No. 816,318. PATENTED MAR. 27, 1906.

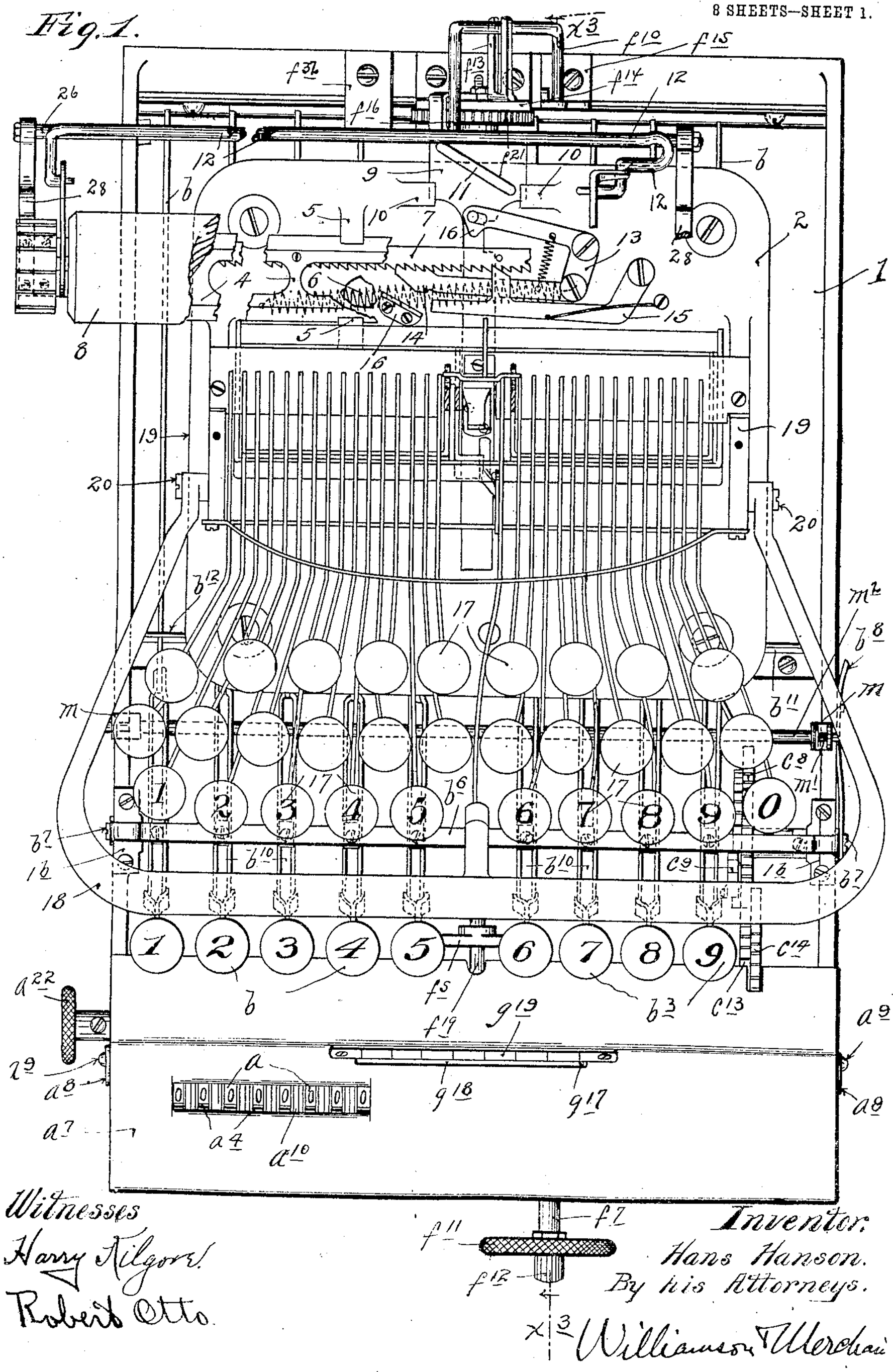
H. HANSON.

CALCULATING MACHINE.

APPLICATION FILED AUG. 13, 1900.

8 SHEETS—SHEET 1.

Fig. 1.



Witnesses
Harry Kilgore
Robert Otto.

Inventor.
Hans Hanson.
By his Attorneys.
Williamson & Merchant

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8 SHEETS—SHEET 2.

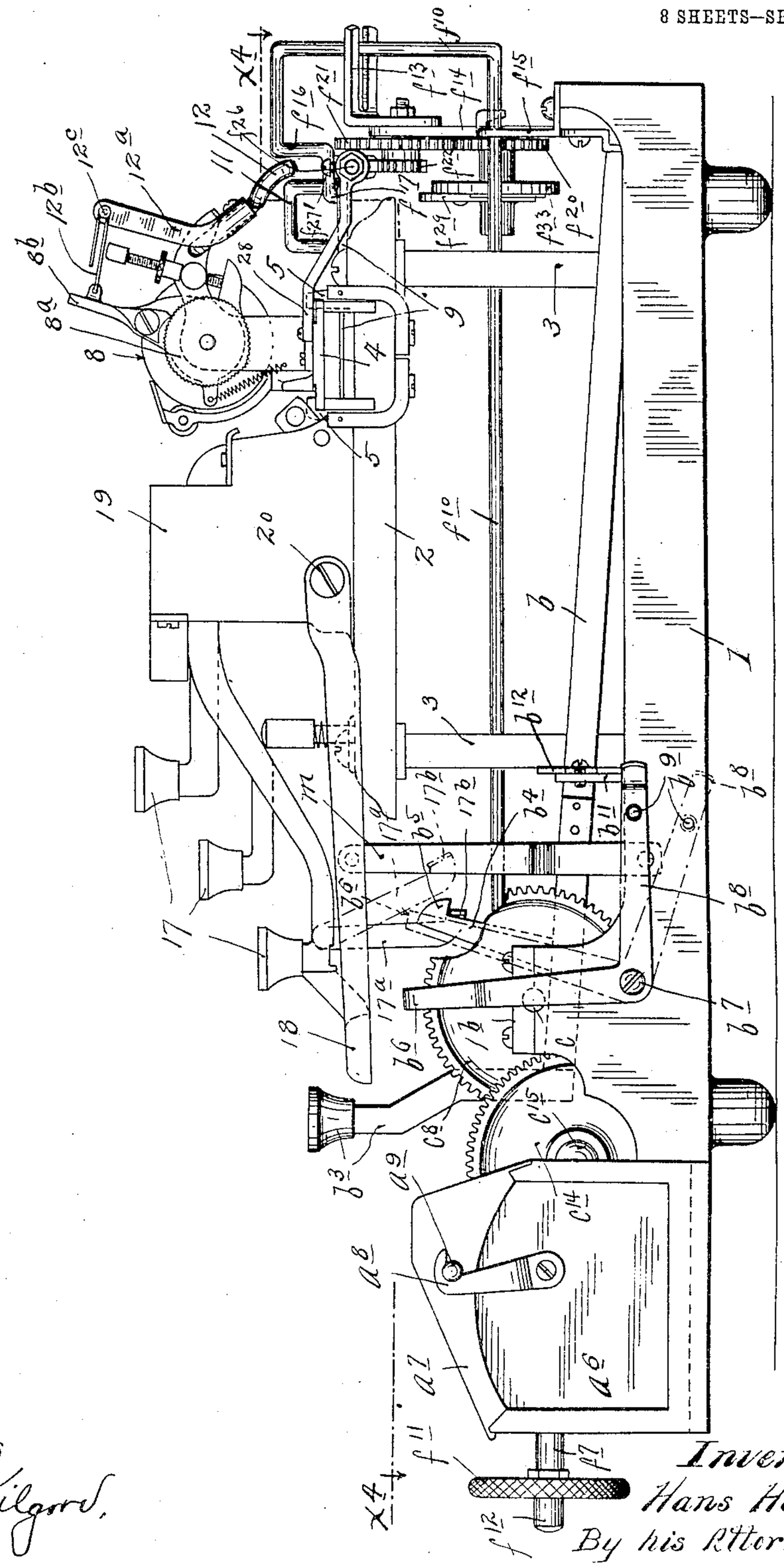

Fig. 2.

Witnesses
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8 SHEETS—SHEET 3.

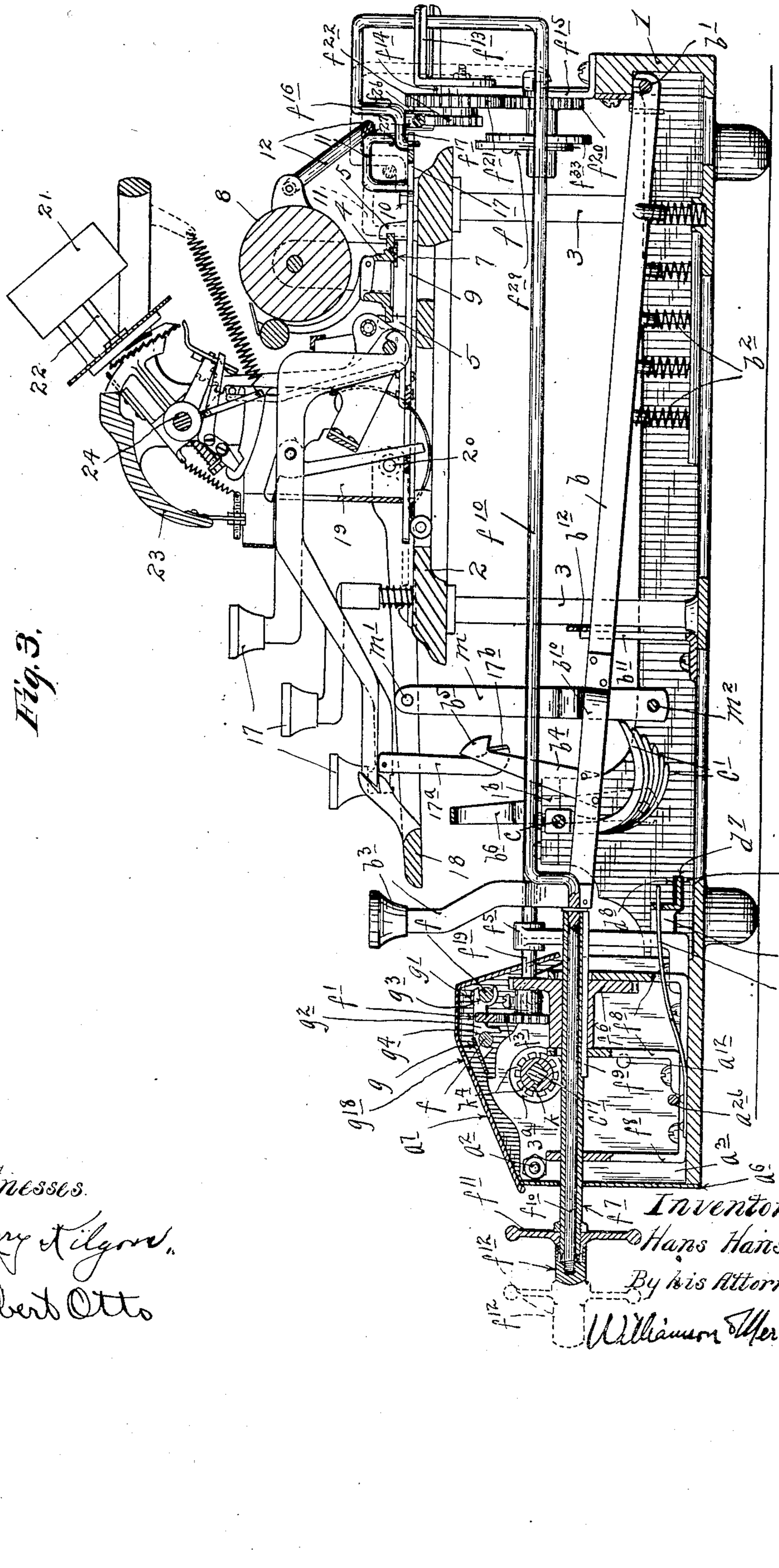

Fig. 3.

Witnesses.
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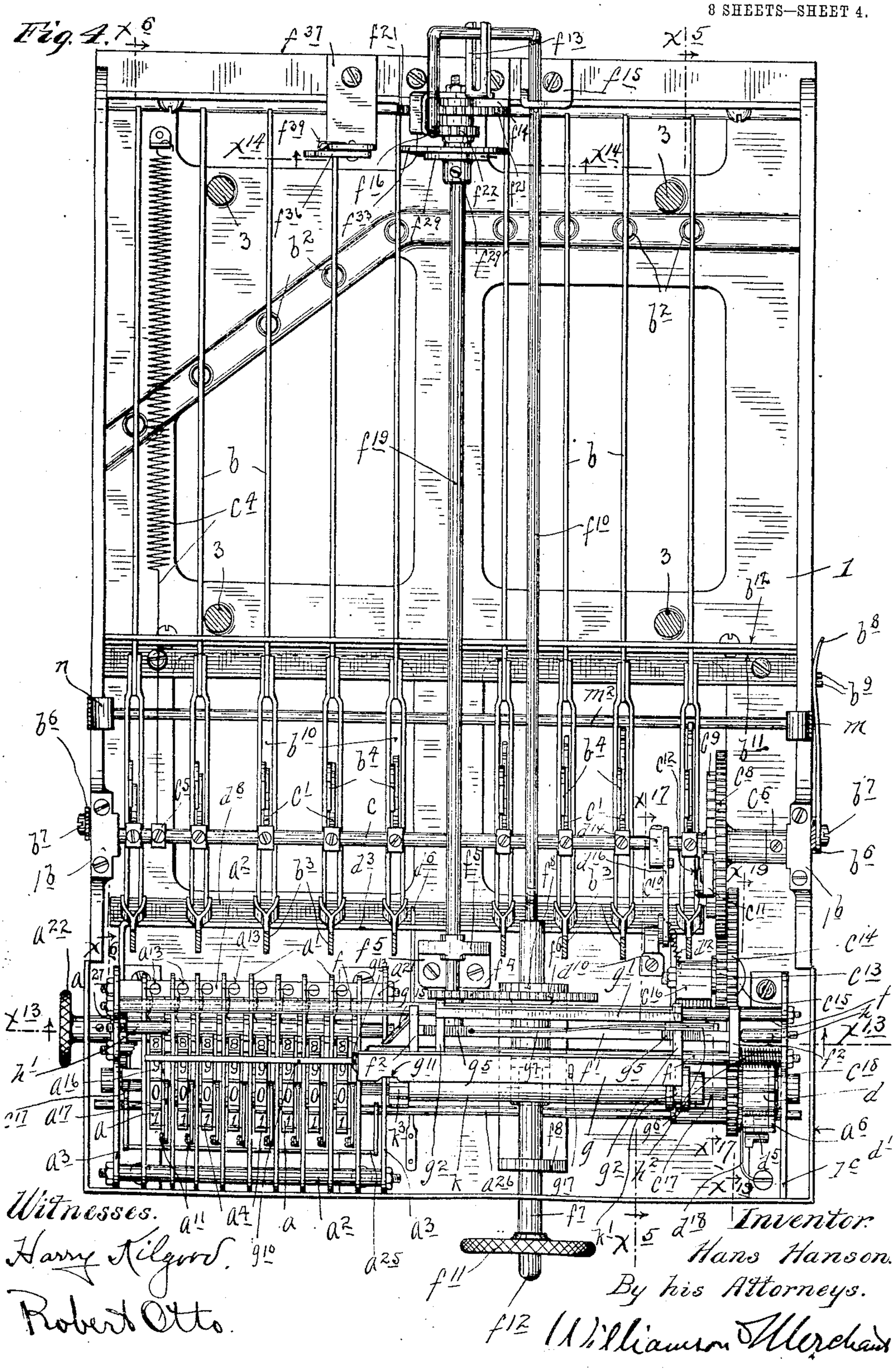
8 SHEETS—SHEET 4.

