. 7, 10, and 13, of lead, composition, or other suitable material, this being preferred rather than to make the drop-slides themselves so heavy as to look unsightly; but these weights might be omitted without in any wise affecting the principle of action or the function of the drop-slides, as the drop-slides can be made heavy enough without the weights by sacrificing to some extent the appearance of lightness in the machine, or springs may replace the weights.

Projecting toward the front from the lower part of each drop-slide is a toe or tappet 42, Figs. 10, 10[a], and 13, which, when any drop-slide is in the normal position and supported by the part 28 of the steel block 4, as shown in Fig. 10 and also in dotted outline in Fig. 13, engages the rear part of the corresponding gravity pawl 30 and disengages the latter from the ratchet 29 in the bottom of the steel block. The lifting of any or all of the drop-slides up to the normal position after their fall therefore automatically releases the corresponding key-slide or key-slides from the gravity pawl or pawls which have previously held them from returning to their normal position, and then the tension of the springs 22 immediately causes them to return to the normal position. Their return brings the parts 28 of the steel blocks 4 into engagement with the lower steps of the step-plates 37 on the drop-slides, and thus holds them from again falling until the operator again draws the key-slides toward the front. In the regular operation of the machine all the drop-slides which have been permitted to drop by the manipulation of the keys are lifted simultaneously by means of a lifting-bar, yet to be described; but provision is also made for lifting any one of them at will. This is done by means of a flexible strip of steel, German silver, or other suitable material attached to the upper part of the step-plate of each drop-slide, as shown at 43, Figs. 3, 10, and 13.

I have shown the machine as without the casing which incloses the drop-slides and register, this being no part of the invention; but when this is put on the upper ends of the

lifting-strips 43, just described, extend upward through the top of the case, and are formed at their upper extremities into a small scroll for conveniently grasping them with the fingers. Thus, if the operator has drawn out any of the key-slides and has thus permitted the corresponding drop-slide to fall, he may, if desired, restore the drop-slide independently by lifting the drop-slide back to its normal position through the aid of the flexible lifting-strip attached to its step-plate, as described. This releases the key-slide correlated with the drop-slide, as hereinbefore described, and permits the key-slide also to return to normal position. The flexible strips also perform the function of indicators which show whether in setting the printing mechanism any error has been committed. The front face of each of the strips is enameled white, and on each of them, except those at the left, this surface has printed on it the ten Arabic numerals in order, beginning with the zero at the bottom and making the next figure above this "1," the next above "1," "2," and so on till "9" is included. A vertical flat plate 44, Figs. 1 and 3, is supported directly in front of the lifting-strips by having its outermost right and left margins bent at right angles backward, and respectively attached by screws to the extreme right and extreme left drop-slide guide. In this indicator-plate are cut holes 45, situated one of them directly in front of each flexible lifting-strip 43, and in such manner that when any drop-slide is in its normal position the zero figure marked on each strip, except the three on the left hand, shows through the corresponding aperture.

The figures on the front faces of the strips are spaced vertically, each from the next one above it, a distance equal to the rise of one of the steps 39 in the step-plates 37. Therefore, if the lower step of the drop-slide step-plates, whose lifting-strips are printed, as described, be considered as the zero position, the zero marked on the strips will be seen through the holes. If any of the drop-slides whose lifting-strips are so marked be permitted to drop through a distance of one step, the figures "1" on such lifting-strips will show. If they drop through a distance of two steps, their figures "2" will show, and so on. The figures on the lifting-strips, therefore, always indicate the number of steps through whose total vertical distance the drop-slides have moved, and as this distance must correspond, as already has been explained, with the key operated on the corresponding key-slide, it follows that if the wrong figure shows at the corresponding hole in the indicator-plate the wrong key has been operated. The operator may then at once correct this error by lifting the drop-slide into normal position, when the key-slide will automatically resume the normal position. It then can be set again to the correct position, and these operations affect no part of the machine except the mechanism directly connected with and positively operated by the drop-slide so manipulated. The lifting-strips of the three drop-slides at the left side, or the tenth, eleventh, and twelfth drop-slides, counting from the right of the entire set when standing in front of the machine, are printed differently from the others, each of these three strips having eleven characters. The lowest character is an asterisk. The next above it is the figure "1," the next above this "2," and so on upward in the usual order of the digits, the uppermost being the zero figure. These characters are spaced along the lifting-strips at the same distance from each other, as described for the other lifting-strips. It follows that when the drop-slides to which the strips having asterisks on them are attached are brought to their normal positions asterisks instead of zero figures will show through the corresponding apertures in the indicator-plate 44. The purpose of this arrangement is explained hereinafter.

It will be seen on inspection of Fig. 9 that the key-slides corresponding with the tenth, eleventh, and twelfth drop-slides (counting from the right when standing in front of the machine) each have one more key than the others counted in the same way up to and including the ninth key-slide. The explanation of this arrangement will also be given hereinafter.

It is one of the functions of the drop-slides to so control the printing mechanism, next to be described, that the latter shall print upon the depositor's pass-book a portion of the characters indicated at the apertures 45 of the indicator-plate 44, and also print them simultaneously with printing the pass-book upon a concealed tape, hereinbefore mentioned, upon which tape the characters not printed in the pass-book are also printed. A second function of the drop-slides is to control the action of the registering or adding mechanism in such manner as to cause the latter to add to the total previously indicated by this mechanism the sum of money indicated by the imprint upon the pass-book, and to do this before any other printing can be done either upon the pass-book or upon the tape. To accomplish the first of these functions, each drop-slide has at the top a rearward projection 46, Figs. 9, 10, 10ª, and 13, and this projection on each of the drop-slides is connected by a link 47, Figs. 10 and 13, to an internally-toothed gear 48, Figs. 1, 9, 10, 13, and 16. The construction of these internally-toothed gears (one for each drop-slide) is shown more particularly in detail in Fig. 16, which is a vertical section through the axis of the gear and the four-armed spider on which it is supported. On each side of each gear is a laterally-projecting rim 49, Figs. 10, 13, and 16. Within this rim and extending farther toward the center is the toothed part 50 of the gear, as shown in Figs. 10, 13, and 16. Outside of the rim 49 the internally-toothed gear extends away from the center, forming

an annular projection 51, to which the link 47 is pivoted, as shown in Figs. 1, 10, and 13. This construction of the gear-wheel gives it not only great rigidity, but also gives it sufficient weight to prevent its acquiring a too high velocity when actuated by its correlated drop-slide through the medium of link 47, and this is the chief purpose which the annular projections 51 of the gears are intended to subserve. Were the drop-slides not resisted in their fall by the inertia of the gears, they would strike too hard blows when their fall is arrested by the steel blocks 4 of the key-slides, and thus would be noisy, and the step-plates would also wear more rapidly. With the construction described the fall of the drop-slides is much slower than if their motion were not opposed by the inertia of the connected wheels, and the arrest of their motion by the steel blocks 4 makes very little noise. The use of heavier or lighter weights 41 on the drop-slides enables the force of gravity and the inertia of the wheels to be counterbalanced so far as to secure the action described to any degree of nicety.

A bar or dead-spindle 52, Figs. 1, 4, 8, 9, 10, and 13 is supported by posts 53, Figs. 1, 4, 8, 9, 10, and 13. The dead-spindle 52 is fitted to holes in the upper parts of the posts 53 and is held in fixed relation with the posts by pins (not shown) which are inserted transversely through the tops of the posts and the extremities of the dead-spindle. The posts are bolted to the bed-plate 18 in such positions that the dead-spindle extends transversely over the upper face of the bed-plate and behind the drop-slides at such distance that when the links 47 are connected with the wheels that are concentric with the spindle, and when they are also connected with the rearward projections of the drop-slides, they assume nearly a vertical position when all the other parts are in the normal position, as indicated in Fig. 10. When the drop-slides fall in operating the machine, the links are only slightly inclined from the vertical position, the arc described by the pin that connects them with the wheels being quite small.

On the dead-spindle are keyed the four-armed spiders 54, Figs. 10, 13, and 16. There is one of these spiders for each of the internally-toothed wheels 48. Each of the spiders has a hub 55, Fig. 16, fitted to the dead-spindle 52 and held in rigid relation with the spindle by a key-pin driven through a hole 56 in the hub, (shown in Fig. 16,) and also through a corresponding hole in the dead-spindle. Three of the arms on each spider include angles of one hundred and twenty degrees between their radial axes, and have at their extremities hubs 57, Figs. 13 and 16. Stud-pin bearings 58, Figs. 13 and 16, project laterally at right angles from the hubs 57, as shown in Fig. 16, and on these stud-pin bearings are fitted rollers 59, Figs. 13 and 16. Each of these rollers has two flanges 60, Fig. 16, and the inner margin of the flanges is shouldered down in such manner that when the parts are assembled and the rollers are mounted on the screw stud-pin bearings the inner face of the rim 49 of the internally-toothed wheel bears against the perimeters of the inner parts of the roller-flanges, as shown in Fig. 16, while the outer parts of said flanges project somewhat beyond the inner margins of the rim 49, the width of the rim being such as to afford an easy-working fit between the projecting flanges. The rollers are of uniform size, and the screw stud-pins are accurately centered at equal radial distances from the axis of the dead-spindle in such manner that when the parts are assembled the rim 49 of the internally-toothed gear-wheel is held in a position concentric with the axis of the dead-spindle. The middle part 59 of each roller is turned down, so as to allow clearance between the crowns of the teeth in the gears 48 and the exterior of said middle parts of the rollers. When the parts of this mechanism are assembled, the wheels 48 turn freely and concentrically with the axis of the dead-spindle 52 through any arc corresponding to the motion of the connected drop-slide.