Fig. 4.



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8 SHEETS—SHEET 5.

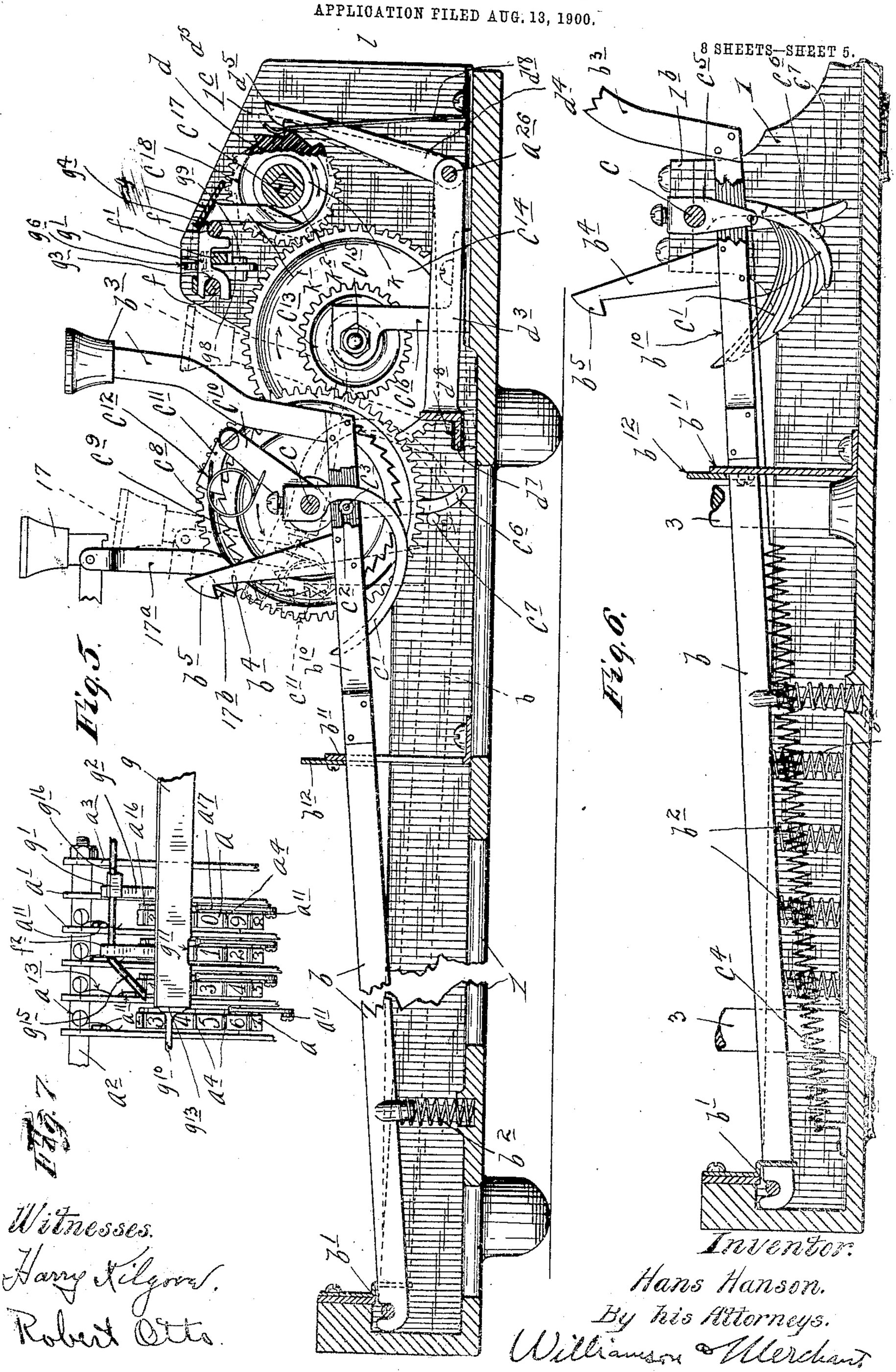

Fig. 5.

Fig. 6.

Fig. 7.

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8 SHEETS—SHEET 6.

Fig. 9.

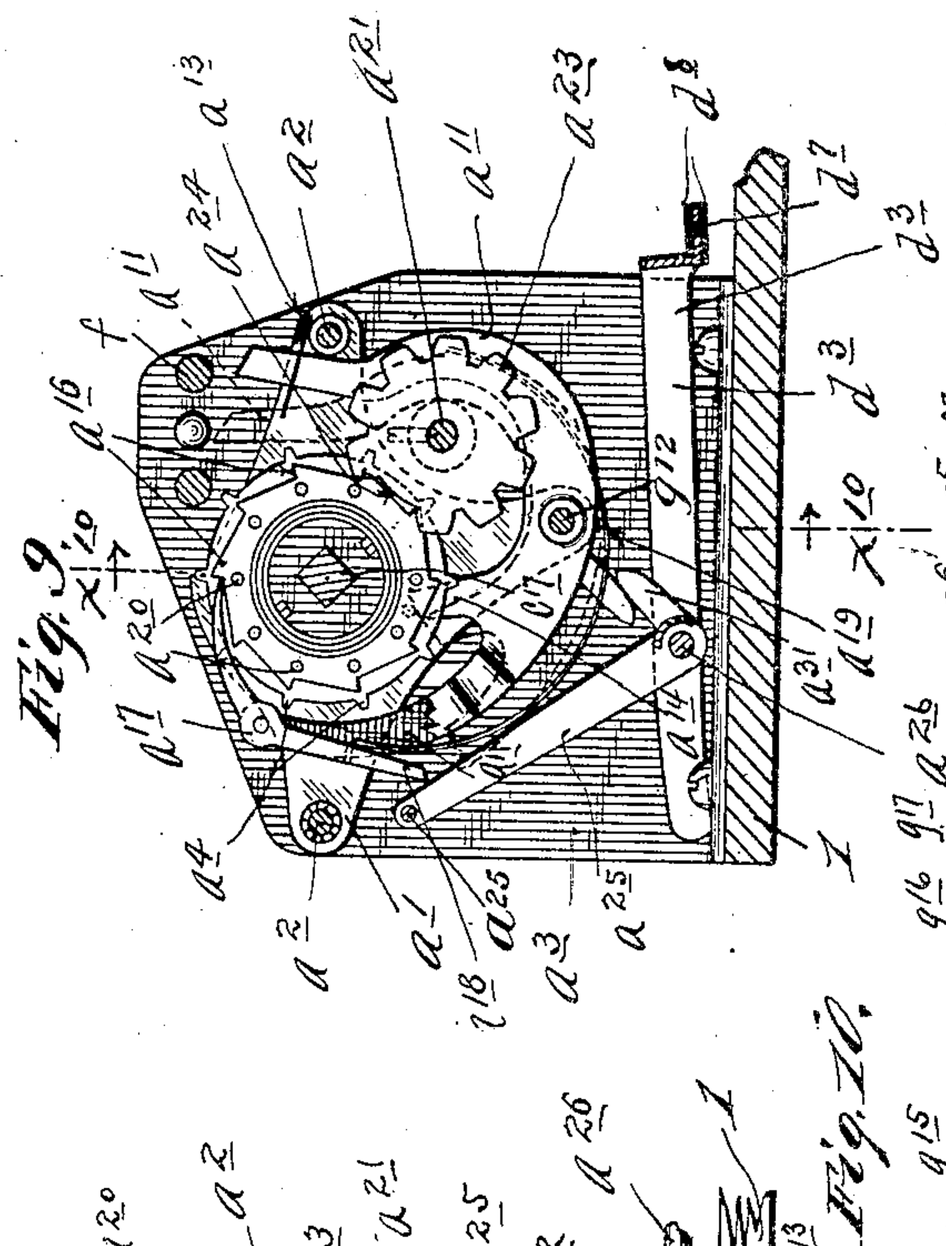


Fig. 10.

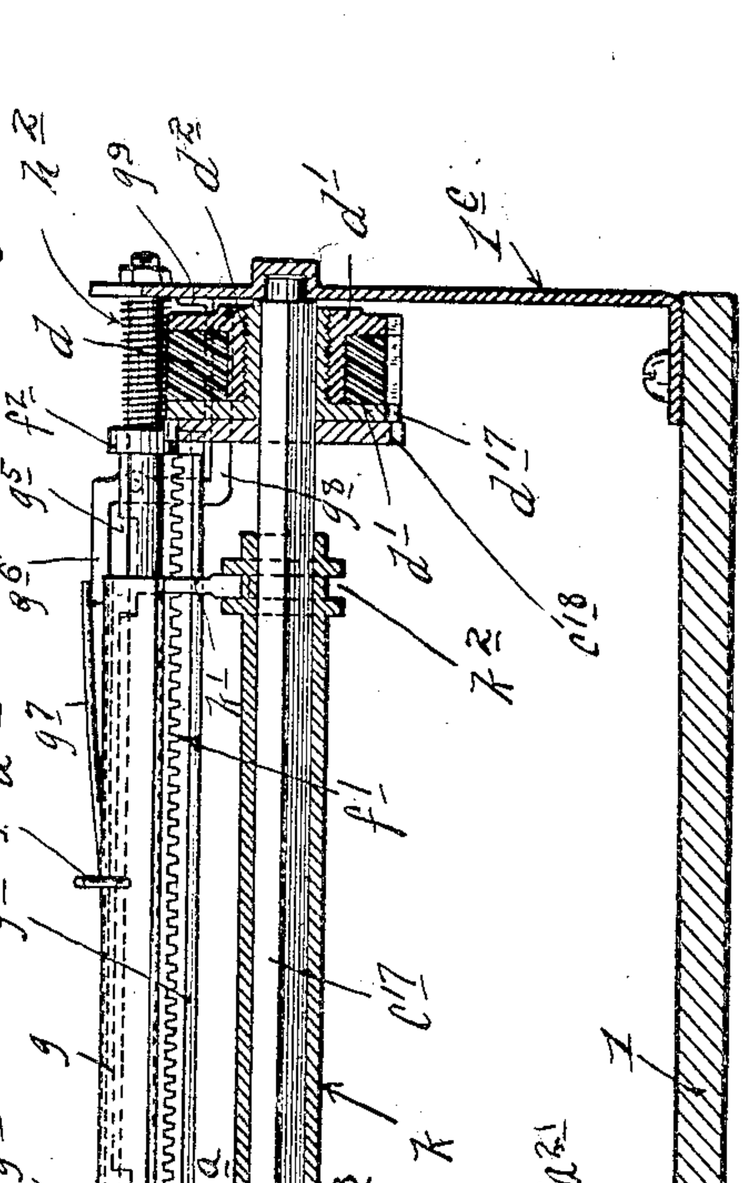
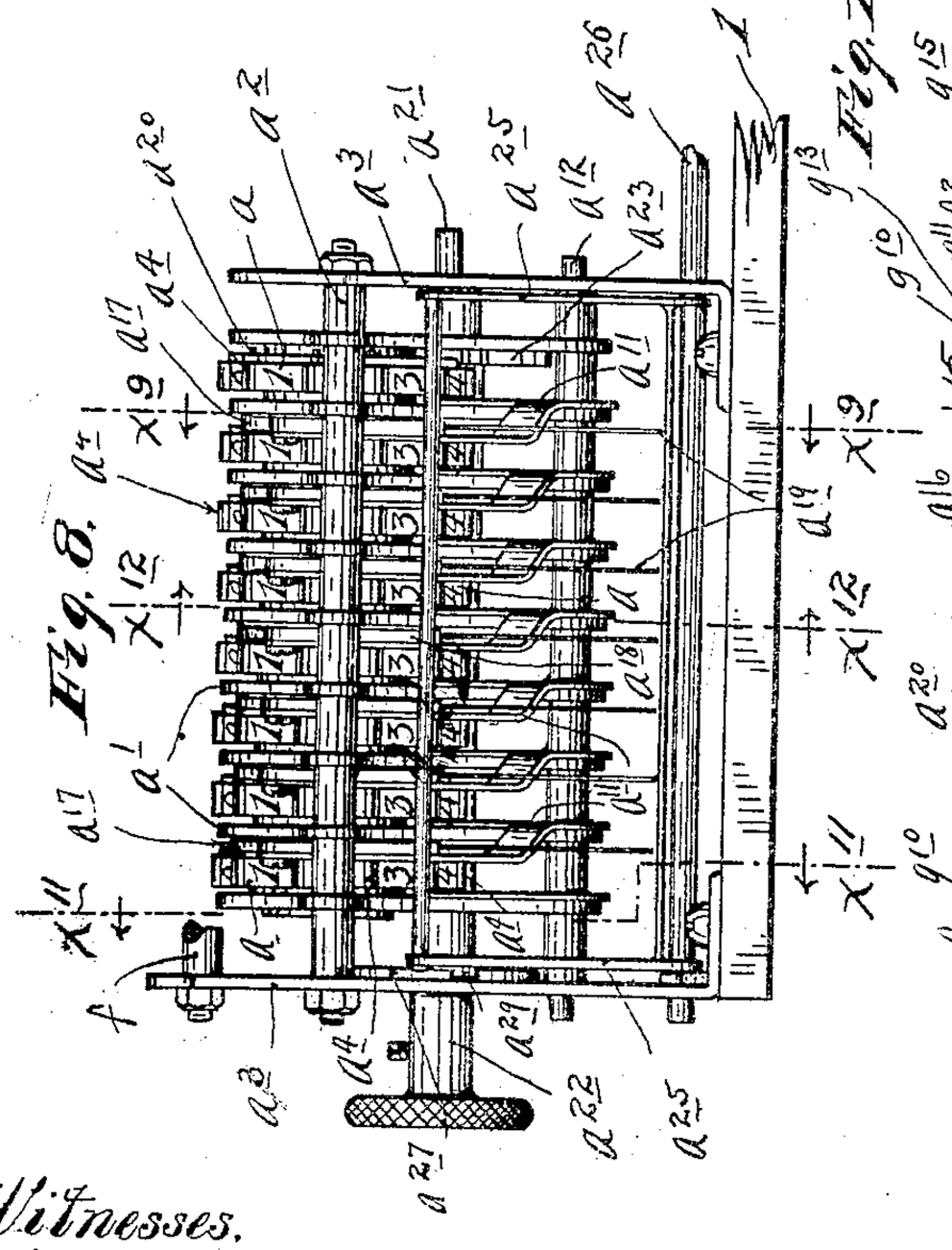


Fig. 8.



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8 SHEETS—SHEET 7.

Fig. 11.

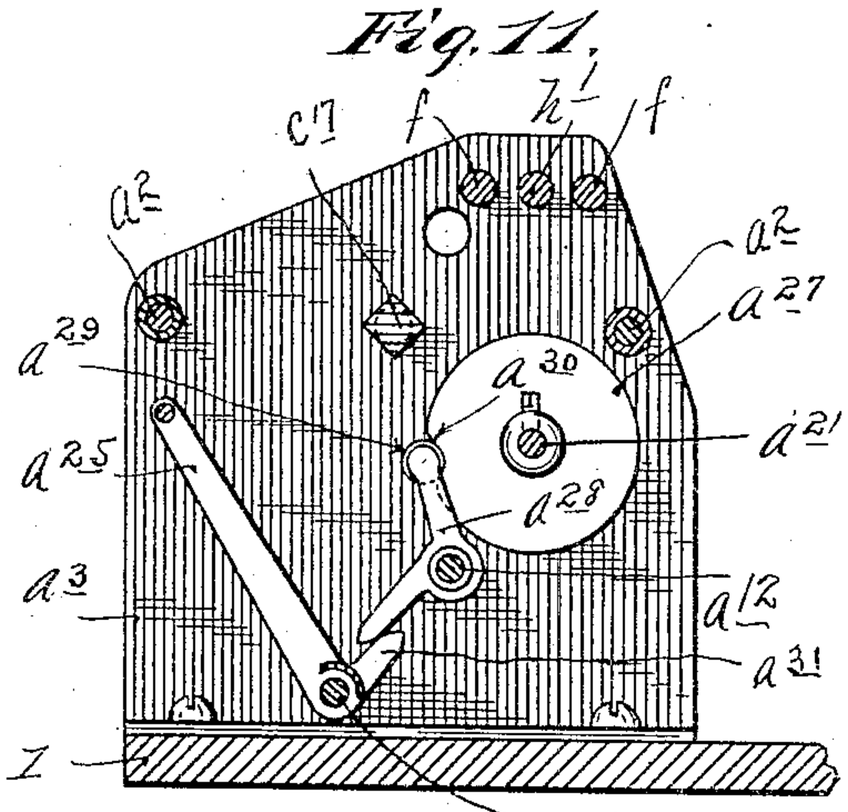


Fig. 12.

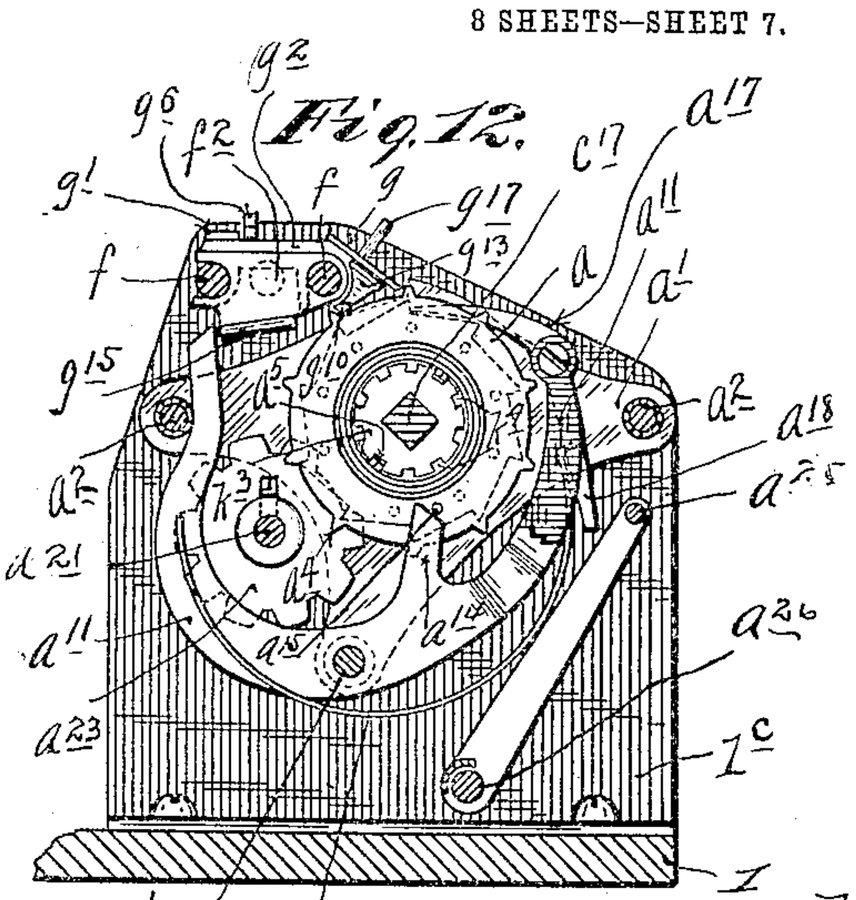


Fig. 13.

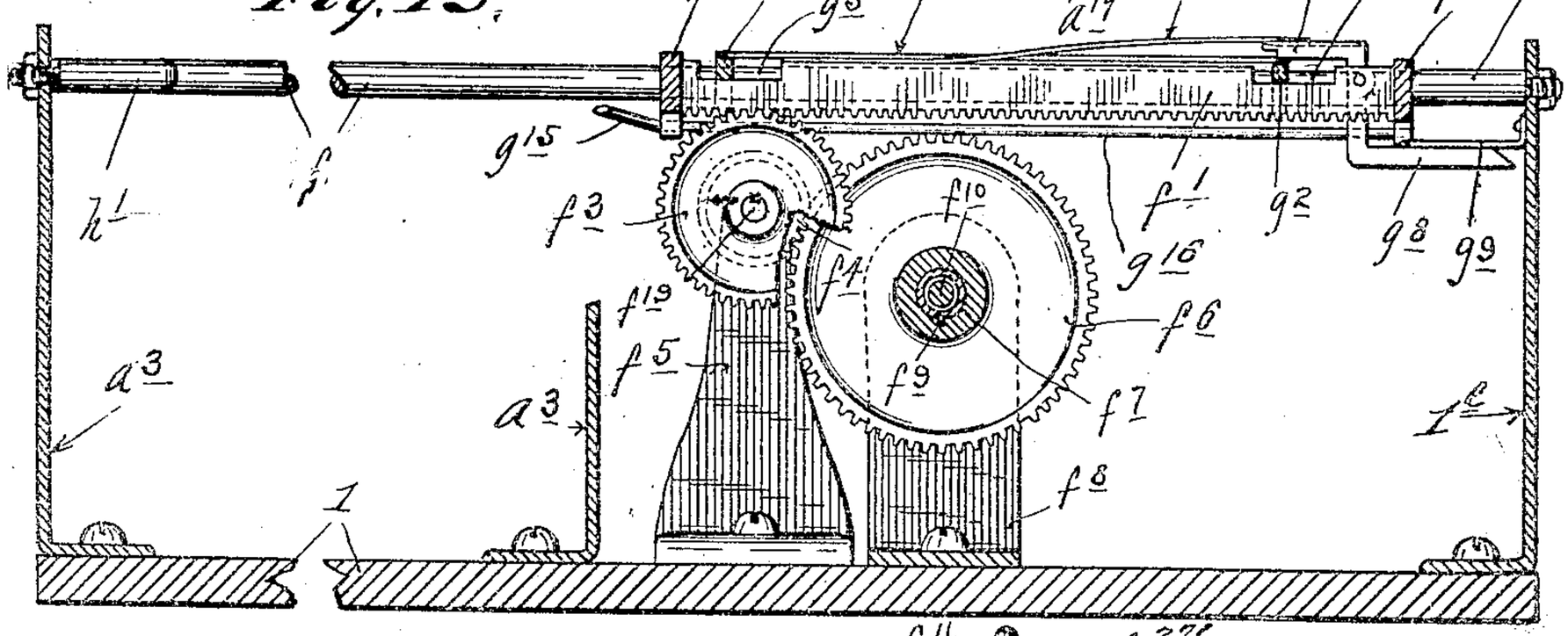


Fig. 15.

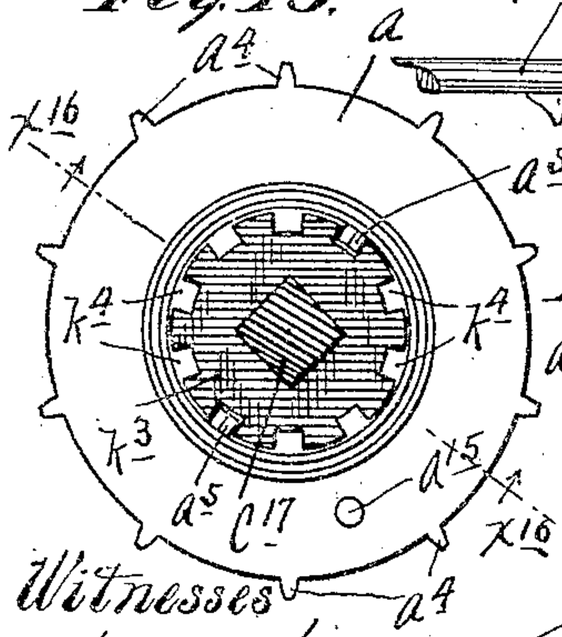


Fig. 14.

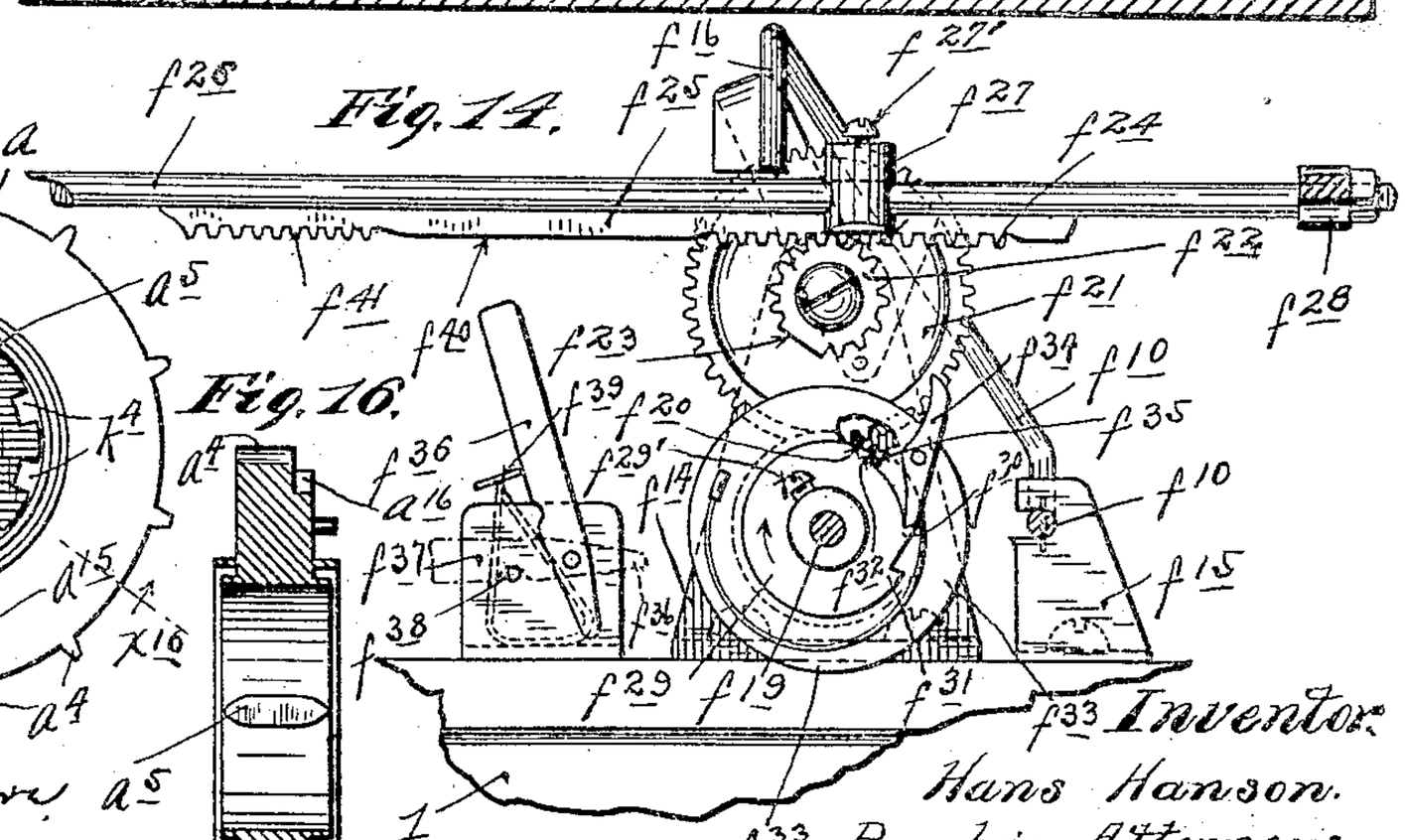
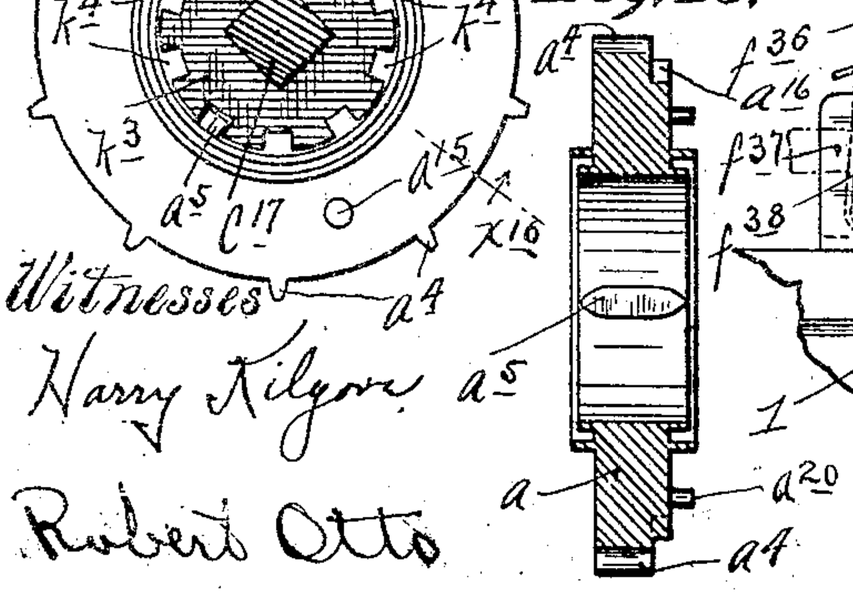