The fourth arm 61, Figs. 10 and 13, is placed at an angle, respectively, of forty-five degrees and seventy-five degrees from the radial axis of two of the spider-arms carrying the rollers 59. In the outer part of each arm 61 is formed a bearing for one of the shafts 62, Figs. 1, 4, 8, 9, 13, 15, and 16. Ends of these shafts are also shown in Fig. 10, but are not numbered on that figure. The extremities of the shafts 62 opposite to those which have bearings in the hubs of the arms of the spiders 54 have bearings 63 in the web 64 of the printing-head, yet to be described, as shown in Figs. 4, 7, 8, and 15. The shafts being shouldered, these shoulders abut against the inner faces of the hubs on the arms 61, Fig. 13, and also against the face of the web 64, Figs. 4, 8, and 15, and this prevents their moving longitudinally. The shafts 62 have free rotary movement in their bearings when actuated in the manner soon to be described. On each shaft 62, near its bearing in its proper spider-arm, is a pinion 65, Figs. 10 and 13, which meshes into the correlated internally-toothed gear which drives it. Each of the shafts 62 has mounted upon it a spur-gear 66, Fig. 15. These gears are preferably made with hubs 67, extending to the right beyond the margin of the shell of the printing-head far enough to admit of their being rigidly attached to their respective shafts by key-pins 68, Fig. 15, and in proper positions to perform a function hereinafter explained.

The printing-head above spoken of consists of a cylindrical shell 69, Figs. 4, 8, and 15, formed integrally with a web 64, Fig. 15, and a hub 70, Fig. 15, by which latter it is supported by the dead-spindle 52, being rigidly attached to said spindle by a pin 71. It comprises type-rings or type-wheels for print-

ing, click-springs for holding certain of these rings when set for printing any particular date, mechanism for holding the type-rings in proper lateral adjustment, bearings for the shafts 62, already described, and two fixed but detachable rings for holding the movable rings upon the outer surface of the cylindrical shell, which is their bearing. The movable printing-rings all slide circumferentially upon the outer surface of the shell when they are moved about the axis of the dead-spindle, as hereinafter described. These rings are shown but not numbered in Figs. 1 and 9. In Fig. 15 they are shown in section on a scale nearly full size and numbered for reference. There are three groups of printing-rings supported on the printing-head shell. This shell has a peripheral rib 72, Fig. 15, formed integrally with and extending entirely around the outer surface of the shell. The four rings numbered 73 74 75 76 in Fig. 15 constitute one group. On the ring 73 are engraved ordinal numbers respectively representing the days of the month, "1," "2," "3," &c., up to and including "31." On the ring 74 are engraved the names of all the months in the year. On the ring 75 are engraved the figures representing the year, beginning with, say, "1895," and following successively with "1896," and so on, for as many succeeding years as it may be desirable to represent on the ring. On the periphery of the ring 76 is engraved the word "Rec'd," several times repeated in different positions, and also the word "Paid," several times repeated. The object in engraving these words in different positions and several times upon the ring is, first, to enable either the word "Rec'd" or "Paid" to be used, according as the machine is to be used by the receiving-teller or the paying-teller, and, second, there being more than one set of engraved types for printing each word, should any one set get worn another can be brought into position for printing. Thus this ring can be made to last much longer in use than though the words to be printed were only once represented thereon. This group of printing-rings, each of which may be rotated upon the outer surface of the printing-head shell, is held laterally by the rib 72 on the right of it and by the fixed ring 77, fitted to the left-hand margin of the shell and there attached by screws (not shown) inserted radially through the ring and penetrating the shell. Attached to the inside of the shell by rivets are click-springs 78 79 80 81, Figs. 4, 8, and 15. Holes are cut through the shell, as indicated in dotted outline in Figs. 4 and 8, which allow bits formed on the points of each of these click-springs to pass through the shell and engage V-shaped nicks on the interior surface of the printing-ring 73, 74, 75, or 76 with which it is correlated. The ring 73 has thirty-one of these V-shaped notches; the ring 74 has twelve of them; the ring 75 has a number of them corresponding to the number of years indicated thereon, and the ring 76 has as many of these notches as the number of the words "Rec'd" and "Paid" engraved upon it. The click-springs hold the rings of this group with sufficient firmness to prevent their turning in the operation of printing, but not so rigidly as to prevent their being turned to any desired or required position by the hand of the operator applied to their exterior surfaces. They can thus be set to print the hereinbefore-described form of record for any date in any year within the scope of the ring 75.

Another group of seven printing-rings, counting toward the right hand from the rib 72 on the printing-head, are those used for printing amounts deposited, and they are respectively numbered 82, 83, 84, 85, 86, 87, and 88 in Fig. 15. These rings are each formed with internal teeth 88, Fig. 15, the crowns of the teeth being made to bear upon the exterior of the printing-head shell, and slots 89, one slot for each spur-gear, are cut through the shell, which allows a portion of the teeth on each spur-gear 66 to pass through the shell and mesh with the corresponding superimposed printing-ring. The front part of the printing-head being cut away in Fig. 15, only one of the gears 66, which respectively move each one of the rings of this particular group, is shown in the figure; but the order of their arrangement will be more fully understood by the aid of the following description of a third group of six printing-rings, separated from the last-described group by an annular space 90, Fig. 15, and operated in the same way. This third group of rings are those used to print the number of the pass-book on the concealed tape, yet to be described. They are numbered 91, 92, 93, 94, 95, and 96 in Fig. 15, and, except in respect of the arrangement of types engraved on their perimeter, they are exactly like the rings of the second group, previously described. The internal teeth on each ring mesh with the underlying gear 66, which actuates the particular ring. The shafts 62 are arranged at equal radial distances from the axis of the dead-spindle 52, and the rings are arranged in planes at equal lateral distances from each other. A regular curve drawn through the axes of the wheels and intersecting their middle vertical planes would be a helix. The arrangement of the wheels 66, which actuate the rings of the group that prints amounts deposited, and which wheels are in the part of the head cut away in Fig. 15, is precisely analogous to that described for the group of rings which print the number of the pass-book.

Each of the rings 86 to 88, inclusive, has engraved in relief on its perimeter two sets of Arabic figures, to wit, in each set the nine digits and the cipher, each set being in the order "0," "1," "2," "3," "4," "5," "6," "7," "8," "9." Each figure of each set of types thus engraved is arranged on the perimeter of each ring of this group at a point diametrically op-

posite the same figure in the other set on the same ring. Thus the type for the figure "1" in one set is opposite the figure "1" in the other set of figures on the same ring, the figure "2" in one set is opposite the figure "2" in the other set of figures on the same ring, and so on for all the figures. The surfaces of the pass-book page and of the concealed tape being presented to the printing-wheels of this group at diametrically opposite points and being pressed simultaneously against the types on the printing-wheels in that position, as hereinafter explained, it follows that the book cannot be printed without printing the tape, and that if either be printed the other must also be printed, each with the same amount. The ring 82 has engraved on its perimeter twenty of the signs indicating dollars ("$") spaced asunder exactly like the figures on the adjacent ring 83. Stud-pins 97 project laterally from the ring 83, and, entering holes in the ring 82, compel these two rings to move together—that is to say, whenever the ring 83 is moved by the mechanism described, the ring 82 is also moved with it and brings one of the dollar signs into position for printing. The ring 82 might, however, be a fixed ring having only two dollar signs engraved oppositely upon it and set so that these would always print when the machine is operated for printing; but making it movable and distributing the wear upon twenty instead of two of these types is preferred. The rings 83 84 85 of the second group have each engraved thereon one set of the natural series of cardinal Arabic numbers or figures in the order "*," "1," "2," "3," "4," "5," "6," "7," "8," "9," "0," an asterisk preceding the figure "1." These figures are arranged in such manner that the figures will be brought into position for printing in due order by operating the correlated key-slides by the use of the keys successively from "1" to "0," inclusive. In their normal position the zero figures on the rings 86 87 88 and on all the rings of the third group are presented to the tape and pass-book for printing, and in the normal position the asterisks on the rings 83 84 85 are presented. Hence in printing one or more zeros by the rings 86, 87, and 88 only the drop-slides corresponding to significant figures need be operated. Thus, were it required to print the number "900,009" of a pass-book, only the "9"-key on the key-slide connected intermediately with the ring 91 and the "9"-key on the key-slide connected intermediately with the ring 96 would need to be operated to arrange the group to print that number. If the number "9,010" of a pass-book were required to be printed, the "9"-key on the key-slide intermediately connected with the ring 93 and the "1"-key on the key-slide intermediately connected with the ring 96 would be all that need be manipulated. This construction, which makes the zeros print without manipulation, is the same for all of the rings, except 82, 83, and 84, which have each eleven characters to print, as will be presently further explained, and which do not print zero in their normal position. The manipulation of the keys is simplified by making the zeros print in the normal position, but for the three keys named as exceptions this advantage is sacrificed to carry out another purpose yet to be described.

The rings are kept properly spaced from each other by combs 98, Figs. 1, 4, 8, 9, and 15, in which latter figure one of the combs is shown as in a position not corresponding with its position on the other figures for the purpose of showing the comb-teeth, which enter between the rings and hold them separated and in their proper positions. The combs are preferably three in number, and when this number is used they are placed one hundred and twenty degrees apart and fastened by screws at one end to the rib 72 and at the other end to a fixed ring 99, Fig. 15. The function of the latter, besides forming a support for the combs, is to form a lateral face-bearing for the ring 96.

The rings 83 84 85 have engraved upon them in relief an asterisk, succeeded by the figures "1," "2," "3," "4," "5," "6," "7," "8," "9," "0," and are so set that the asterisk prints in the normal position. The key-slides corresponding with these rings have each ten keys, one for each of the significant figures and one for the zero. None of the other key-slides has a zero-key. The manipulation of the key-slides intermediately connected with the rings that print asterisks is the same as that of the others, with the exception that the others need not be operated to print zeros. In printing, the figures presented at the bottom of the rings print the pass-book and those presented at the top print the tape.