Fig. 16.



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8 SHEETS—SHEET 8.

Fig. 17.

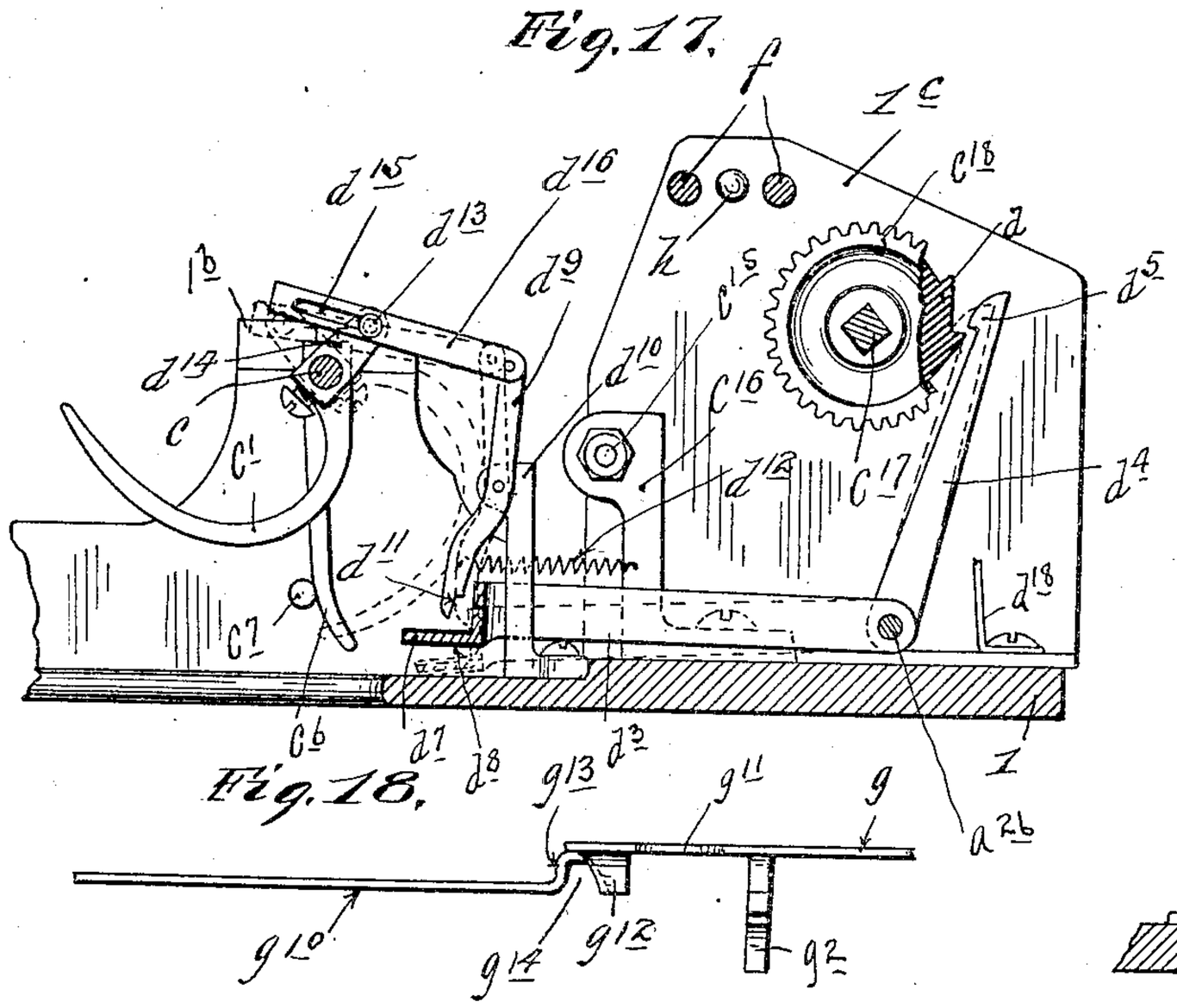


Fig. 18.

Fig. 19.

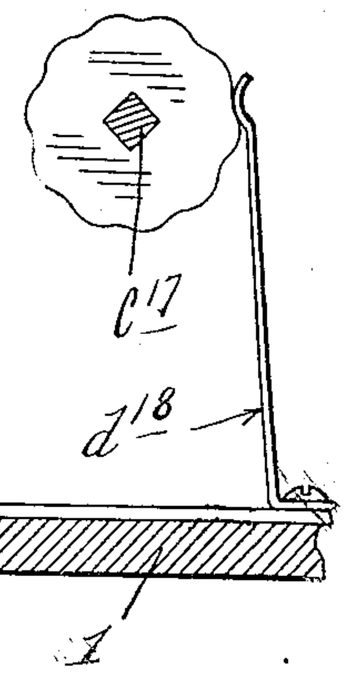
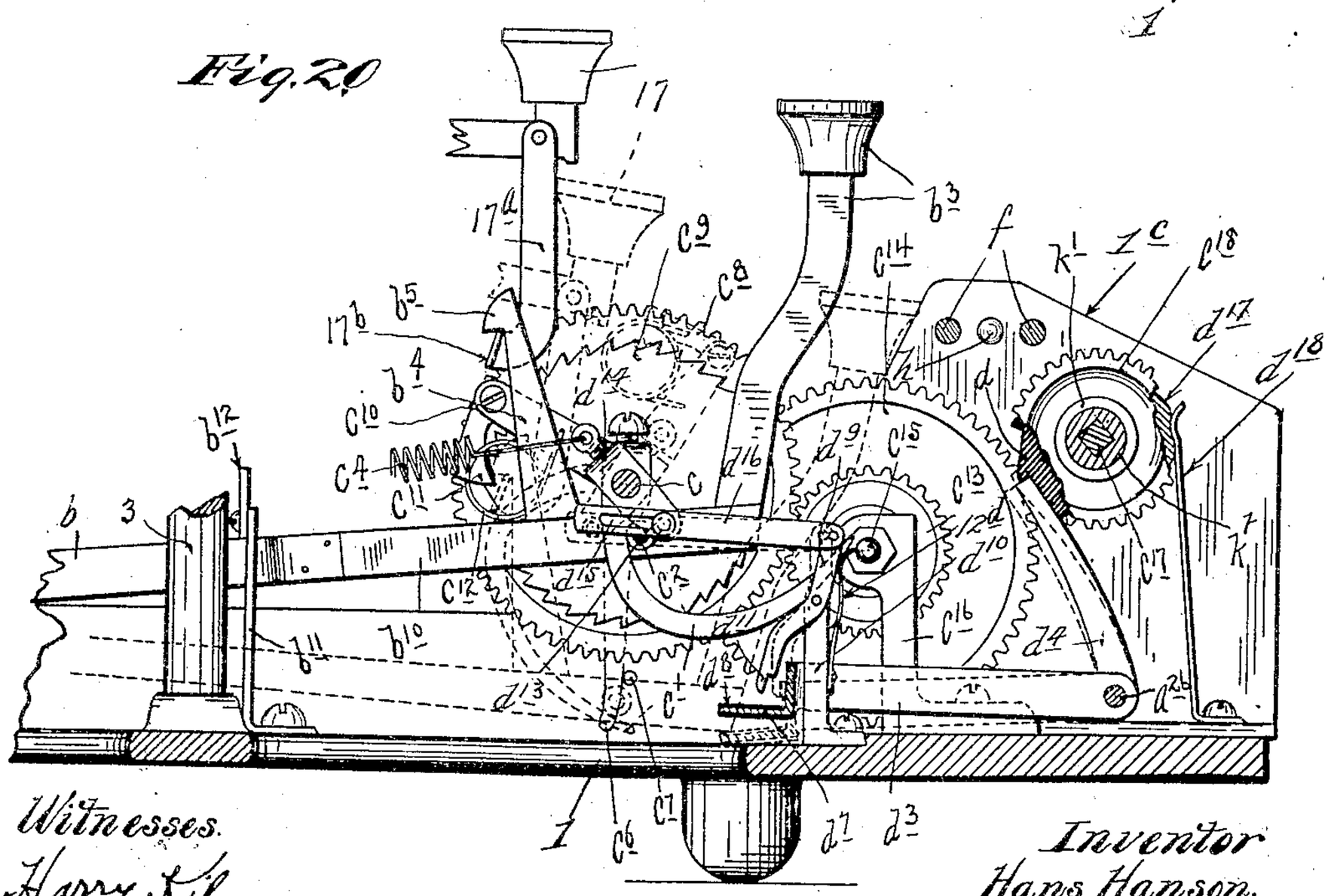


Fig. 20



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UNITED STATES PATENT OFFICE.

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CALCULATING-MACHINE.

No. 816,318. Specification of Letters Patent. Patented March 27, 1906.

Application filed August 13, 1900. Serial No. 26,686.

To all whom it may concern:

Be it known that I, HANS HANSON, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in a Combined Type-Writing and Computing Machine; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has for its especial object to provide an improved combined type-writing and computing machine. Its most radical features of novelty are three—to wit, connections between the computer-keys and the numeral-keys of the type-writer of such a character that the operation of the computer-keys will operate the numeral-keys and through the same the printing devices of the type-writer for both listing and adding the numbers, but that the numeral-keys of the type-writer may be operated without operating the computer-keys, thus permitting the type-writer to be always available for its ordinary use; carriage-locating and line-spacing devices subject to a common hand-lever for effecting the line-spacing and positioning the type-writer carriage and the register-carriage in proper positions for completing the registration of the numbers and for starting the next line; a slip-motion device in the driving connections between the two carriages operative to hold the register-carriage stationary while the type-writer carriage moves forward one or more feed-steps, thus making punctuation or wide spacing possible between the columns of the listed numbers.

The foregoing and other minor features of the invention will appear in the description and be defined in the claims.

The invention is illustrated in the accompanying drawings, wherein like notations refer to like parts throughout the several views.

Figure 1 is a plan view of the combined machine, the computer being shown as combined with a standard type-writer known to the trade as the "Blickensderfer," some parts being broken away and others removed. Fig. 2 is a side elevation of the parts shown in Fig. 1. Fig. 3 is a vertical section approximately on the line x^3 x^3 of Fig. 1. Fig. 4 is a horizontal section approximately on the line x^4 x^4 of Fig. 2, some parts being shown in full. Fig. 5 is a vertical section on the line x^5 x^5 of Fig. 4. Fig. 6 is a vertical section on the line x^6 x^6 of Fig. 4. Fig. 7 is a detail in plan with parts broken away, showing a portion of the register. Fig. 8 is a view in front elevation with some parts broken away, showing the register. Fig. 9 is a vertical section on the line x^9 x^9 of Fig. 8. Fig. 10 is a transverse vertical section approximately on the line x^{10} x^{10} of Fig. 9. Fig. 11 is a vertical section on the line x^{11} x^{11} of Fig. 8. Fig. 12 is a vertical section on the line x^{12} x^{12} of Fig. 8. Fig. 13 is a transverse vertical section approximately on the line x^{13} x^{13} of Fig. 4, some parts being removed. Fig. 14 is a transverse vertical section on the line x^{14} x^{14} of Fig. 4, some parts being removed. Fig. 15 is a section on the line x^{15} x^{15} of Fig. 10, some parts being removed. Fig. 16 is a section on the line x^{16} a^{16} of Fig. 15. Fig. 17 is a vertical section on the line x^{17} x^{17} of Fig. 4. Fig. 18 is an edge elevation of the so-called "register-retaining" device. Fig. 19 is a vertical section approximately on the line x^{19} x^{19} of Fig. 4; and Fig. 20 is a view corresponding to Fig. 5, but illustrating a modified construction.

The construction and operation of the type-writer illustrated in the drawings is well understood by persons familiar with type-writers, and a description thereof will here be but briefly given and only to such extent as deemed necessary in order to give a clear understanding of the relation of the attachment or calculating mechanism thereto.

The frame of the combined type-writer and adding-machine is made up of a base 1 and an elevated table 2, connected to said base by columns 3. The numeral 4 indicates the type-writer carriage, which is mounted in suitable guides 5 on the table 2, is normally put under strain to move toward the left by a spring 6, and is provided with an escapement-rack 7, an impression-roller 8, and other devices not necessary to specify. The numeral 9 indicates a sliding plate mounted in suitable guides 10 on the table 2 and, as shown, provided with a projecting rib 11, against which the longitudinally-extended portion of a bail 12, pivotally mounted on the type-writer carriage 4, normally engages. By means of a bell-crank 13 a spring-pressed pawl 14 is connected for movement to the sliding plate 9. A spring-pressed retaining-pawl 15 also normally engages the escapement-rack 7. Short reciprocating movements of the slide 9 simply cause the driving-pawl 14 to reciprocate and impart the step-by-step feed

movements to the rack 7 and carriage 4. Extreme movements inward of the slide 9 cause a projection 16 on the bell-crank 13 first to strike and release the pawl 14 from the rack 7, and then cause the said pawl 14 to engage the retaining-pawl 15 and release the same also from said rack. These long and short movements of the slide 9 are imparted as hereinafter described. The rdinary keys of this type-writer are indicated by the numeral 17, the lower row (marked on the machine with the successive numerals or digits from "1" to "9," inclusive) being those which are used to print the numerals indicated. The numeral 18 indicates a spacing-bar, which is in the form of a bail pivoted to brackets 19 on the table 2, as shown at 20. The numeral 21 indicates in diagram the type-head supported by an oscillating support 22, pivoted to a bracket 23 on the table 2, as shown at 24. With this class of type-writer the depression of any one of the keys 17 will cause the selected character of the head 21 to move against the impression-roller 8. Also the depression of any one of the said keys 17 or of the spacing-bar 18 will, through connections not necessary for the purposes of this case to consider, impart those short movements to the slide 9, which, as before indicated, acting through the bell-crank 13 and driving-pawl 14, impart the step-by-step feed movements to the type-writer carriage 4. It will of course be understood that the spacing-bar 18 and the keys 17 are spring-held upward.

The roller 8 has a ratchet-wheel 8^a, which is moved by a pawl-equipped arm 8^b. In the application of the calculating attachment, as shown, the bail 12 has a rigidly-secured arm 12^a. The free ends of the arms 8^b and 12^a are connected by a link 12^b, shown as pivoted to the former and having the hooked end engaging a pin 12^c on the latter.

My improved calculating mechanism or adding attachment will now be considered. This calculating mechanism in its most approved form and as applied to a type-writer comprises a register made up of a series of sections, a bank of digit or computer keys independent of the numeral-keys of the type-writer, a differential feeding mechanism, a register-carriage with connections whereby it is moved form the type-writer carriage, including a so-called "wheel-mover," which is moved longitudinally by said register-carriage and is rotated by said differential feed device and operates upon the wheels of the register in succession.

Register.—The register in its preferred form, as illustrated in the drawings, is best shown in Figs. 7, 8, 9, 10, 11, 12, and 15, but is also shown more or less in Fig. 4. As shown in Fig. 4 it is located at the front and left-hand side of the type-writer and comprises a series of register-wheels or annular counting members a, located in axial line and rotatively mounted on the laterally-spaced partition-plates a'. The partition-plates a' are secured at their ends on a pair of spacing-rods a^2, which in turn are secured at their ends to a pair of laterally-spaced bearing-plates a^3, supported at their bases by the type-writer base 1. These counting-wheels a are thus mounted for independent rotations. On their peripheries they are provided with ten teeth or projections a^4, and between these teeth they are marked with the successive digits from "0" to "9." Each wheel a is also provided with several internal and transversely-extended teeth a^5, sharpened at their ends for a purpose which will hereinafter appear. A casing a^6, with removable cover a^7, which, as shown, is held in place by hooks a^8 and coöperating pins a^9, is provided to inclose the register and other parts hereinafter noted, and the said cover a^7 is provided with a slot or sight-opening a^{10}, through which in the normal positions of the counting-wheels a the zero-marks thereof appear in a row, as shown in Fig. 1.

For coöperation with the series of counting-wheels a is a carrying mechanism. (Best shown in Figs. 8, 9, 10, and 12.). For each counting-wheel a, except the one at the left-hand end of the series, is a carrying-lever a^{11}, as shown, approaching in form a semicircle, and each pivoted on a spacing-rod a^{12}, to which rod, as shown, depending prongs of the bearing-plates a' are also connected. The carrying-levers a^{11} are subject to light springs a^{13}, (best shown in Figs. 7 and 9, but also in Fig. 4,) which springs are shown as secured to the bearing-plates a' and serve to frictionally hold the said levers either in the position indicated by full lines in Figs. 9 and 12 or in the position indicated by dotted lines in Fig. 9. Each lever a^{11} is provided with a cam-lug a^{14}, and the coöperating wheels a are provided on their adjacent faces with cam pins or projections a^{15}. The coöperating pins and the cam-lugs a^{15} a^{14} are so related that the pin of a given wheel will engage the coöperating lug and force the lever a^{11} into its dotted-line position, Fig. 9, under that step of movement of that particular counting-wheel which moves its notation "9" from and its notation "0" to alinement with the sight-opening a^{10}. Each register-wheel a is also provided, as shown, on its right-hand face with a ten-toothed ratchet-wheel a^{16}, and each carrying-lever a^{11} is provided at its outer free end with a pawl a^{17}, which engages the ratchet-teeth a^{16} of the coöperating wheel a. These pawls a^{17} have depending ends a^{18}, that are subject to light springs a^{19}, carried by the levers a^{11} and normally causing the said pawls a^{17} to keep engagements with the ratchet-wheels a^{16}.

When one of the register-wheels a is given its tenth unit of movement from zero, the action of the cam-pin a^{15} on the lug a^{14} of the

coöperating lever a^{11} will set the carrying-lever in what may be termed a "set" or "carrying" position. (Shown by dotted lines in Fig. 9.) The pawl a^{17} of the lever is thus set to act upon the teeth a^{16} of the register-wheel a of the next higher order, but the carrying onto the wheel of higher order will not be accomplished until the said lever is returned to its normal position. The devices whereby the register-wheels are given their step-by-step or units of movement under the control of the differential feed device and whereby the carrying-levers are later restored to normal positions to carry the tens onto the wheels of higher order will be set forth later on.

After a computation or addition has been made it is desirable to return or to restore all of the register-wheels to their zero positions. To accomplish this, each register-wheel is provided, as shown on its right-hand face, with nine pins or projections a^{20}, spaced apart to correspond in degrees to the spacing of the ratchet-teeth a^{16}, the space where the tenth tooth would naturally come being left clear, as best shown in Fig. 9. Secured on a transverse shaft a^{21}, mounted in the bearing-plates a^3, and provided with an outer end knob a^{22}, is a series of spur-gears a^{23}, corresponding in number to the number of counting-wheels a. These gears a^{23} have each nine teeth, a tooth being omitted at one point. (Indicated at a^{24} in Fig. 9.) The teeth of the gears a^{23} are adapted to intermesh with the pins a^{20} of the corresponding wheels a; but in the normal positions of the said parts, as shown in Fig. 9, each stands out of line of movement of the other. When, however, the wheels a have turned from their normal positions, the turning movement of the wheels a^{23} will engage the pins a^{20} of such wheels and will turn them to their normal positions, while any wheel a which may have been left standing at zero will not be moved.

In order to permit the return movements of the register-wheels a, the pawls a^{17} must be released, and this is simultaneously accomplished by means of a bail a^{25}, which is pivoted on a rock-shaft a^{26}, and the upper transverse bar portion of which is engageable with the depending tail portions a^{18} of the said pawls. A cam-disk a^{27} (best shown in Fig. 11) is rigidly secured on the shaft a^{21} just inward of the left-hand bearing-plate a^3. a^{28} indicates a bell-crank pivoted on the rod a^{12}, before noted. At one end the bell-crank a^{28} is provided with a roller a^{29}, which works in a recess a^{30} in the said cam-disk. The other arm of the bell-crank a^{28} normally engages a projection a^{31} from the bail a^{25}.

When the shaft a^{21} is turned, together with the gears a^{23}, the cam-disk a^{27}, acting through the bell-crank a^{28}, will move the bail a^{25}, thereby releasing the parts a^{17} and holding the same released until one complete rotation has been made, at which time the register-wheels will all have been restored to normal or so-called "zero" positions. Attention is here further called to the fact that in the normal positions of the parts, as shown in Figs. 9 and 12, the lugs a^{14} on the carrying-levers a^{11} engage back of the coöperating pins a^{15} of the corresponding wheels a and prevent backward movements of the said register-wheels. Hence the said lugs a^{14} act as stops to prevent the counting-wheels under return movements from being thrown beyond their zero positions. Under the return movements of the register-wheels their peripheral lugs a^4 act on the alining finger g^{10} with a lifting action, thereby raising the supplemental section g of the register-carriage on its pivotal bearings, thus permitting the wheel-lugs to pass.

Digit-keys.—The digit or computer key levers of the calculating mechanism or attachment are indicated by the character b, the same, as shown, being pivoted to the rear portion of the base 1, as shown at b', and yieldingly held upward by a coiled spring b^2. At their free forward ends the keys 5 are provided with finger-pieces b^3, located in a transverse row just forward of the spacing-bar 18 of the type-writer. There are but nine of these keys b, and they are marked and appropriated to the successive digits "1" to "9," inclusive, as indicated by the numerals on their finger-pieces b^3 in Fig. 1. As will also be noted by reference to Figs. 1 and 4, the digit-keys b and the numeral-keys 17 of the type-writer, which bear corresponding numerals, stand in line with each other. These corresponding keys b and 17 are connected by separable hooks preferably formed as best shown in Figs. 2, 3, and 5, wherein b^4 indicates light upright fingers carried by the keys b and 17^a indicates the depending link-sections pivoted to the type-writer keys 17. The sections b^4 and 17^a are provided, respectively, with hooked ends b^5 and 17^b, which normally and under the action of gravity engage, as shown in the drawings, and connect the digit-keys b of the attachment and the numeral-keys 17 of the type-writer in such manner that when one of the keys b is depressed it will draw down the corresponding numeral-key 17, but when one of the said keys 17 is depressed it will not act upon the corresponding key b.

By means of a bail b^6, the downturned prongs of which embrace the sides of the base 1, being pivoted thereto at b^7, the hooks b^4 17^a may simultaneously be disconnected, so that the depression of the digit or attachment keys b will not act upon the printing mechanism of the type-writer. This action is illustrated in Fig. 2 by dotted lines, which show the transverse bar portion of the bail b^6 as thrown against the pivoted links 17^a, forcing them into inoperative positions. To set the bail b^6 in either of its two positions, it is provided with a laterally-springing arm b^8, having a

perforation adapted to engage with either of the pair of pins b^9 on the adjacent side of the base 1. For a purpose which will presently appear the digit-key levers b are bifurcated, as shown at b^{10}. (See particularly Figs. 4, 5, and 6.) As shown, the key-levers b work through a slotted guide-plate b^{11}, provided with a top bar b^{12}, which serves as a stop to limit the upward movements thereof.

Differential feed mechanism.—The parts classified as within the differential feed mechanism are best illustrated in Figs. 4, 5, 6, and 17. The notation c indicates a rock-shaft which is extended transversely of the machine just over the outer ends of the key-levers b and is mounted in suitable bearings 1^b of the base 1. To this shaft c is secured a series of curved cam-fingers c', nine in number, and working each through the bifurcation b^{10} of the corresponding digit-key lever b. The ends of the fingers c' terminate, preferably approximately the same radial distance from the center of the shaft c; but from the left toward the right the said cam-fingers are curved successively one unit of movement farther on the line of a segment struck from the axis of the shaft c, as best illustrated in Fig. 6. Each key b is provided with a cam-roller c^2, mounted between the sides of its bifurcated section on a pin c^3. These so-called "cam-rollers" c^2 when the keys are depressed act upon the cam-fingers of the corresponding keys and serve to impart as many units of rotation to the shaft c as are indicated on the finger-pieces of the respective keys. A spring c^4, (see Figs. 3 and 6,) connected at one end to the base 1 and at its other end to a depending arm c^5 on the rock-shaft c, yieldingly holds the rock-shaft and its cam-fingers c' in their normal positions, (shown in the drawings by full lines,) in which position the stop-finger c^6 on said shaft c engages a stop-pin c^7 on the base 1, as shown in Figs. 5 and 6. Loosely mounted on one end, as shown the right-hand end of the rock-shaft c, is a spur-wheel c^8, which is provided with a ratchet-wheel c^9. On the same end of the shaft c adjacent to the ratchet-wheel c^8 is a rigidly-secured arm c^{10}, having at its free end a pawl c^{11}, which by a spring c^{12}, applied thereto and to said arm c^{10}, is held for operation on the said ratchet-wheel. Each tooth of the ratchet wheel c^9 represents one unit of oscillatory movement of the rock-shaft c as imparted by the coaction of the cam-fingers c' and the rollers c^2 under the depression of the digit-keys. In the construction illustrated the spur-gear c^8 meshes with a smaller spur-gear c^{13}, secured for movement with a large spur-gear c^{14}, both of which gears c^{13} and c^{14} are mounted on the stud c^{15}, projected from a bracket c^{16}, supported by the base 1. A transversely-extended shaft c^{17}, which, as shown, is angular or square in cross-section, is suitably journaled at its ends in the left-hand bearing-plate a^3 of the register and in a similar bearing-plate [illegible], secured at the forward right-hand corner of the machine-base 1. This shaft c^{17} is located with its axis coincident with the axis of the passage formed through the hub portions of the counting-wheels a of the register, as best shown in Fig. 10. Also it will be noted that the right-hand bearing-plate a^3 is cut away at 3^a, so as to leave a large opening around the shaft c^{17}. Secured at the right-hand end of the shaft c^{17} is a spur-gear c^{18}, which meshes with the spur-gear c^{14}, hereinbefore noted.