The printing mechanism will now be described.

In proper relation with the printing-head are screwed into the bed-plate four stout guide-rods 100, Figs. 1, 4, 8, and 9. A carriage 101, Figs. 1, 4, and 8, slides vertically on these guide rods or posts and carries the platen 103 for holding the pass-book to be printed. The carriage has at each of its four corners a sleeve-bearing 102, Figs. 1, 4, 8, and 9, fitted to the guide-posts in such manner that it may move up or down parallel to itself in all parts of its motion. The top of this carriage is faced off to form a sliding bearing for the platen 103, Figs. 4, 8, and 9, which is supported by and moves up and down with the carriage. The under side of this platen is planed to fit the upper face of the carriage and to slide thereon, as yet to be described. The platen is of considerably greater length than the carriage, and at each end it has a descending projection 104, Figs. 1 and 4. A rod 105, Figs. 1 and 4, is passed through holes bored in line through the downward projections on the platen and through the body of the carriage, and is then fastened

rigidly to the downward projections by a key-pin at one end and a screw-thread and nut on the other, the latter being shown but not numbered in Fig. 1. The rod is fitted to slide easily in the hole bored through the body of the carriage, and this permits the platen to be drawn toward the front to receive the pass-book to be printed and again slid back to the position shown in Figs. 4 and 9, which is the position for printing. The distance to which it can thus be drawn forward is limited by the abutment of the rearward downward projection 104 against the rear of the carriage. (Shown in dotted outline in Fig. 4.) When slid into the position for printing, the motion is also limited by the abutment of the front downward projection 104 against the front of the carriage.

The inking mechanism is attached to and carried by the platen. Attached by screws to opposite sides of the platen are curved supports of steel, 106, Figs. 4 and 9. In the upper parts of these supports are bearings for a rock-shaft 107, to which are attached the rock-levers 108. (Also shown but not numbered on Fig. 1.) These levers rock with the rock-shaft, and thus move simultaneously and equally when actuated, as will presently be explained. A spring 109, Figs. 4 and 9, is attached to one of the curved uprights (in this instance the inner one) and also to the nearest of the pair of rock-levers 108 at a point in advance of the rock-shaft. The action of this spring is to press this pair of rock-levers downward toward the type-rings of the printing-head. The motion this produces is limited by an adjustable screw-stop consisting of a bracket 110, Fig. 4, riveted or otherwise fastened to and projecting forward from one of the curved supports 106 at a little distance below the rock-shaft, and a screw 111, Fig. 4, fitted into the front end of the bracket, upon which screw the under surface of the rock-lever on that side rests when in its lowest position. While the downward motion of the pair of rock-levers is thus limited, the upward motion against the action of the springs is free within the extent which the spring will permit. In the front parts of this pair of rock-levers are bearings for the spindle of an ink-roller 112, Figs. 1, 4, and 9, which inks the types brought to the upper position at the time when the platen 103 is being pushed backward into the printing position.

It is desirable that the inking shall be confined to the types that are to be printed from immediately, and as in the general operation of the machine the types are brought into position before the platen 103 is pushed back to the position for printing, it is necessary, in order to prevent inking types when the platen is pulled forward to the position for receiving the book, that during this latter motion the inking-rolls shall be held away from the types. To effect this, a spring-dog 114, Fig. 4, is attached to the spindle of the ink-roller and so constructed and adjusted that when the platen and its attachments are pulled toward the front the dog slides upon the top of the fixed ring 99, Fig. 15, and pushes the ink-roll away from the type. From the rear side of said dog 114, Figs. 5 and 6, projects a small arm 114^a, whose motion is limited by the stop-pin 114^b, inserted in the side of the rocker-arm 108, to which the ink-roller is pivoted. The dog rocks freely on the journal of the ink-roller. The arm 114^a is engaged by a wire spring 114^c and pressed toward the stop-pin 114^b, against which said arm abuts at all times except when the ink-roller is passing over the types in the direction indicated by the arrow in Fig. 6. When moving in the opposite direction, which it does when the platen is moving forward into the position for taking out the book just printed and for receiving another book to be printed, the dog 114 takes the position shown in Fig. 5, holding the inking-roll away from the types, over which it passes without inking them. The inking is, therefore, performed only during the rearward movement of the platen. I do not confine myself to any particular way of fastening the spring 114^c to the rocker-arm 108; but in this instance I have used pins 114^d, around which the spring is coiled, as shown in both Figs. 5 and 6. The construction of the dog, spring, and stop on the lower rocker-arm 118 of the lower ink-roller 115, Fig. 5, is substantially the same described for these parts on the rocker-arm 108 in Fig. 6, and therefore needs no further description. When the platen is pushed back into the position for printing, this dog, being free to swing toward the front, does not push the roll away, but permits it to roll over the surface of the types and ink them. This ink-roll 112, as also another one yet to be described, is made of felt, and is charged with good stamping-ink—that is, ink of the kind used in stamping figures and dates upon checks, documents, &c., with metal types. The lower types are inked by the ink-roll 115, Fig. 4, which is mounted on rock-levers 118 exactly like the roll 112, and has a spring-dog 116 exactly like that described for roll 112, which holds the roll away from the types when the platen is pulled forward. It also has an adjustable stop 117, Fig. 4, like that marked 110 and 111 in the same figure and already described. As the motion of this pair of rock-levers when pushed away from the types by the dog is in an opposite direction from that of the upper pair, both the dog 116 and the stop 117 have their position reversed as compared with the positions of the dog 114 and the stop 110 and 111. The spring which rocks the levers 118 toward the types is, however, differently attached. The outer one of this pair has a rearward extension 119, with an eyehole into which the spring 121 being hooked, the latter is also hooked at the other end onto a pin 120 inserted into the rear end of the platen.

From the front end of the platen project

two opposite lugs 122, Figs. 1, 4, and 9, to which is attached a handle 123, of suitable material, as wood, bone, or ivory, which the operator grasps in sliding in or pulling out the platen when operating the machine.

To the left longitudinal margin of the upper face of the platen is attached, by screws, rivets, or brazing, a straight metal rib or guide 124, Figs. 4 and 9, against which the left edge of the pass-book is made to bear when printing. This insures accurate horizontal alinement on the page of the printed dates and figures representing amounts deposited. There are also curved spring-plates attached to the upper face of the platen, which perform the double function of holding the book to be printed firmly down upon the platen and also of gages for position, which enables the operator to quickly, yet with sufficient accuracy, place the book in the proper position to secure the needed uniformity of spaces between the successively printed lines. One of these springs 125, Figs. 4 and 9, is attached by screws to an upward projection 126, Fig. 9, formed on the platen, and it extends toward the front from the line of types that print to a distance equal to the desired distance between the printed lines after they are printed, so that when the book is placed on the platen, if the last printed line be pushed under the spring till it is just hidden from view, the next line printed will be at the proper uniform distance from the last one previously printed. Near the front end of the platen are bolted two brackets 127, Figs. 1, 4, and 9, to the rear faces of which are attached the bent spring-plate 128, Figs. 1, 4, and 9, the rear margin of which presses downward upon the platen or upon the book when slid under it upon the platen. The rear edge of this plate is placed at a distance from the front edge of the plate 125 equal to twice the desired distance or space between the printed lines. If, therefore, the pages of the book be ruled with uniform distances between the ruled lines equal to the desired distances between the printed lines, and the book to be printed be slid under the plate 128 till the line next below where it is desired to print is brought flush with the rear edge of the plate, the book will be in the proper position for printing, provided its left margin be also pressed against the longitudinal guide 124, previously described. It will be more convenient to call these spring-plates book-holders in further referring to them. The inner or right-hand corner of the front edge of the rear book-holder 125 and the right-hand corner of the rear edge of the front book-holder are bent upward a little, so that these corners do not bear upon the platen. When, therefore, the platen is drawn toward the front as far as it can be, the operator, holding the pass-book in his right hand by its right margin, can with a single movement slide the book under the book-holders, and almost simultaneously bring the book into position for printing. After printing, the platen being pulled toward the front as far as it can be, the operator takes hold of the book at its right-hand margin with his right hand and slips the book out toward the right, and then may hand it immediately to the depositor.

I have found that the front book-holder is alone sufficient both as guide and holder. The printing is, however, perhaps somewhat more perfect when both are used, and hence it is preferred to use both.

The carriage 101, upon which the platen 103 slides, has downwardly-projecting lugs 113, Figs. 1, 4, and 8. A link 130, pivoted to the lugs 113, connects the platen with the front end of a rock-lever 129, Figs 4 and 8, to which the link 130 is also pivoted. When the rock-lever is operated as hereinafter described, it operates the carriage to move it and the platen supported by it toward and away from the types for printing the pass-book. A similar rock-lever 131, Figs. 4 and 8, carries the tape-box 132 and its mechanism. (Shown in the same figures.)

The body of the tape-box is preferably made of a single piece of cast-iron with downwardly-projecting sliding bearings 133, Figs. 1, 4, 4A, and 8, fitted to slide on the guide-posts 100 in the same way as described for the sliding bearings of the platen-carriage. These sliding bearings are connected by a plate 134, Fig. 4A, cast in one piece with the sliding bearings, which plate forms the bottom of the tape-box. On the upper side of this plate are cast in one piece with the plate three sides of a rectangular box. The upper part of this box is, when in use, covered partly by a plate 135, Figs. 4 and 4A, which extends toward the front a little way, and the rest is covered and closed by a detachable metal cover 136. (Shown in side elevation in Figs. 4 and 8, and partly broken away in Fig. 1 to show the interior from the front.) Fig. 4A represents the tape-box with the cover removed in order to show the spools which carry the tape and the mechanism in the box for feeding along the tape when it is printed. From the rear of the box extend continuations 137 of the sides to the rear sliding sleeve-bearings. Between these continuations are cast on the plate lugs 138, Figs. 4, 4A, and 8, to which a link 139 is pivoted. This link is also pivoted to the rock-lever 131, which moves the entire box and its appurtenances up and down in printing the tape.

The cover 136 is accurately fitted to the front edges and top edges of the sides 132 of the box, and the back edge of the cover is fitted into a groove cut under the solid part 135, as shown in Figs. 4 and 8 at 140. The front part of the cover is also closely fitted to the front projecting part of the plate 134. A hole is bored through both the cover and the plate at this front part, and a bolt 141, Figs. 4 and 4A, is inserted through the bottom of the tape-box, as shown in Fig. 4.

This bolt is the size of the hole where it passes through the bottom plate, but above this it is flattened into a tongue fitted to a slot formed in the front part of the cover, as shown in Fig. 4ª. This tongue protrudes somewhat above the cover and has formed in it an eye 142, Fig. 4, for the application of a padlock 143.

When the cover is placed in position and the padlock is applied and locked, no access to the interior of the box can be had without breaking open the box or picking the lock. A slot 144 (shown in dotted outline in Figs. 1, 4, and 8) is formed in and extends across the bottom plate between the sides 132 of the box. Another slot 145 (shown in dotted outline in Figs. 4 and 8) is formed through the bottom plate. Through these slots the tape is fed out of the box, over the printing-roll 149, and into the box again, in the direction indicated by the arrows in Fig. 4, being unwound from the spool 146 onto the spool 147, the edge of the tape being indicated by a dotted line in Fig. 4 and the tape numbered 148 in Fig. 1. The tape is made of suitable paper of the proper width to suit the spools, this width being sufficient to span the type-rings which print amounts paid or deposited and the number of the book to which such amount is to be credited. The date being written or stamped each day on the tape, the amounts deposited and the numbers of the books are all that need to be printed on it for that day, and an example of the printing would read as follows, to wit: "$ * * 49.50; 333,465;" the last group of six figures being the number of the book and the first group being the amount deposited and simultaneously printed on the pass-book.

In the opposite sides of the box are cut vertical slots 150 and 151 for receiving the spindles of the spools, so that they can be placed in the tape-box when the cover 136 is removed. Each spool has a central metal spindle or axis, that of the spool 146 being fixed in the spool, while that of the take-up spool 147 may be slipped out of and put into it again, and so that the body of the spool may turn on the spindle. The spindle of the supply-spool (from which spool the tape is unwound as wanted) is shown at 152, Figs. 4, 7, and 4ª, and the spindle of the take-up spool is shown at 153 in the same drawings. The lower parts of the slots 151 are made half round to furnish a bearing for the rock-spindle 153. The fixed spindle 152 does not exactly rest in the bottom of the slots 152, although it so nearly touches the bottom as to appear as touching it in the drawings. A V-shaped bearing 154 is attached by rivets to the inside of the box on each side thereof, as shown in Figs. 4 and 4ª, upon which the periphery of the spool bears, and the function of the spindle 152 is merely to maintain parallelism between the axis of the supply-spool and that of the take-up spool. This construction furnishes the necessary friction to give tension to the tape and cause it to draw tightly and smoothly over the printing-roll 149. On its way from the supply-spool to the printing-spool the tape passes over two rods 155, Figs. 4 and 4ª. These rods are each of uniform diameter throughout their length, and their axes are parallel with the axes of the spools.

The printing-roll is preferably made of metal clothed with a sheathing of elastic india-rubber, but it may be a wooden roll, if desired. It turns on a spindle having bearings in opposite lugs 156, Fig. 8, and also shown but not numbered in Fig. 4. It is thus turned by the friction of the tape, which passes over it and acts like a belt on a pulley. The tape is caused to feed off from the supply-spool onto the take-up spool, while the printing-roll is lifted away from the printing-head, and it is perfectly at rest as regards this feed motion at the instant when the impression of the types is made upon it. The mechanism whereby this is effected is as follows: To the spindle 153 of the take-up spool 147, Figs. 4, 4ª, and 8, are keyed an outside rocker-arm 156 and an inside rocker-arm 157, the latter being shown only in Figs. 4, 7, and 4ª. To the end of the rocker-arm 157 is attached a spring-pawl or a gravity pawl 158 that engages the teeth of a ratchet-wheel which is attached to the end of the spool 147 at such distance from the rocker-arm 156 that when the spindle is placed in the slot 151 the ratchet-wheel may go inside of the box, while the rocker-arm 156 takes its proper position outside and the rocker-arm 157 takes a position on the inside of the box between the side of the box and the ratchet-wheel, all as shown in Fig. 4ª. A gravity holding-pawl 159, pivoted to the inside of the box, Figs. 4, 4ª, and 7, also engages the ratchet-wheel teeth to prevent this wheel from turning in the direction opposite that indicated by the arrows. To the top of the front and left-hand guide-post 100 is rigidly attached a horizontal bent steel arm 160, Figs. 1, 4, 4ª, and 8. A stud-pin projects laterally from this arm and enters into a slot formed longitudinally in the rocker-arm 156. When the tape-box is lifted after printing, the action of this mechanism turns the ratchet-wheel in the direction indicated by the arrows. When the box is moved downward again for printing, the gravity pawl 159 prevents the spool from turning, while the pawl 158 slips over and takes up another tooth. Thus the tape is fed along the desired space at each upward movement of the tape-box.

The simultaneous movement of the platen-carriage, its attached mechanism, and the tape-box, with its attachments, toward and away from the printing-head is effected as follows: Housings 161, Figs. 1, 9, 10, and 13, bolted to the bed-plate 18, contain bored bearings for the shafts 162, 163, 164, and 165. Upon the shaft 162, which is the crank-shaft, is keyed a pinion 166. This meshes into a spur-gear 167, keyed to the shaft 163, which is a cam-shaft, carrying a series of cams, hereinafter described. Spur-gear 167 meshes into

another spur-gear 168, which is an idle-wheel keyed to the shaft 164. Idle-gear 168 meshes into the spur-gear 169 on the printing-shaft 165. A detachable crank 170, Figs. 1 and 9, is fitted to the right-hand end of the crank-shaft 162. A pawl 171 is pivoted to a boss on the inner face of the right-hand housing and arranged to engage the teeth of the idle-wheel 164, and thus prevent the entire system of gearing from turning, except in one direction, that indicated by the arrows in Figs. 10 and 13. The adjustment of the gears fast to shafts in proper relation to the printing-shaft makes it convenient to have an idle-wheel that takes when required a different position relative to its two related gears and which will mesh in any position with said related gears. As the hardened and tempered pawl which prevents the rearward movement of the series of gearing engages the idle-wheel always in definite positions, if no provision were made for changing the engagement it would after some use wear the particular tooth of the idle-wheel which it engages, this wheel being of cast-iron. For this and for convenience of access and for easy disengagement of the pawl in adjusting the machine it is necessary to turn the gears in a direction opposite to that in which they normally turn in use. The pawl is, therefore, pivoted to the housing and made to engage with the upper part of the idle-wheel, so that the latter may be disengaged by sliding on its shaft, and the pawl can thus be made to engage with any other tooth. At the same time the pawl is in a convenient position to be disengaged in the adjustment, as aforesaid. While pawls engaging with ratchets for stopping retrograde movements are common, it is not usual to make a pawl engage with the teeth of a spur-gear for this purpose, and the introduction into a system of spur-gearing of a special idle-wheel engaged by a pawl which enables the position of engagement to be shifted with reference to the teeth engaged by the pawl without disturbing the relations of position between other parts of the system is, as I believe, a new feature. The printing-shaft 165 has bearings in both housings, and also an outer bearing 176, Fig. 9, in a housing 177, Figs. 4, 8, and 9, which is bolted to the bed-plate. In this housing are also inserted stud-bearings 178 and 179, which are respectively the fulcrums of the rock-levers 129 and 131, hereinbefore described. On the left extremity of the printing-shaft is keyed an eccentric 180. In the face of this eccentric is inserted a crank-pin. To this crank-pin is fitted one end of a link 181. The other end of this link is flexibly joined to the inner ends of toggles 182 and 183, and also to the upper end of the oscillating link 184. The lower end of link 184 turns on a stud-bearing 185 inserted in the housing, as shown in Figs. 4, 8, and 9. The outer extremities of toggles 182 and 183 are pivoted to adjustable bearings 186 and 187, fitted to clamp in the furcated rear ends of the rock-levers 129 and 131. This mechanism, therefore, constitutes a linkage system whereby the rock-levers 129 and 131 are rocked on their fulcrums to simultaneously move the platen-carriage 101, with its attachments, and the tape-box 132, with its attachments, alternately toward and from the printing-head when the shaft 165 is turned by turning the crank 170. The spur-gears 167 and 169 have each the same diameter and the same number of teeth, and therefore turn with the same circumferential velocity. The pinion 166 on the crank-shaft has only one-third the number of teeth that the gear 167 has, and hence it requires three turns of the crank to turn the cam-shaft 163 and simultaneously the printing-shaft 165 through one revolution, and thus to cause the platen-carriage and tape-box to move once toward and then once away from the printing-head.