With the feed mechanism just described it will be understood that when one of the digit-keys b is depressed the shaft c^{17} will be rotated through as many units of angular movement as are indicated on the digit-key depressed. To illustrate: Ten so-called "units of rotation" or angular movement of the shaft c^{17} make one complete rotation thereof. The depression of the digit-key marked "1" will cause the shaft c^{17} to be rotated one-tenth of a complete revolution, and the depression of the digit-key marked "9" will cause the said shaft c^{17} to be rotated nine-tenths of a complete rotation. These statements should be remembered for the reason that the rotation of the shaft c^{17}, acting through the so-called "wheel-mover" k, carried thereon, imparts the step-by-step or unit movement to the counting-wheels a of the register, as will later more fully appear.

When one of the digit-keys b is depressed, the pawl c^{11} of lever c^{10}, acting on the ratchet-wheel c^9, turns the rock-shaft c as many units of movement as indicated on the key depressed. When the depressed key is released, it is thrown upward by the action of its spring b^2, and the spring c^4, becoming active, carries the rock-shaft c, pawl c^{11}, and other parts carried thereby back to their normal positions as limited by the stop c^7. Thus by the action of the keys b and their rollers c^3 on the curved cam-fingers c' of the rock-shaft c and by the action of the pawl c^{11} on the ratchet-wheel c^9 the differential feed movements are given.

Overfeed movements under the action of momentum are prevented by means of a stop device, which operates to positively intercept the movements of the shaft c^{17} at the proper times. Of the parts of this stop device, d indicates a wide-faced ratchet-wheel of rubber, leather, or other suitable material which is sufficiently rigid to maintain its form and sufficiently elastic to avoid sharp concussions. This elastic ratchet-wheel d is secured on the end of the shaft c^{17} outward of the gear c^{18} and preferably is thus secured between a pair of metal sides or disks d', having telescoping screw-threaded hubs d^2. These clamping members serve to hold the pliable or elastic ratchet-wheel d in form. The ratchet-wheel d has ten teeth. A bail d^3,

pivoted on the transverse shaft a^{26}, heretofore noted, is provided with an arm d^4, having a hooked end d^5, which is normally held out of engagement with the teeth of the ratchet d by a spring d^6, secured on the base 1 and engaging the transverse portion of the said bail d^3, as shown in Figs. 3 and 5. The said bail d^3 is provided at its inner transverse portion with a flange d^7, which is preferably faced on its upper and lower surfaces with rubber, leather, or similar material d^8 to cushion the impacts which it receives. Said flange d^7 underlies the outer ends of all of the key-levers b, and at the extreme downward movement of any of the said keys it is engaged by the depressed key, and by the movement of the bail d^3 caused thereby the hooked end d^5 of the arm d^4 is thrown into engagement with one of the teeth of the ratchet d, thereby intercepting and positively stopping rotation of the said ratchet-wheel and of the shaft c^{17}. This stopping of the ratchet-wheel and shaft, however, taking place, as it does, at the final downward movement of the depressed key b, comes at a time after the full and proper movement has been imparted thereto by means already described. When the bail d^3 is depressed to its limit, it is temporarily locked down by a detent d^9, pivoted to a small standard d^{10} on the base 1 and having at its free lower end a notch or shoulder d^{11}, which engages with the upper transverse portion of the bail d^3, as shown in Fig. 17. A light spring d^{12}, which, as shown, connects said detent with the bracket c^{16}, heretofore noted, tends to draw the said detent into engagement with the said bail. Normally, however, the detent is held inoperative, as shown in Fig. 17, by means of a pin d^{13} of a short arm d^{14}, carried by the rock-shaft c, which pin engages a slot d^{15} of a link d^{16}, the forward end of which is pivoted to the upper end of said detent. The slot d^{15} is long enough to permit the free movement of the rock-shaft c when the keys are depressed. Hence it will be seen that the differential feed-shaft c^{17} is locked by the device just described from the time that the depressed key b reaches the limit of its downward movement until the said key and the rock-shaft c have returned to normal position.

To prevent accidental movements of the feed-shaft c^{17} at times when it is not locked by the device just described, one of the clamping-disks d' is provided with ten peripheral depressions d^{17}, with which the free end of a friction-spring d^{18}, secured on the base 1, is arranged to engage. This frictional retainer is very easily overcome by the feed movements and does not increase materially the force required to operate the differential feed mechanism.

The modification in the differential feed mechanism illustrated in Fig. 20 is similar to the mechanism illustrated in the other views, with certain exceptions, which may be briefly noted, to-wit: The curved cam-fingers c' on the rock-shaft c are curved forward instead of rearward. The cam-rollers c^2 are so arranged that under a depression of the key-levers the said rollers will carry the pawl c^{12} backward over the teeth of the ratchet-wheel c^9 and the feed movement will be given under the action of the spring c^4 when the key-lever is released or thrown up. This modification has the advantage that no matter how quickly a key may be depressed the feed movement will always be the same, as the same depends on the tension of said spring c^4 becoming operative upon the release of the key. Further, in this modification the arm d^{14} on the rock-shaft c extends downward instead of upward, a leaf-spring 12^d is applied to the detent d^9 instead of the coiled spring d^{12}, (shown in the main views,) a stop-pin c^7 is located in front instead of to the rear of the arm c^6, and the dog d^4 operates on the rear instead of the forward side of the ratchet-wheel d.

Register-carriage and connections.—These parts are best shown in Figs. 3, 4, 5, 7, 10, 12, and 13. A pair of parallel guide-rods f extend crosswise of the machine and are supported in the frame-plates a^3 and 1^c, hitherto noted. The register-carriage is mounted for transverse traveling movement on the said rods f as guides and is made up of what may be termed the "body" or "primary section," a supplemental or relatively shiftable section, and a wheel-mover subject to and movable with said supplemental section. Said primary section of said register-carriage includes a rack f', with end pieces or heads f^2, that slide upon the guide-rods f. The supplemental or relatively shiftable section of said register-carriage includes an alining-plate g with alining-finger g^{10}, a cross-bar g' with brackets g^2, having open seats g^3, which rest on the inner guide-rods f, and open seats g^4, which rest upon the outer guide-rod f, thus affording a free pivotal mounting for the said supplemental section of said carriage, as best shown in Figs. 3 and 5. Said brackets g^2 project forward and work within elongated notches g^5 cut in the rack-bar f', as best shown in Fig. 13. The rack-bar f' is provided with a bell-crank latch-lever g^6 at its right-hand end, the upper latch-arm of which is engageable with the right-hand member of the brackets g^2 on the supplemental section of the register-carriage to lock the supplemental section with its said end brackets g^2 bearing against the left end walls of the notches g^5, or, in other words, at the extreme left of its shiftable travel relative to the main or body section of the carriage, the purpose of which relations of said parts will more fully appear in tracing the operation of the machine. Said bell-crank lever g^6 is subject to a spring g^7, carried by the rack-bar f' and tending

to force the latch into its lowermost position for engagement behind the adjacent bracket g^2. The lower arm g^8 of said bell-crank latch-lever g^6 is in position to engage a spring-finger g^9, projecting toward the left from the frame-plate 1^c, as best shown in Fig. 13, when the carriage is at its extreme right-hand or idle position, so as to unlatch the said lever and hold the same with its latch-arm g^6 in its uppermost or inoperative position against the tension of its depressing-spring g^7.

The forward edge of the alining-plate g is adapted to engage the forward members of the peripheral teeth a^4 on the counting-wheels a, and the alining-finger g^{10}, carried by said plate g, is adapted to engage the rear members of the pair of said teeth a^4, between which the said parts g and g^{10} travel when the carriage is moved to the left; thereby insuring the alinement of the counting-wheels a and holding the same against displacement in either direction after the same have been properly positioned by the wheel-mover k or the carrying-levers a^{11}. Otherwise stated, the said alining members g and g^{10} do not interfere with the proper rotation of the wheels a under the control of the wheel-mover k or the carrying-levers a^{11}. Moreover, the pivotal mounting of said alining members g and g^{10} prevents the finger g^{10} from interfering with the return of the counting-wheels to their zero position.

In the forward lower edge of the alining-plate g is a notch g^{11}, as best shown in Figs. 7, 10, and 18, to pass the peripheral teeth a^4 of the counting-wheels a when rotated by the wheel-mover k, and depending from said plate g to the left of the notch g^{11}, as best shown in Fig. 18, is a lug g^{12}, which in turn is spaced apart from the crooked right-hand end of the alining-finger g^{10}, thereby leaving a passage g^{14}, through which the peripheral teeth a^4 of the counting-wheels a may pass when being rotated by the carrying-levers a^{11}. For action on said carrying-levers a^{11} there is attached to the head-pieces f^2 of the primary section of the register-carriage a rod g^{16}, having the left projecting end thereof bent forward at an angle to afford a cam g^{15}, which when the carriage is moved toward the left into its initial position for a new line acts in succession on the set members of the carrying-levers a^{11} to carry forward onto the counting-wheels the tens for the last previous line, as will be more readily understood when the operation of the machine is summarized.

The wheel-mover k is in the form of a sleeve of proper shape in cross-section to fit the angular shaft c^{17} and to slide freely thereon, but be subject thereto for rotation therewith. Said wheel-mover k has a ten-toothed head k^3 at its left, the ten notches k^4 of which are adapted to register with the internal teeth a^5 of the counting-wheels a, as best shown in Fig. 15. The supplemental section of the register-carriage—to wit, the right-hand bracket g^2—has a depending arm k', which engages with an annular groove k^2, formed in the right-hand end of the sleeve or wheel-mover k. It follows from this construction and relation of the said parts that the wheel-mover k is subject to the supplemental section of the register-carriage and will be made to move with the carriage transversely of the machine on its supporting-shaft c^{17}, and thereby the toothed head k^3 of the wheel-mover will pass through the central openings of the counting-wheels a, and the said head k^3 will be made to engage with the said counting-wheels in succession and become operative to turn the same under the rotation of the shaft c^{17}. It should be noted that the relation of the wheel-mover to the carriage is such that the head k^3 of the wheel-mover always stands vertically in line with the notch g^{11} in the alining-plate g, which notch permits the passage of the peripheral teeth a^4 of the particular counting-wheel a subject to the head k^3 of the wheel-mover k.

The alining-plate g of the supplemental section of the register-carriage is provided with a pointer-finger g^{17}, (best shown in Fig. 10,) which works through a slot g^{18} and coöperates with a scale g^{19} on the register-cover, as best shown in Fig. 1, to indicate the position of the register-carriage and serves to show the operator when the wheel-mover is brought into position for engagement with the left-hand member of the counting-wheels required for any given line. Otherwise stated, it indicates when the wheel-mover is set for action on the proper denominational member of the counting-wheels.

The reciprocations of the register-carriage are limited by end stops (marked, respectively, h and h') fixed, respectively, to the adjacent frame-plates 1^c and a^3, as best shown in Figs. 4 and 13.

A buffer-spring h^2 encircles the forward guide-rod f, as best shown in Figs. 4 and 10, and serves to yieldingly hold the register-carriage at the instant when a slip-motion device comes into action for permitting punctuation between the dollars and cents columns and for preventing movement of the carriage under the effect of momentum when the cents are being listed, as will more fully appear when tracing the operation.

The register-carriage receives its motion from the type-writer carriage by means which will now be noted.

A shaft f^{19}, which for distinction may be called the "escapement-shaft for the register-carriage," extends from front to rear of the machine below the type-writer table 2 and is supported in a forward bearing-bracket f^5 and a rear bearing-bracket f^{14}, both fixed to the bed 1 of the machine. To the forward end of said shaft f^{19} is fixed a gear f^3, which

engages with the teeth of the register-rack f', as best shown in Figs. 4 and 13. The said shaft f^{19} is also provided with a gear f^4 for another purpose, which will later be named. On the rear end of said escapement-shaft f^{19} is loosely mounted a spur-gear f^{20}, (best shown in Figs. 3, 4, and 14,) which engages with another spur-gear f^{21}, loosely mounted on the upper portion of frame-bracket f^{14}. A pinion f^{22}, provided with a flat toothless portion f^{23}, (best shown in Fig. 14;) is held for rotation with said gear f^{21}. The teeth of said pinion f^{22} normally engage with the teeth f^{24} of the type-writer-carriage rack-bar f^{25}, as shown in Fig. 14. Said rack-bar f^{25} is secured to a rod f^{26} by means of heads f^{27}, slidable on the rod, and equipped with set-screws $f^{27'}$ for securing the said rack to the said rod at any desired set position. The rod f^{26} has arms f^{28} rigidly connecting the same with the type-writer carriage 4, as best shown in Figs. 1 and 2. It follows, of course, that the bar f^{25} travels with the type-writer carriage. The type-writer carriage is permitted a much greater traveling movement than the register-carriage, and when the toothed portion f^{24} of the rack runs beyond the pinion f^{22} the flat surface f^{23} of said pinion will engage the smooth or toothless surface f^{40} of the rack-bar f^{25}, and thereby the pinion f^{22} will be held or prevented from rotation, while at the same time the type-writer carriage is free to travel. Said rack-bar f^{25} is shown as provided with another set of teeth f^{41} to the left of its smooth or toothless portion f^{40}, which teeth f^{41} can be brought in position for coöperation with the pinion f^{22} whenever so desired by properly setting said rack-bar f^{25}, thereby rendering it possible to list parallel columns on a single page. The pivotal motion permitted to the rack-bar f^{25} by its heads f^{27} connecting the same to the rod f^{26} enables this adjustment of the rack-bar to be readily made.