As there is necessarily some lost motion or backlash in communicating motion through the mechanism hereinbefore described from the drop-slides to the type-rings, mechanism for automatically alining the type-rings is supplied, as follows:

The types on the rings being first brought into accurate alinement while the rings are bunched on a mandrel, a rectangular notch 188 (shown in dotted outline in Figs. 4 and 8 and in full outline in Fig. 8*) is milled in the perimeter of each ring by cutting across the perimeter of the entire bunch between each two adjacent rows of types on the bunched rings, so that after this operation if the notches are alined the types are also alined. These notches are cut in such position between the types that the straight edge of a reciprocating alining-plate 189, Figs. 4, 8, 8*, and 9, entering therein forces the rings all into the position of alinement. The front edge of the plate is chamfered off, so that it may enter the notches before the parallel sides enter, in order that it may enter freely. This feature is indicated in dotted outline in Figs. 4 and 8, but better in Fig. 8*, which represents a side view of portions of one of the printing-rings and of the alining-plate. This plate reciprocates in a box 189[a], Figs. 4, 8, and 9, which is attached by screws to the rib or flange 72 on the printing-head and to the fixed ring 99. The reciprocation is effected once for every turn of the printing-shaft by the eccentric 180, which also performs the function of a crank-wheel for driving the rock-levers 129 and 131. The motion of the eccentric is converted into reciprocation by means of an eccentric-rod and ring 190, Figs. 4, 8, and 9, the ring being fitted to the eccentric against a shoulder, as shown in Fig. 9. The eccentric is so adjusted that it causes the front margin of the alining-plate to enter fully into the notches in the type-rings just before the impression of the tape and the pass-book against the types, and so that at the instant of printing the types are exactly alined, and so that it will be withdrawn again before beginning the restora-

tion of the type-rings to their normal positions.

The rock-levers 129 and 131 may, if desired, be connected by a spring 191, Figs. 4 and 8, placed in front of their fulcrums. This spring will assist in drawing the printing-levers together. Also by leaving some play in the bearings 178 this construction permits the platen-carriage to automatically adjust its motion to printing books of different thicknesses.

To obtain a sufficient variation in the amplitude of the reciprocatory motion of the platen-carriage, platen, and book-holder, without any material difference in the force of the impression upon the book and types, the spring 191 should have a considerable length. It should also have tension enough to hold the bearing of said rock-lever up against the bottom of the stud-pin which is its fulcrum, so that in printing upon the minimum thickness the slackness left in this bearing is retained wholly upon the upper side of said stud-pin. The upper end of the spring 191 might also be attached to a stud in the front side of the upper part of the housing 177; but, as I believe myself to be the first in the art to have devised mechanism for automatic and successive regulation of the amplitude of motion in reciprocatory mechanism for impressing a platen supporting a book or parts of books of very different thicknesses upon types in printing without materially affecting the force of the impression, I desire to claim this feature broadly without restricting myself to the precise mechanism herein described for effecting such regulation.

As the drop-slides and the type-rings have a positive connection, it follows that what restores the drop-slides to normal position will also restore the type-rings to normal position. This is effected after the printing is done on the pass-book by mechanism now to be described.

The impression upon both book and tape occurs simultaneously at about the half-revolution of the printing-shaft, and the restoration to normal position is effected during the few degrees of revolution before the complete turn is effected and the crank comes to a full stop.

Extending toward the front from the rock-shaft 166^a, Figs. 9 and 10, are two stout rocker-arms 192, Figs. 9, 10, and 13, keyed to the shaft. These arms are parallel to each other both in their horizontal and vertical planes. To their front extremities is rigidly attached a horizontal bar 193, which when lifted by the rocker-arms moves parallelly to itself under the rearward projections of the entire range of drop-slides, its lowest position being shown in full outline in Figs. 10 and 13 and its highest position (that at the time it has restored the drop-slides to normal position) being shown in dotted outline in Fig. 10. In taking the latter position it lifts into normal position all the drop-slides that are not in that position, no matter what position they may be in before lifting. I therefore call this bar the "lifting-bar" and the rock-shaft 166^a, with all its appurtenances, the "lifter." To the rock-shaft 166^a is rigidly attached a rock-lever 194. The upper extremity of this rock-lever is furcated, and in the furcated end is pivoted a friction-roller 195, Figs. 9 and 10. To the cam-shaft 163 is rigidly keyed a tappet-arm 196, which once in every revolution of the cam-shaft 163 engages the roller at the end of the rock-lever, and thus operates the lifter. The cam-shaft turns simultaneously with the printing-shaft and makes the same number of turns. Hence the tappet-arm 196 can be adjusted to begin actuating the lifter at any desired point of the revolution of the printing-shaft. In use the tappet-arm is so set as to begin the lift a little before the revolution is completed to complete the lift just before the revolution is finished and to drop again to its lowest position at or near the time when the crank-shaft is locked at the end of the third turn of the crank. The lifter when released from its engagement from the tappet-arm falls by gravity. A buffer or cushion 198, of felt or other suitable material, under each arm 192 receives it and deadens the noise these arms would otherwise make in falling upon the bed-plate.

The locking device is shown in plan in Fig. 9, partly in Fig. 1, and in detail in Fig. 2. A hook 199 is fitted to swing easily on the crank-shaft 162 and engage a lug 200, attached to the outside face of the cam-shaft gear 167. The gear 167 is so adjusted on its shaft before keying it fast that the hook engages the lug immediately after the disengagement of the rock-lever 194 from the tappet-arm 196. This stops the turning of the crank, and, as the pawl 171, engaging the teeth of the idle-wheel 168, prevents the crank from turning backward, no further motion of the crank is possible in either direction until the hook is released from its engagement with the lug. The part of the hook that engages the lug hangs downward from the shaft 162, the hook being so poised that it naturally takes this position. To a small upward projection 201 from the top of the hook 199 is attached a rod 202, Figs. 1, 2, and 9, which extends toward the front of the machine, protruding a little way through the glass case (not shown) that incloses all the parts except the printing mechanism on the left-hand side of the machine. The protruding end of the rod may be furnished with a push-button. The operator, standing or sitting in front of the keyboard, presses with the thumb of his left hand upon the protruding end of the rod at the instant he desires to turn the crank for printing. This pressure swings the top of the hook rearward and the bottom forward in such manner as to disengage the hook from the lug 200. A very slight movement of the crank changes the position of the lug 200, so that the hook

and lug will not reëngage till the wheel 167 has completed one revolution. Meanwhile, the operator having moved his thumb from the end of the rod 202, the parts are free to reëngage automatically when the wheel 167 has made a complete turn, and thus limit the number of turns which the crank 170 and its shaft 162 can make before stopping.

The adding mechanism by which each amount printed upon the pass-book and the tape is added to the total amount previously so printed is mounted on a supporting-bridge 203, Figs. 9 and 10, this bridge being bolted to the upper margins of the housings 161, hereinbefore described. As this register is adapted to use in other machines, and therefore a proper subject for a separate application for Letters Patent, I shall describe it here no further than is necessary to show how it is combined with other parts of the machine.

Different constructions of adding mechanism may be used, but it is essential to my invention that, whatever kind of adding mechanism be used, it shall be correlated with the printing mechanism in such manner as to add to the total previously deposited only the amounts printed at any one time, and so that, while the mechanism that controls the setting of the types may act independently of the adding mechanism in order that errors in setting may be corrected, the adding mechanism must depend upon the mechanism that sets the types for the control of its action. In other words, it must add only when the printing is done, and must add only the amounts which the type-wheels are set to print at the instant the adding mechanism begins to act.

The general character of this adding mechanism is as follows: A set of indicating or figure wheels 204, mounted on a spindle, as shown but not numbered in Fig. 9, is each fitted to turn easily on said spindle and are driven by a ratchet-and-pawl mechanism, except five thinner wheels 205, Fig. 17, which are driven by carrying mechanism only. Each of the wheels 204, except the units-wheel, may be also driven by the carrying mechanism as well as by the ratchet mechanism in such manner that when any one of them makes a complete revolution it will, during the last thirty-six degrees of such revolution, move the next wheel in order through thirty-six degrees, or through one-tenth of a revolution.

It is not necessary for the purposes of this application to minutely describe this carrying mechanism. Several carrying mechanisms exist, each of which will answer the purpose. All that would be needed to adapt such a register to the machine I have described would be to supply mechanism for actuating the pawl mechanism in proper relation with the mechanism for setting the type-rings into the printing position. The mechanism I employ for this purpose is a series of rock-levers and cams, which I will now describe.

The cams are shown at 206, Figs. 10 and 13. Supported by bearings in the front and lower parts of the register-housings is a stout fixed spindle 207, Figs. 4, 10, 13, and 18, to which are fitted a set of bent rock-levers 208, Figs. 1, 4, 9, 10, 13, and 18. The fixed spindle 207 is the fulcrum of these levers, each of which is a lever of the first order. Each of these levers has a friction-roller 209, Figs. 4, 10, and 13, at the end of its shorter arm, which roller bears against the perimeter of the cam which operates it while it is so operated, and also when the levers are in the normal position. (Shown in Figs. 1, 4, 9, and 10.) The longer arm of each lever terminates in a finger 209ª, which in the normal position rests upon the upper end of the drop-slide correlated with it, as shown in Figs. 1, 4, 9, and 10, and in dotted outline in Fig. 13. By examining these figures with reference to the normal position it will be seen that in this position the friction-rollers 209 bear against those parts of the perimeters of the cams which are concentric with the cam-shafts, these parts being portions of true circles described from the center of the cam-shaft 163. The cams 206 are all keyed to the shaft 163 and turn with it when the crank 170 is turned during the act of printing, the cam-shaft making one turn to each three of the crank, as already explained. It will also be seen that in the normal position the rock-levers 208 will remain at rest when the drop-slides are operated to let them fall, and that the motion upward of their longer arms is entirely independent of that of the drop-slides. The longer arm of each of these levers is weighted in casting, so that it overbalances the weight of the shorter arm, and when not opposed either by the correlated cam or by its correlated drop-slide such longer arm falls by gravity, holding the friction-roller of the shorter arm against the perimeter of the cam. When, however, the drop-slide is allowed to remain in its normal position, the correlated rock-lever does not move to operate the register, no matter how much the cam-shaft may be turned. Also, when the drop-slide corresponding with any one of these rock-levers is, by the operation of its correlated key-slide, arrested in its fall before it has moved through the entire possible distance it could fall were it not arrested by the drop-slide, that is to say, a distance equal to the total rise of the ten steps on the drop-slide, the long arm of the rock-lever can fall only till the end of the finger rests on the top of the drop-slide. Thus, when the longer arm is moving downward its motion is independent of its correlated drop-slide, except when the latter acts as a stop to limit such downward movement; and as the cam operating this lever to restore it to its normal position can only lift the longer arm back through the distance it falls, the drop-slide, without either any direct or indirect positive connection with the lever or cam, yet limits the motion