From the parts so far described it is obvious that when the toothed portion f^{24} of the rack-bar f^{25} is in engagement with the pinion f^{22} the said pinion and the gear f^{21}, which is held to move therewith, will receive rotary motion under the travel of the type-writer carriage. This motion is transmitted to the escapement-shaft f^{19} through a slip-motion device which will now be described. This slip-motion device is employed in order to permit a period, other punctuation-mark, or space to be made to appear on the proof-sheet between the columns representing dollars and cents; otherwise the gear f^{20} on the shaft f^{19}, with which the gear f^{21}, driven by the type-writer carriage, imparts motion, might be rigid on the shaft f^{19}, and if the said gear f^{20} was rigid with the shaft f^{19} the machine would print what is usually termed "solid matter," or, in other words, the figures would be closely spaced. Said slip-motion device includes, in addition to said gear f^{20}, loose on the shaft f^{19}, a disk f^{29}, secured to the shaft f^{19} by a set-screw $f^{29'}$, as shown, and provided with two ratchet-teeth (marked, respectively, f^{30} and f^{31}) and with a shoulder f^{32}. A larger disk f^{33} is fixed to the hub of the loose gear f^{20} and on its profile-face carries a spring-pressed pawl f^{34} for coöperation with the said ratchet-teeth f^{30} and f^{31} of the smaller disk f^{29}, fixed to said shaft f^{19}, as hitherto noted. Said larger disk f^{33} also has a profile-pin f^{35}, which plays between the shoulder f^{32} of the smaller disk f^{29} and the ratchet-tooth f^{30} thereof. In the normal relation of the parts the pawl f^{34} engages the ratchet-tooth f^{30}, and the profile-pin f^{35} of the larger disk f^{33} engages with the shoulder f^{32} of the smaller disk, and thereby the two disks are locked together for positive movement with the shaft f^{19} in either direction of the latter's rotation. For printing solid or closely-spaced matter the said disks f^{33} and f^{29} would thus remain permanently locked together, and the action would be exactly the same as if the gear f^{20} was fixed to the shaft f^{19}.

A trip-lever f^{36} is pivoted to a frame-bracket f^{37} and is subject to a spring f^{39}, so applied as to hold said trip-lever in either of two extreme positions. (Shown by the full lines and the dotted lines, respectively, in Fig. 14.) The downward motion of the lever f^{36} is limited by a fixed stop f^{38}. The said lever f^{36} is shown in full lines in Fig. 14 in its idle or inoperative position, and when set for coöperation with the other parts of the slip-motion device said lever f^{36} takes the position shown in dotted lines in said Fig. 14. When so set as shown in dotted lines in Fig. 14, the inner end of said lever will project into the path of the spring-pawl f^{34} on the large disk f^{33} and will thereby trip the same out from the ratchet-tooth f^{30} and permit a limited slip motion, or, in other words, permit the disk f^{33} to move forward in respect to the smaller disk f^{29} until the pawl f^{34} engages the next ratchet-tooth f^{31} of said smaller disk, during which action the register-carriage and the shaft f^{19} are held from movement by the buffer-spring h^2 hitherto noted. The parts are so set and timed that this slip motion will occur at the right point to punctuate or space between the dollars and cents column.

Carriage-locating and line-spacing devices.—These parts are best shown in Figs. 1, 2, 3, 4, and 13. It has already been noted that the escapement-shaft f^{19} for the register-carriage is provided near its forward end with a gear f^4. Said gear f^4 engages with a relatively large gear f^6, mounted for rotation with a long sleeve f^7, which in turn is mounted to slide in and rotate on its three bearing-brackets f^8, fixed to the base 1 of the machine, as best shown in Fig. 3. The gear f^6 is connected with said sleeve f^7 for rotation therewith by means of a long key f^9, which permits the slid-

ing motion of the sleeve in respect to the gear as hitherto noted, and the said gear f^6 is held from sliding with the sleeve by the mounting thereof between the two rearmost members of the bearing-brackets f^8, as shown in Fig. 3. The forward end of a long rod f^{10} passes outward through the sleeve f^7 and is provided with an end nut f^{12}. The sleeve f^7 is provided with a hand-wheel f^{11}, and the hub of this wheel is adapted to engage with the nut f^{12} when the hand-wheel and sleeve are pulled outward, thereby enabling a longitudinal motion to be imparted to the rod f^{10}. The rear end of the rod f^{10} works through the bearing-bracket f^{15} and then extends upward at right angles with the vertical portion working between bifurcated or forked guide f^{13}, fixed to the rear bearing-bracket f^{14}. The upper end portion of the rod f^{10} is then again bent at right angles and extends inward and then downward, as shown at f^{16}, for engagement with the type-writer-escapement-releasing bail 12 and is then again bent at right angles to afford a projecting horizontal end portion f^{17}, which engages in a notch or mouth formed in the rear edge of the escapement-slide 9 of the type-writer, all as best shown in Fig. 3.

The line-feed pawl-lever 8^b is connected by link 12^b with the arm 12^a, projecting upward from the bail 12, as best shown in Fig. 2 and as hitherto noted when describing the type-writer. It is therefore of course obvious that a forward motion of the rod f^{10} will cause the part f^{16} thereof to engage and rock the bail 12 and its lever-arm 12^a, and thereby through the link 12^b also to rock the line-feed lever 8^b of the type-writer carriage as required to move the paper forward the requisite distance to effect the line-feed. The forward motion of the rod f^{10} also causes the part f^{17} thereof to force forward the escapement-slide 9 of the type-writer, thereby rocking the bell-crank 13 and releasing both the driving-pawl 14 and the locking-pawl 15 from the escapement-rack 7 of the type-writer carriage. The type-writer carriage thus being released from its escapement-rack may be moved in either direction by the rotation of the hand-wheel f^{11} and the sleeve f^7 under the action of the connections therefrom; but the gear f^6, which rotates with the sleeve f^7, engages the gear f^4, fixed to the escapement-shaft f^{19}, and hence the said shaft and all the parts carried thereby will also receive rotary motion under the manipulation and rotation of the hand-wheel f^{11}. It follows, therefore, from the construction and relation of the said parts just hereinbefore described that both the type-writer carriage and the register-carriage are subject to the hand lever or wheel f^{11} and that by the rotation thereof the said type-writer carriage and the said register-carriage will be moved in opposite directions, and hence it further follows that by the manipulation of the hand-wheel f^{11} both the type-writer carriage and the register-carriage may be located either at opposite extreme positions or any intermediate desired position which may be necessary for the proper coöperation thereof. Hence the hand-wheel f^{11} and rod f^{10} and the connections therefrom serve to effect the line-feed and to properly locate both carriages for the required actions therefrom.

Summary of operation.—The action of the different groups of mechanism has been so fully stated in connection with the detail description that it is thought a brief summary of the general operation will be sufficient. The idle position of the register-carriage is at the extreme right-hand limit of its transverse traveling movement, and when in this position the type-writer carriage will necessarily stand at the extreme left of its travel in virtue of the connections between the type-writer escapement-rack and the rack of the register-carriage. If these idle positions of the two carriages be assumed as the starting-point for tracing the operation, then the successive steps of manipulation would be as follows: The operator would first properly locate the two carriages and effect the line-feed of the paper on the platen by the proper manipulation of the hand-lever f^{11}; otherwise stated, he would pull out the hand wheel or lever f^{11}, thereby pulling forward the rod f^{10}, thus releasing the type-writer carriage and its escapement-rack and rocking the line-feed pawl-lever 8^b, as hitherto fully noted, and then while still holding the hand-wheel f^{11} in its outermost position he would rotate the same, and thereby, through the gears f^6 and f^4, impart rotary motion to the register escapement-shaft f^{19}, and by the connections from said shaft f^{19} at the opposite ends thereof the type-writer carriage would be moved toward the right into its proper initial position and the register-carriage be moved toward the left into its proper initial position, which would be indicated by the pointer g^{17} on the scale g^{19}, readable on the face of the register-cover, as hitherto noted. This initial position of the register-carriage would of course be one wherein the head k^3 of the wheel-mover would engage the proper denominational member of the counting-wheels a corresponding to the left-hand number or column in the line of figures. Having thus effected the line-feed and properly located the two carriages, the operator pushes the hand-wheel f^{11} and the sleeve f^7 back inward to its limit or lets go of the hand-wheel, whereupon the carriage-motor spring 6, through the bell-crank 13, Fig. 1, will affect said movement automatically, forcing rearward therewith the rod f^{10}, in virtue of the mounting of the sleeve on the rod, and thus permitting the type-writer escapement-pawls to reëngage with their coöperating rack 7 and

bringing all the parts into coöperative relation. It has been assumed that the counting-wheels were all in their initial or zero positions. The operator then manipulates the so-called "digit" or computer keys in the natural reading order of the numbers in the line. For example, suppose that the number "2496" is to be listed on the paper in the type-writer and to be registered on the counting-wheel. The two carriages having been properly set, as hitherto described, for making the wheel-mover k to act on the fourth denominational wheel from the right, the operator first strikes the computer-key "2" and follows with the computer-keys "4," "9," and "6." The depression of each computer-key pulls down the corresponding numeral-key of the type-writer in virtue of the hook-like connections by which the same are united, as hitherto noted, and hence the printing devices of the type-writer will be actuated in the usual way to print the corresponding numbers in the natural reading order, or from left toward the right. The escapement movement of the type-writer under the action of its numeral-keys will impart motion to the escapement-shaft f^{19}, and this in turn acting on the rack f' of the register-carriage will move the same one step toward the right at the same time that the type-writer carriage is moved one step toward the left. The head of the wheel-mover k is thus brought in succession into engagement with the proper denominational members of the counting-wheels a, and when the computer-key is depressed through the differential feed devices heretofore described will rotate the particular wheel then engaged thereby as many steps of movement as there are units in the number represented by the computor-key struck. When computer-keys corresponding to all the numbers in the horizontal line have been struck in regular reading order, the register-carriage will be at the right-hand limit of its transverse travel and the type-writer carriage at the left-hand limit of its travel. Thereupon the operator will again manipulate the hand wheel or lever f^{11}, thus again effecting the line feed of the paper on the type-writer and relocating the two carriages in the proper positions for the next line of numbers. The keys are then again struck in the natural reading order of their numbers, with the result that the second line will be listed directly under the first, and the number or counting wheels will be properly actuated to count the units in each denomination and to set the carrying-levers all as required to carry forward the tens to the higher orders in succession from the right toward the left at a later stage—to wit, when the register-carriage and the type-writer carriage are reset into initial positions for the next line. In this carrying action the inclined or cam-acting end g^{15} of the rod g^{16} comes in contact in succession with the set members of the carrying-levers a^{11} and by rocking the same back into their normal positions causes the pawls a^{17} thereof, engaging the ratchet-wheel a^{16} of the counting-wheel a of the next higher order, to move forward as required to carry the tens. As only one counting-wheel a will be rotated at a time, the single notch or opening g^{14} between the parts g^{12} and g^{13} of the alining-plate g (best shown in Fig. 18) will always afford the necessary clearance to pass the peripheral teeth a^4 of the particular counting-wheel a which is being rotated by any set carrying-lever a^{11}, subject to the cam end g^{15} of the rod g^{16}. This is true even if all the register-wheels should have stood at "9" and one or more units should be added in the lowest denomination, for the reason that the said carrying-levers a^{11} are actuated in succession under the movement of the register-carriage toward the left for assuming its initial position for the next line. Of course the register-carriage must always move far enough toward the left to actuate all of the carrying-levers a^{11} which may have been set under the initial rotation of the counting-wheels effected under the manipulation of the computer-keys. When all the desired lines of numbers have been listed, the operator again manipulates the hand-wheel f^{11}, so as to effect the line-feed of the paper and to throw the register-carriage to the extreme left-hand of its travel, or at least far enough to make sure that all the carrying-levers set when listing the last line of numbers will be actuated, so as to carry the tens and complete the addition on the register-wheels. The operator then notes through the sight-opening what the proper reading of the total or aggregate number is and then operates the numeral-keys of the type-writer to list the total at the foot of the column. This being done, the operator again manipulates the hand-lever f^{11}, so as to restore the register-carriage to its right-hand or idle position and the type-writer carriage to its left-hand or idle position. The operator then manipulates the hand-knob a^{22} and restores all the counting-wheels to their zero positions. All the parts of the machine will then be in readiness for listing and adding another set or series of columns of numbers.

The operation has been traced without regard to whether or not the numbers were to be listed as solid matter or as punctuated matter. The actions are precisely the same, with the exception that if punctuation or spacing is desired between dollars and cents the trip-lever f^{36} is turned down into its dotted-line position, as shown in Fig. 14, for coöperation with the pawl f^{34} on the large disk f^{33} to trip the pawl and permit the same to slip from the tooth f^{30} to the tooth f^{31} of the smaller disk f^{29}, as hitherto noted in describing the said slip-motion device. When this slip takes

place, the register-carriage stands stationary, being yieldingly held by the buffer stop-spring h^2, as hitherto noted, and hence the decimal or other punctuation key of the type-writer may be operated to print a decimal between the dollars and cents columns, or the space-bar of the type-writer may be actuated simply to afford a space between the dollars and cents in the listed line.

From the foregoing statements it is thought that the general operation of this machine will be fully understood.

A few comments should, perhaps, be made as to certain characteristic features of novelty in this machine. From the described connections between the computer-keys and the numeral-keys of the type-writer it must be obvious that the type-writer is always available for use in the ordinary way without the operation of the computer, while, on the other hand, that whenever the computer-keys are operated the numeral-keys of the type-writer will also be operated when the connecting-hooks between the said two sets of keys are left standing in the normal relative positions, and hence that the printing devices of the type-writer will be called into action and operate to list the numbers which are to be added. This relation of the type-writer to the computer is, so far as I know, broadly new. Otherwise stated, I am the first, so far as I know, to combine a type-writer and a computer by connections of such a character that the type-writer is always ready for use in the ordinary way without the actuation of the computer and that when the computer-keys are operated the double function will be secured and that this single or double function is always available without requiring the manipulation of any shift-key or other interlocking or unlocking device. The described connections are also such that the connecting-hooks may be locked out of engagement whenever so desired to permit the computer to be used without listing the numbers, or, in other words, without operating the printing devices of the type-writer. The bail b^6 serves to disengage the connecting-hooks b^4 and 17^a and hold the same separated, and a bail composed of the parts m m^2, suspended from the escapement-bar 18 of the type-writer, with its cross-rod m^2 underlying all the computer-key levers b, renders the escapement action of the type-writer carriage available on the escapement-shaft f^{19} and through the same on the register-carriage when the computer-keys are operated and the connecting-hooks b^4 and 17^a are disconnected, as shown in dotted lines in Fig. 2.