which the cam can impart to the lever. Thus, if the drop-slide falls into the "1" position the long arm of the lever will fall a distance corresponding to that when the cam-shaft moves enough to let it fall. If the drop-slide fall to any other of the stated positions corresponding to any position of the key-slide, the longer arm of the lever when the cam is turned will fall till arrested by the drop-slide, and the cam will move it again to the normal position. The peripheries of the cams are laid out so that this rocking or oscillation of all of the levers is effected in a single revolution of the cam, and the cams are so set on the shaft that the lifting of the longer arms of the rock-levers is successive, each being completely lifted to the normal position and held there by the concentric part of the perimeter of the cam before another is lifted. This lifting, when a properly-constructed register is employed, may be either successive from right to left or from left to right. It only needs to be successive and complete for each one of the levers in either direction, in order that when the carrying mechanism acts between any two or more figure-wheels of the register only one lever shall be in motion. The cutting of the cams may be to any outline that will when the crank is turned to its limit—three turns—allow all the cams to act as described, and will resist the falling of the levers enough to prevent their striking the tops of the drop-slides with such force as to cause undue noise and wear. The drop-slides limit the downward motion of the long arms of the levers; but, to prevent these arms from moving too far upward by their own momentum, as they are not positively connected with the cams, a stop-bar is employed, against which they may abut when they reach the normal position, but it has been found preferable to make the shorter arms of the levers bring up against the crank-shaft 162 at the normal position, which effects the same result. This shaft is, therefore, a stop-bar for the levers as regards this function.

It has been explained that when in the normal position the type-wheels connected with the last three drop-slides on the left side of the keyboard print asterisks. As the rock-levers actuating the register cannot move when the drop-slides are in normal position, nothing is added to the previous total by any rock-lever whose correlated drop-slide is in the normal position; and hence when asterisks are printed by the said type-rings nothing is added to the previous total; but when the key-slides corresponding with these three type-rings are drawn out so that their correlated drop-slides fall through a total distance of ten times the rise of each step on said drop-slides, the type-rings connected with these drop-slides print zeros. It is necessary, therefore, that nothing be added to the previous total by reason of these key-slides and drop-slides taking this tenth position. To prevent such addition, it is necessary to inhibit the motion of the rock-levers correlated with these drop-slides whenever they take such position. To effect this, there is pivoted on the back side of each of the three left-hand drop-slide guides a rocking latch-bar 211. (Partly shown but not numbered in Fig. 1, and numbered in Figs. 4, 8, 10, and 14, the latter being an enlarged detail in rear elevation.) These latch-bars play on pivots 212, Fig. 14, inserted in the rear faces of the drop-slide guides 33. Near the top of each of these rocking latch-bars is formed, on the side next the drop-slide, an inclined plane 213, and near the bottom of each is formed, on the same side, another inclined plane 214. These inclined planes both incline toward the longitudinal axis of the latch-bar. To the rearward projection from the upper part of the drop-slide is attached a double inclined plane 215. The upper inclined face of the double inclined plane engages the inclined plane 213 on the latch-bar when the drop-slide is in the highest position, as shown in Fig. 14 on the drop-slide at the left, and forces the latch-bar into a vertical position. When the drop-slide is permitted to fall into its lowest position, the lower inclined face of the double inclined plane 215 engages the inclined face 214 and forces it into the inclined position, (shown in Fig. 14 on the drop-slide at the right,) the positions of these parts being so related to each other as to produce the effect described. When the latch-bar is in the vertical position—its normal position—it offers no obstruction to the action of the corresponding rock-lever, and the finger 209^a on the rock-lever passes freely down between the drop-slide guides 33 till it rests on the top of the drop-slide, as previously described, and, as the double inclined plane does not act till the drop-slide has fallen through a distance equal to the total rise of nine steps, the position of the rocking latch-bar remains vertical until the drop-slide falls to take the tenth position. As the first nine positions correspond successively to the nine digits in their order on the figure-wheels of the register, it follows that for each or any of these positions the rock-levers 208 work freely to operate the register, as will soon be described; but when either of the three drop-slides corresponding to the type-wheels that print asterisks drops into the tenth position the rocking latch-bar correlated with it assumes the inclined position shown at the right in Fig. 14, and the upper end of the bar is brought into engagement with a notch formed in the finger 209^a, and in this position the corresponding rock-lever can move neither up nor down, and hence becomes inactive in moving the part of the register it is intended to actuate when moving freely. As none of the rock-levers 208 can move when the drop-slides are in normal position, none of the rock-levers can then actuate the register, and as the type-wheels connected with the three drop-slides at the left of the keyboard in their normal position

print asterisks, no registering is done when asterisks only are printed by them; and as in their tenth position the type-wheels connected with these slides print zeros, no registering takes place when only zeros are printed, and no registering is done by any rock-lever 208 when the type-wheel connected with it prints either zeros or an asterisk, but each actuates its corresponding figure-wheel when the type-wheel connected with it prints any significant figure, and adds the amount, whether units, tens, hundreds, or thousands of cents or of dollars—corresponding with the figure printed—to the grand total previously registered.

As the register is not included in the present application for patent, it only remains to show the means whereby the rock-levers 208 actuate their respective figure-wheels by their upward and downward motion. On the rear side of each of these rock-levers is formed an extension on which is cut concentrically with the center of the shaft 207 a segmental gear 217, Figs. 10 and 13. This gear meshes into another segmental gear on a rock-lever 218, Figs. 10 and 13, carrying a pawl that engages the teeth of a gear, which in turn meshes with a pinion keyed to the figure-wheel 204 of the register. The teeth of these gears are so cut as to number and pitch that a movement of any one of the rock-levers 208 through a distance corresponding with the rise of one step on the drop-slide causes the pawl to move the wheel it engages two teeth, and this movement turns the figure-wheel connected with the wheel moved by the pawl through one-tenth of its circumference. When the rock-lever moves a distance corresponding with a rise of two steps of the drop-slide, it moves its figure-wheel through two-tenths of a revolution, and so on. The figures are marked on the figure-wheels in due order, so that when any figure-wheel has turned through its entire circumference it brings the figure zero up to a lining-bar, Fig. 18, (which bar is shown removed from its position on the register,) and through the carrying mechanism, previously referred to, but not described, it moves the wheel representing the next higher denomination in the decimal system of rotation through one-tenth of a revolution.

The operation of the machine is as follows: The receiving-teller takes the pass-book and money of the depositor and counts the money, comparing it with the ticket handed in at the same time, on which ticket is written the amount the depositor wishes to place to his credit. If the amount be found correct as stated on the ticket, the teller then operates the keys corresponding with the amount named and counted, and also the keys corresponding with the number of the depositor's book. Next he places the book on the platen, as hereinbefore described, and slides the platen into the position for printing. He then turns the crank on the printing-shaft three times, draws the platen to the front, and, lastly, returns the book to the depositor. He is then ready to receive another deposit, which he records in like manner.

Many of the specific constructions herein described may be much varied without departing from the spirit of my invention. Any positive connection that will impart rotary motion to the rings by the vertical movement of the drop-slides would be the mechanical equivalent of the said link for the purposes of moving the type-ring correlated with that particular drop-slide. The essential feature of this part of the mechanism is that there should be a positive connection between the drop-slide and its correlated type-ring, so that a longitudinal movement of any one of the slides shall produce rotary motion of the type-ring connected with it when the latter is placed and operated at a lateral distance away from such drop-slide. Weights, pulleys, and cords might replace most of the springs.

The crank for operating the printing and registering mechanism may be placed in any convenient position other than that shown and described, intermediate gearing or other mechanism being used to transmit its motion to the cam-shaft and printing-shaft.

The precise construction of the key-slides and drop-slides herein described may be varied to a considerable extent so long as their functions remain as herein described. Instead of the spiders 54, with friction-rollers at the extremities, a hollow drum with slots cut in after the manner of the drum which supports the type-rings of the printing-head may be employed, and the outer perimeters of the rings could then bear upon the interior of this drum concentrically with the axis of the printing-head and the type-rings, any mechanism thus supporting them and leaving them free to rotate about such axis being, for the purposes of this machine, the mechanical equivalent of said spiders and friction-rollers.

What I claim is—

1. The combination of movable type wheels or rings, a support therefor a keyboard provided with stops for key-pawls and ribs for separating and guiding the key-slides, the key-slides, one for each type-wheel, all of them arranged to act in a single plane, and each having consecutively arranged keys provided with tilting key-pawls pivoted to the key-slides, key-buttons attached to the key-pawls, pawl-springs attached to the key-pawls, and springs, 22, attached to the key-slides and to the keyboard substantially as and for the purposes set forth.

2. The combination with the transversely-grooved keyboard and the key-slides having one or more tilting keys pivoted thereto and springs for holding said keys in their normal or inoperative positions relative with said keyboard and key-slides, said keys also having key-pawls for engaging the front side of the grooves on the keyboard and key-buttons attached to shanks or stems extending upwardly

from the key-pawls, all substantially as herein described, of a spring attached to each key-slide and also to said keyboard for restoring the key-slide and parts supported by it to their normal positions, a ratchet, 29, and pawl, 30, for retaining the key-slide and its attachments in any one of its specific numerical positions, substantially as and for the purposes set forth.

3. The key-slides, each having the general form of a rectangular parallelepiped with one side removed, and having tilting key-pawls pivoted thereto with shanks protruding through holes in the upper side of the slide, a tang, 3, extending downward at the front end with an attachment for a spring, and a block, 4, of steel or other suitable material fitted and attached to the rear end, substantially as and for purposes described.

4. In combination with the key-slides, each having key mechanism for stopping and holding it in a definite position when operated by its key, stepped drop-slides, 36, each positively connected with a correlated printing-ring or type-wheel, for actuating said ring, and drop-slide guides, 33, each drop-slide being also correlated with a separate particular key-slide, and the steps on each of the drop-slides being respectively and successively correlated with the successive definite numerical positions of its corresponding key-slide, and movable type wheels or rings successively and respectively correlated with said drop-slides and key-slides, substantially as and for purposes specified.

5. The combination with each of the key-slides having key mechanism positively attached thereto and a spring, 22, for restoring the slide and its attached keys to their first or normal position, and with the corresponding drop-slide, the block, 4, the ratchet, 29, on the under side of the block, 4, the pawl, 30, pivoted to the keyboard, and the toe, or lifting-tappet, 42, substantially as and for the purposes explained.

6. The combination with a printing-head composed of a fixed barrel or drum, movable type rings or wheels having diametrically-arranged duplicate types, the combs, 98, for holding the type-rings in specific lateral relation, a reciprocatory book-holder on one side of the head, and a reciprocatory tape-box containing a concealed tape and tape-feeding mechanism on the side of the head opposite that of the book-holder, of mechanism for bringing any of the types on the type-rings into position for printing, and mechanism for impressing diametrically upon the types in the position for printing a book or sheet on one side and a concealed tape on the other, substantially as described and for the purposes set forth.

7. The combination of a fixed, slotted shell, barrel, or drum, 69, type-rings having internal teeth fitted to slide and revolve upon the periphery of said shell, barrel, or drum, shafts, 62, pinions, 65, spur-gears, 66, fixed spiders, 54, and their friction-rollers, dead-spindle, 52, and its supports, internally-toothed wheels or rings, 48, fitted to bear and revolve upon said friction-rollers, drop-slides, drop-slide guides, and a positive connection between each drop-slide and its correlated type-ring, 48, substantially as and for purposes specified.

8. In a printing-head, having type-rings with duplicate types placed diametrically for printing therewith on opposite sides, the adjustable rings for printing dates and other matter, said rings being internally notched as described, the combination therewith of said adjustable rings, a barrel or drum having apertures through its wall or shell under said rings, and curved springs attached to the interior of the shell or barrel and having bits fitted through said apertures for engaging the notches in said adjustable date-rings for holding types on said date-rings in fixed alinement with the lines of the printing positions of types of the rings having the diametrically-arranged duplicate types, substantially as and for the purposes specified.

9. The combination with the drop-slides, of the lifter, 192, 193, 194, the rotating tappet-arm, 196, the cam-shaft, 163, spur-wheel, 167, crank-shaft, 162, and the pinion, 166, substantially as described and for the purposes set forth.

10. In a bookkeeping-machine, the tape-box constructed substantially as herein described, consisting of a movable box and its cover, a lock for holding the cover to the box, a feed roll or spool, a take-up roll or spool, a ratchet-and-pawl mechanism for actuating the take-up roll or spool, a printing-roll pivoted to the box, and a tension mechanism, substantially as and for the purposes set forth.

11. In a bookkeeping-machine, the combination of the sliding platen, the carriage for supporting the platen, the guide for regulating the lateral position of the book while printing it, and a book-holder, substantially as described and for the purpose set forth.

12. The combination with the drop-slides, 36, of the lifter, 192, 193, 194, the rotating tappet-arm, 196, the cam-shaft, 163, and spur-gear, 167, and the friction-roller, 195 substantially as and for the purpose described.

13. The combination with the carriage, the platen and the printing-head, of an inking mechanism consisting of supports attached to the platen, rock-levers pivoted to the supports, ink-rolls pivoted to the rock-levers, spring-dogs pivoted to the said rock-levers, and springs for pressing the ink-rolls toward and upon the types to be inked, substantially as and for the purposes specified.

14. A combination of mechanism for setting up on the type-rings of the printing-head the types representing amounts on that side of the printing-head that prints the pass-book, and for simultaneously setting up like types on the opposite side of said head on the same rings, mechanism for setting up on the side

of the head opposite that for printing the book the number of the book upon which such amount is to be printed, a movable platen for supporting the book to be printed and presenting it to the types so set up, a movable tape-box on the side opposite the platen for holding and presenting a concealed tape to the types on that side of the printing-head, adding mechanism for successively adding to the previous totals the amounts so printed on the pass-book and the concealed tape, mechanism for moving and operating the platen and the tape-box, and mechanism for moving the register, substantially as and for the purposes set forth.

15. The combination of an adding mechanism having number-wheels actuated by ratchets and rocking levers each of which has a pawl at one end and a toothed sector at the other, a second set of rock-levers, 208, having also toothed sectors with teeth meshed in the teeth of the sectors on the rocking levers of said adding mechanism, a dead-spindle forming a fulcrum for the rock-levers, 208, a cam-shaft, 163, cams, 206, drop-slides, 36, and the crank-shaft and stop-bar, 162, for limiting the upward movements of the longer arms of said rock-levers, 208, substantially as and for purposes set forth.

16. The combination of the rock-levers, 208, provided, at the front ends of their longer arms, with fingers, 209^a, and provided, at the rear ends of their shorter arms, with friction-rollers and toothed sectors, a dead-spindle forming a fulcrum for said rock-levers, adding mechanism connected with said toothed sectors for imparting motion to the number-wheels of the adding mechanism, a cam-shaft and series of cams attached to said cam-shaft for actuating said rock-levers in one direction, a stop-bar for limiting the motion of the rock-levers in the direction wherein they are actuated by the cams, and mechanism for rotating said cam-shafts, substantially as and for the purposes described.

17. The combination of one or more printing rings or wheels, each having types for printing significant figures, zero, and an arbitrary character, mechanism for bringing the zero types into printing position, adding mechanism, correlated with the said printing mechanism for adding to a previous total the amounts represented by the types of significant figures placed in printing position, and mechanism for automatically preventing the operation of the adding mechanism correlated with said printing rings or wheels whenever the zero characters thereon are moved into the printing position, substantially as described, and for the purpose set forth.

18. In combination with a series of type-rings for printing figures, each of which has engraved thereon types for the nine digits and the zero character, and in some of which the zero type follows the "9" type in regular sequence of arrangement, one or more type-rings in which a type of arbitrary form follows the "9" type in regular succession of arrangement, while the zero type precedes the "1" type in the order of arrangement, and mechanism for bringing the zero types into position for printing substantially as and for the purpose set forth.

19. In combination with the printing-head and type-rings, key mechanism, drop-slide mechanism, and mechanism for converting the reciprocating motion of the drop-slides into rotary motion of the type-rings, the notches, 188, in the type-rings and the straight-edged alining-plate, 189, substantially as and for the purpose set forth.

20. The combination with the printing-head and type-rings, the key mechanism, drop-slide mechanism, mechanism for converting the reciprocating motion of the drop-slides into rotary motion of the type-rings, notches, 188, in the type-rings, and straight-edged alining-plate, 189, of mechanism for moving said alining-plate into and out of said notches, substantially as specified.

21. The combination of the alining-plate and the specific mechanism for moving it herein described, consisting of the box, 189^a, the eccentric, rod, 190, and the eccentric, 180, on the printing-shaft, substantially as specified.

22. In a bookkeeping-machine, the combination with rings or wheels having types thereon for printing, horizontally-movable key-slides, vertically and automatically movable drop-slides positively connected with the type rings or wheels, and tilting keys attached to the key-slides for operating said key-slides, of key-buttons attached to and forming part of said keys, each button having an inclined facet presented to the rear for application of the operator's fingers, substantially as and for the purposes set forth.

23. In a bookkeeping-machine, the combination with rings or wheels having types thereon for printing, horizontally-movable key-slides, vertically and automatically movable drop-slides positively connected with the type rings or wheels, and tilting keys attached to the key-slides for operating said key-slides, of key-buttons attached to the keys as part of said keys, each key-button having two inclined facets one presented to the front with a figure or character indicated upon it and one presented to the rear for application of operator's fingers, substantially as and for the purpose set forth.

24. The combination of the slotted shell of the printing-head, movable and internally-toothed type rings or wheels fitted to said head, drop-slides, drop-slide guides, internally-toothed gears positively connected with said drop-slides, shafts provided with pinions meshed with the teeth of said internally-toothed gear and provided at their opposite ends with spur-gears meshed with the internal teeth of said type-rings, fixed bearings

for the ends of said shafts, and the lifters, marked for indicating to the operator the positions of the type-wheels and attached to said drop-slides for separately and independently restoring to zero position, before the act of printing, any type rings or wheels that may have been wrongly set by inadvertency of the operator, substantially as and for the purposes described.

25. The combination of the slotted shell of the printing-head, movable and internally-toothed type rings or wheels fitted to said head, drop-slides, drop-slide guides, internally-toothed gears positively connected with said drop-slides, shafts provided with pinions meshed with the teeth of said internally-toothed gears and provided at their opposite ends with spur-gears meshed with the internal teeth of said type-rings, fixed bearings for the ends of said shafts, and lifters attached to said drop-slides for separately restoring to zero position, before the act of printing, any type rings or wheels that may have been wrongly set by inadvertency of the operator, substantially as and for the purposes described.

26. The combination of a tape-box, a platen, a book-holder, a main driving-shaft, printing, adding and restoring mechanisms connected with said main shaft, housings supporting said shafts and printing, adding, and restoring mechanisms, a toothed idle-wheel, 168, and a pawl, 171, pivoted to the housing in relation with the toothed idle-wheel and preventing retrograde movement of said main driving-shaft and mechanism therewith connected, substantially as and for purposes described.

27. The combination of a reciprocatory tape-box for containing and concealing a tape, movable type-wheels or type-rings for printing said tape, and means for moving said tape-box toward and away from and impressing said tape upon the types of said type rings or wheels, and a second reciprocatory printing mechanism having a holder for gaging and retaining an inserted book or sheet in positions for producing on said book impressions in successive lines each like an impression printed during the same operation of the machine on the tape, substantially as herein described and for purposes set forth.

28. The combination with the reciprocatory tape-box having mechanism for feeding a tape and mechanism for printing amounts on said tape, of a separate reciprocatory printing mechanism provided with a holder for receiving, gaging, and retaining books or sheets separately and successively inserted for printing amounts in successive lines thereon, each of said amounts respectively corresponding to the amounts printed in the same operation of the machine on the tape, and adding mechanism for adding each amount so printed to a previously-registered total at each printing of the tape and inserted book or sheet, substantially as herein described and for the purposes set forth.

29. In combination with the hand-crank shaft, and the system of gearing for operating the printing, registering and restoring mechanism, a lug, 200, on the cam-shaft gear and the automatic gravity locking-hook stop, 199, and rod pivoted to it and extending toward the front for manually unlocking the mechanism for printing and adding, substantially as and for the purposes described.

30. The combination of type wheels or rings engraved with the nine digits and an arbitrary character and with the zero character, adding mechanism, rock-levers for operating said adding mechanism, said rock-levers having thereon double inclined planes, 215, and being correlated with said printing rings or wheels, guides for said drop-slides, and rocking latch-bars pivoted to said guides for inhibiting the action of said rock-levers when the zero types on said rings or wheels are brought into position for printing, substantially as and for the purposes described.

31. In a bookkeeping-machine wherein books or books opened at any particular page are separately and successively placed in and taken out of the machine for printing, as described, the combination of a printing-head, movable ranks of type supported on said head, means for moving said ranks of type into positions for printing and for setting up matter to be printed, a book-holder or book-support in relation with the printing-head for receiving, holding and alining books to be successively printed, reciprocatory mechanism positively connected with said book holder or support for pressing the page, leaf, or sheet to be printed upon, and taking it off from, the faces of said types, and automatic mechanism for materially and directly varying the amplitude of the motion of said reciprocatory mechanism, in accordance with the variation of thickness of the book or the part thereof upon which the impression is made, without material alteration of pressure upon the type, substantially as described and for purposes specified.

32. The combination of the printing-head supporting movable type rings or wheels, the reciprocatory platen and book-holder, the rock-lever, 129, fitted to have some play on its bearing, 178, the rock-lever, 131, and the spring, 191, attached to and connecting said rock-lever to the other rock-lever which actuates the tape-box said spring being also attached to both said rock-levers near their fulcrums substantially as and for the purposes specified.

33. The combination of the key-slides, key-pawls, the key-pawl pivots, 71, having an easy fit in the lateral walls of said key-slides, the keyboard, 14, and the rib-bars, 20, fast to said keyboard for retaining said pivots in the key-slides when the said slides are in their

working position substantially as described, and for the purpose set forth.

34. The combination with the key-slides having tangs, 3, the keyboard, having the transverse rib, 16, and the rib-bars, 20, attached to the keyboard, of plates, 21, fastened to said rib-bars, and springs, 22, attached to said ribs, 16, on the keyboard, and to the tangs on the key-slides for holding said key-slides in working position substantially as described.

35. The combination with the printing-head and the three groups of movable type wheels or rings supported side by side thereon—one group for printing numbers of books, a second group for printing amounts received or paid out, and a third group for printing dates and other inscriptions—of a reciprocatory book-holder arranged on one side of said head for receiving, retaining, and superimposing a book over the second and third of said groups, and a reciprocatory tape-box on the opposite side of said head for superimposing a contained tape over the said first and second groups of type wheels or rings and for printing on said tape only the amounts deposited and book-numbers during the printing upon the book of dates and other inscriptions together with amounts deposited substantially as and for purposes herein set forth.

36. The combination with the printing-head having the slotted shell, 69, supporting internally-toothed movable type-rings, and the dead-spindle which supports said head, of the drop-slides and the drop-slide guides, the four-armed spiders fast on said dead-spindle, each having friction-rollers on the arms whose radial axes are one hundred and twenty degrees apart and a bearing for a laterally-extending shaft in the other arm, the laterally-extending shafts, 62, each having at one end a pinion, 65, and at the other end a spur-wheel, 66, the teeth of which project through one of the slots in said slotted shell and there mesh with the internal teeth of a superimposed type-ring, and the internally-toothed gears, 49, supported by and working upon said friction-rollers, each meshing with one of said pinions and having a positive connection with a correlated drop-slide for transmitting the vertical rectilinear motion of the drop-slides to the type-rings and converting such vertical motion into a greater rotary motion in said type-rings, substantially as and for purposes described.

37. In a bookkeeping-machine the combination with the printing-head, type-wheels or type-rings fitted upon and supported by said head, the movable platen for supporting and holding a book to be printed on one side of said head, the carriage which supports said platen and the mechanism for printing a tape on the side of the head opposite that on which the book is printed, of inking-rollers for inking rows of type diametrically opposite each other, supports attached to said platen, spring rocker-arms pivoted to said supports, the ink-rolls being pivoted to and supported by said rocker-arms on opposite sides of said head, and mechanism for preventing the inking of the types during the movement of the platen which withdraws the book from under the printing-head, substantially as and for the purposes specified.

38. In a bookkeeping-machine and cash-register the combination with the printing-head and type wheels or rings supported thereby, of the movable platen, a reciprocatory support for said platen on which it is fitted to slide horizontally, upright supports attached to the platen, spring rocker-arms pivoted to said upright supports, ink-rollers pivoted to and supported by said rocker-arms and the spring-dogs one pivoted to the front end of each pair of said rock-levers for engaging the margin of the head during the forward movement of the platen and preventing the ink-rollers from coming in contact with the type during said forward movement substantially as and for the purposes set forth.

39. In a bookkeeping-machine the combination with a printing-head and movable type-rings supported on said printing-head, of inking-rolls on opposite sides of said head, rock-levers to the ends of the longer arms of which said inking-rolls are pivoted, a movable platen having uprights attached to it provided with bearings for the said rock-levers, springs, one of which is attached to each pair of rock-levers and one of its upright supports for rocking the levers toward said type wheels or rings, and adjustable screw-stops for limiting the motion of said rocker-arms in the direction of the type wheels or rings, substantially as and for the purposes described.

40. In a machine for keeping books the combination of movable type wheels or rings, a reciprocatory carriage having intermittent motion in a vertical plane, a reciprocatory platen supported by said carriage and adapted to move in a horizontal plane relatively with the motion of said carriage and independently of the operation of all other parts of the machine for bringing the platen into position for receiving the book to be printed and subsequently carrying said book into the position for printing, mechanism for holding said platen in relation with said carriage, and mechanism for first moving the carriage and platen simultaneously toward the type wheels or rings for making the imprint upon the book, and afterward moving it away from said type wheels or rings after printing, substantially as and for the purposes described.

41. In a bookkeeping-machine, the combination with type wheels or rings and a platen for supporting the book to be printed, of a book-holder attached to the platen for holding the book firmly upon said platen, a longitudinal guide also attached to said platen for aiding the lateral alinement of the book, and mechanism for moving the platen, its attached book holder and guide first toward and then away from said type wheels or rings,

substantially as and for the purpose specified.

42. The combination with the type wheels or rings, and with the body of the tape-box cast open at the top, having the transverse groove, 140, and containing a tape, tape-feeding mechanism, and mechanism for printing said tape upon said type wheels or rings, of a detachable cover, 136, fitted to the top of said body and having its rear margin fitted into said groove, an eyebolt, 142, in the front of the bottom of said body and extending through the front margin of the cover, and a padlock whose hasp is fitted into the eye of said eyebolt, substantially as and for the purposes specified.

43. The combination with the type wheels or rings, of a reciprocating tape-box having slots, 150 and 151, formed in its sides, a take-up spool and a let-off spool whose spindles are fitted in said slots, tape-feed mechanism for transferring the tape from the let-off spool to the take-up spool, and the V-shaped friction-tension attached to the inside of one of the walls of the tape-box in relation with one or other of the slots, 150, and in relation with one of the heads of the let-off spool, substantially as described and for the purposes specified.

44. The combination, in a machine for keeping books, with a printing-head supporting types for printing, a reciprocatory platen provided with mechanism for successively receiving, retaining and alining separately-inserted books or sheets to be printed, and with a tape-box containing a concealed tape and feed mechanism whereby the said tape is presented also to the types of the printing-head for printing substantially as herein described, of rock-levers, 129 and 131, having their shorter arms bifurcated, the upright support, 177, provided with bearings for said rock-levers, the adjustable stud-bearings, 186 and 187, fitted to be clamped in the bifurcated ends of said arms, 131 and 129, the toggle-links, 182 and 183, each fitted at one end to one of the said stud-bearings, the link, 184, pivoted to the joint of said toggle-links and having the other end pivoted to said upright, the link, 181, pivoted at one end to the joint of said toggle-links and at the other end pivoted to the crank-pin of the eccentric, 180, the eccentric, 180, fast on the shaft, 165, the shaft, 165, having bearings in said upright and in the housings, 161, and mechanism for driving said shaft substantially as and for the purposes set forth.

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Witnesses:
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