Having regard to the reliability of the combined machine for both listing and adding the numbers, it should be noted that in the Blickensderfer type-writer, as is well known, the printing-head 21 is positively held for synchronous movement with the type-writer key-levers, or, otherwise stated, a full stroke of the type-writer key-lever is absolutely necessary in order to print the character brought into action thereby. It follows that any strokes of the computer-keys which will be sufficient to print at the type-writer will of necessity be sufficient to impart the proper number of steps of movement to the counting-wheels, or, in other words, as many steps of movement as there are units represented by the key being struck. These facts together with the described devices for preventing overrotation of the counting-wheels under the effect of momentum and for preventing backlash or accidental displacement thereof, all as hitherto described, positively insures the true and accurate counting action of the register-wheels necessary to secure the reliable registration of the numbers being listed and added. Attention is also specially called to the "carriage-locating and line-spacing devices" hitherto described under that heading and the actions of which are also traced in the summary of the operation. So far as I know I am the first to have provided a common hand-lever with connections both to the type-writer carriage and the computer-carriage and operative to effect the line-feed on the type-writer and to locate the two carriages in their proper relative positions for completing the registration on the adding-wheels and taking initial positions for the next line. This is a feature of large advantage for insuring increased speed by saving to the operator the time which would otherwise be required to handle the two carriages and to effect the line-feed, and is of even larger importance for always insuring the line-feed, and thus preventing "piling," or, in other words, rewriting over a printed line. It also enables the operator to control the manipulation of the two carriages and effect the line-feed with one hand, while the other is left free to handle his copy-slips, such as checks, way-bills, &c. It is obvious of course that the connections between the hand-lever and the two carriages may be modified without departing from the spirit of this feature of the invention.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. The combination with a type-writer involving finger-operated numeral-keys, of computing mechanism involving a register made up of a series of sections, a bank of finger-operated digit-keys having finger-pieces exposed where they may be struck by the fingers, a differential feed device actuated by said digit-keys and operating on said register-sections, and connections from the type-writer carriage, whereby the step-by-step movement of said carriage will render said differential feed device operative on the sections of said register, in succession.

2. The combination with a type-writer involving a bank of numeral-keys, of comput-

ing mechanism involving a series of counting-wheels, a wheel-mover mounted for both axial and rotary movements, an independent bank of finger-operated digit-keys with connections to the corresponding numeral-keys of the type-writer, a differential feed device actuated by said digit-keys and rotating said wheel-mover, and connections between the type-writer carriage and said wheel-mover for imparting a step-by-step movement from the left toward the right, to said wheel-mover, and rendering it operative on said counting-wheels in succession.

3. The combination with a type-writer involving finger-operated numeral-keys, of computing mechanism comprising a bank of finger-operated digit-keys, with finger-pieces exposed where they may be struck by the fingers, and connections between the numeral-keys of said type-writer and the corresponding digit-keys of said computing mechanism, which connections cause the latter to operate the former, but permit the former to be operated without operating the latter.

4. The combination with a type-writer, involving a carriage and finger-operated numeral-keys, of calculating mechanism comprising an independent bank of finger-operated digit-keys having finger-pieces exposed where they may be struck by the fingers, a divided connection between said digit-keys and the corresponding numeral-keys of the type-writer, and means for simultaneously disconnecting the sections of said divided connections, at will.

5. The combination with a type-writer involving finger-operated numeral-keys, of calculating mechanism comprising an independent bank of finger-operated digit-keys having finger-pieces exposed where they may be struck by the fingers, a divided connection between said digit-keys and the corresponding numeral-keys of the type-writer, and a pivoted bail engageable with said connections to render them operative and inoperative, at will, said bail having a device for setting it in either of its two positions.

6. The combination with a type-writer having a carriage of a register involving a series of sections, differential feeding mechanism, a wheel-mover movable step by step from one section to the other of said register, and connections between said wheel-mover and the type-writer carriage, operating to move the former step by step over the sections of said indicator and then to leave the said wheel-mover standing idle upon the continued movement of the type-writer carriage toward the left.

7. The combination with a register made up of a series of counting-wheels, of a bank of digit-keys, a rotary feed-shaft, a wheel-mover rotating with and sliding on said feed-shaft for successive action on said counting-wheel, differential feed mechanism rotating said feed-shaft, and an intercepting stop device comprising a ratchet-wheel on said feed-shaft, a pawl coöperating with said ratchet-wheel, and a connection from said pawl subject to the action of any of the depressed digit-keys, substantially as described.

8. The combination with a series of counting-wheels and a key-operated differential wheel-mover which operates in succession thereon, of a series of carrying-levers adapted to be set in operative position by the rotation of counting-wheels of a given order, and hand-operated means for restoring successively to normal position such carrying-levers as have been set by the counting-wheels, thus effecting the carrying over of the proper amount from a lower to a higher denominational order.

9. The combination with a series of counting-wheels and a differential wheel-mover which operates in succession thereon, of a series of carrying-levers arranged to be set in operative position by counting-wheels of a given order, a paper-supporting carriage moving uniform distances for letter-spacing, and means for restoring to normal position such carrying-levers as have been set by the counting-wheels, said means being operative during the return of the paper-supporting carriage to its initial position for starting a new line.

10. The combination with a register made up of a series of adding-wheels and carrying devices, of resetting mechanism for said adding-wheels, comprising a shaft on which is rigidly mounted a series of mutilated gear-wheels, corresponding in number to the number of adding-wheels, and coöperative teeth or projections on said adding-wheels, said mutilated gear-wheels and adding-wheels being capable of intermeshing with each other, and also capable of free movements, in which each set clears the other, without shifting the relative positions to each other of the shafts or supports of either set of wheels, and means for rotating the shaft on which said mutilated gears are mounted.

11. The combination with the counting-wheels a having the carrying-pins a^{15}, resetting-pins a^{20} and teeth a^{16}, of the carrying-lever a^{11} subject to said carrying-pins a^{15} and provided with the pawls a^{17} acting upon said ratchet-teeth a^{16}, the shaft a^{21} with suitable finger-piece, the series of resetting-gears a^{23} coöperating with said pins a^{20}, as described, a pawl-releasing bail acting upon said pawls a^{17}, and a cam-disk on said shaft a^{21} having connections for operating said releasing-bail, substantially as described.

12. A register comprising a series of counting-wheels with a series of carrying-levers, which carrying-levers are set in carrying positions by wheels of a lower order and carry onto the wheels of a higher order, under movements from their carrying to their nor-

mal positions, in combination with a register-carriage having a cam operating on said carrying-levers under movements from the right toward the left, means for imparting a step-by-step movement of said carriage from the left toward the right, a wheel-mover mounted to rotate with respect to, but to travel with said carriage for action on said counting-wheel, and differential feed mechanism for imparting the rotary feed movements to said wheel-mover, substantially as described.

13. The combination with a type-writer, of a register involving a series of counting-wheels and carrying devices, a register-carriage connected for movements with the type-writer carriage and provided with a supplemental sliding frame-section, a latch for locking together the register-carriage and the supplemental frame, a trip for releasing said latch at one limit of movement, which latch becomes operative at the other limit of movement, a wheel-mover mounted to travel with said supplemental carriage-section for successive action on said counting-wheels, and differential feed mechanism for rotating said wheel-mover, substantially as described.

14. The combination with a type-writer, of a register involving a series of counting-wheels and carrying devices, a register-carriage connected for movements from the left toward the right, under movements of the type-writer carriage from the right toward the left, which register-carriage has a sliding supplemental section, a latch for locking said sections of the register-carriage together, a trip for releasing said latch under the movement of said register-carriage to the extreme right, a rotary wheel-mover mounted to travel with the supplemental register-carriage section for action on the counting-wheels from left toward the right, and differential feed mechanism for rotating said wheel-mover.

15. The combination with a type-writer, of a register involving a series of counting-wheels and carrying-levers, which carrying-levers carry onto the wheels of a higher order when moved from their carrying or set position back to normal, a register-carriage connected for movements from the left toward the right, under movements of the type-writer carriage from the right toward the left, which register-carriage is provided with a sliding supplemental section and with a cam for action on said carrying-levers, under movements toward the left, a rotary wheel-mover mounted to travel with said supplemental frame-section, and differential feed mechanism for rotating said wheel-mover, substantially as described.

16. The combination with a type-writer having an escapement-controlled carriage, of a register involving a series of counting-wheels, a register-carriage connected to the type-writer carriage for reverse movements therefrom, a wheel-mover mounted to travel with said register-carriage for successive action on said counting-wheels, differential feed mechanism for rotating said wheel-mover, and a handpiece mounted for a compound movement and provided with connections to said register-carriage and to the type-writer escapement, whereby one movement releases said escapement and the other moves the register and type-writer carriages, substantially as described.

17. The combination with a type-writer having an escapement-controlled carriage and a roll-feeding ratchet, of a register involving a series of counting-wheels and carrying devices, a register-carriage connected for movements with the type-writer carriage, a wheel-mover traveling with said register-carriage for action on said wheel, differential feed mechanism for rotating said wheel-mover, and a handpiece having connections to said register-carriage and to the escapement and ratchet devices of said type-writer, whereby one movement of said handpiece will release said escapement and actuate said roller-feed ratchet, and the other movement thereof will move the register and type-writer carriages, substantially as described.

18. The combination with a type-writer having a space-bar and escapement device, of an attachment comprising a register, a bank of digit-keys operating the numeral-keys of the type-writer, but permitting said numeral-keys to be operated independently thereof, and a connection between the space-bar and escapement device of the type-writer and said independent bank of digit-keys, for operating the former upon the depression of any of the said digit-keys, whereby the computing mechanism is operative without actuating the printing devices of the type-writer.

19. The combination with a type-writer having a carriage, of an attachment comprising a register, a bank of digit-keys, denominational selecting mechanism controlled by the type-writer carriage, differential feed mechanism controlled by said digit-keys, and a connection between the space-bar of the type-writer and the digit-keys of said attachment, for controlling the denominational selecting mechanism through the movements of the type-writer carriage when operating the computing-machine without recording the figures on the paper in the type-writer.

20. The combination with a bank of digit-keys, of a register-mover having a ratchet-wheel, a stop pawl or arm coöperating with said ratchet-wheel and subject to any depressed digit-key at the limit of its downward movement, differential feed mechanism controlled by said keys and operating on said register-mover, and a detent operative while the digit-key is making its return movement,

to lock said stop pawl or arm in engagement with the said ratchet-wheel, substantially as described.

21. The combination with a type-writer, of a register comprising a series of counting-wheels, a register-carriage, a wheel-mover rotatable with respect to but traveling with said register-carriage, differential feed mechanism for rotating said wheel-mover, and connections between the register-carriage and the type-writer carriage involving a device for temporarily interrupting the movement of the register-carriage while the type-writer carriage makes a step of movement, substantially as described.

22. The combination with a type-writer having a feed-rack, of an attachment comprising a bank of digit-keys, a register made up of counting-wheels, a register-carriage, a wheel-mover moved by said register-carriage for action on said counting-wheels, a differential feed mechanism controlled by said digit-keys and imparting a rotary feed movement to said wheel-mover, connections between said register and type-writer carriages involving a driving and a driven part, the latter having at least two ratchet-teeth, and the former having a coöperating pawl, and a pivoted trip engageable with said pawl to cause an escapement movement thereof, substantially as described.

23. In adding attachments for type-writers, the combination with the transversely-movable paper-carriage and the regular type-keys and printing devices of the type-writer, of a supplemental series of adding-keys arranged to actuate the printing devices of the corresponding type-keys, and an adding mechanism operated by the adding-keys to add together the amounts printed by the operation of said keys, substantially as described.

24. The combination with a type-writer, of a computer having an independent set of digit or computing keys, and connections between the computer-keys and the numeral-keys of the type-writer, which connections cause the computer-keys to operate the numeral-keys of the type-writer, and thereby, the printing devices, but which connections permit the numeral-keys of the type-writer to be operated without operating said computer-keys, whereby the combined machine is always ready for use to secure the double function of listing and adding numbers, or the type-writer may be used, independently of the computer, in the ordinary way for type-writing purposes.

25. The combination of a type-writer, a computer, an actuating connection between the numeral-keys of the type-writer and the computer, and mechanism arranged to be operated once for each line to operate the computer and to shift the carriage of the type-writer, substantially as described.

26. The combination of a computing-machine having an operative lever, a type-writer having a traveling carriage, and a connection between said lever and the type-writer carriage, substantially as described.

27. The combination with a type-writer having mechanism for feeding the paper thereon, of a computer, an actuating mechanism between the numeral-keys of the type-writer and the computer, an operating mechanism for the computer, and a connection between said operating mechanism and the paper-feeding mechanism of the type-writer, substantially as described.

28. The combination with a type-writer having a traveling carriage and mechanism mounted thereon for feeding the paper, of a computer having actuating mechanism and an operating-lever, and a connection between the lever of the computer and the paper-feeding device of the type-writer, substantially as described.

29. The combination with a type-writer, of a computer having a carriage receiving motion from the type-writer carriage, and a slip-motion device in the driving connections between said two carriages, which slip-motion device is operative to hold the computer-carriage stationary while the type-writer escapes for feed movement, whereby punctuation or spacing may be made to appear between columns of the listed numbers, substantially as described.

30. The combination with a type-writer, of a computer having a carriage receiving motion from the type-writer carriage, a slip-motion device in the driving connections between said two carriages, and a buffer-spring for action on the computer-carriage at the time when the slip-motion occurs in the said driving connections, and throughout the subsequent travel of said computer-carriage, all for coöperation to permit punctuation or spacing to be made to appear in the listed line of numbers, substantially as described.

31. In adding attachments for type-writers, the combination with the transversely-movable paper-carriage and the regular type-keys and the printing devices of the type-writer, of a supplemental series of adding-keys, means connecting said keys with the printing devices of the corresponding type-keys, but leaving the latter normally free to be operated independently of the adding-wheels, and an adding mechanism operated by the adding-keys, to add together the amounts printed by the operation of said keys, substantially as described.

32. In adding attachments for type-writers, the combination with the transversely-movable paper-carriage and the regular type-keys and printing devices of the type-writer, of a supplemental series of adding-keys coöperating with the corresponding type-keys to cause the latter to actuate the

printing devices when the adding-keys are operated, but leaving them normally free to independently actuate their printing devices when the adding devices are not operated, and an adding mechanism operated by the adding-keys to add together the amounts printed by the operation of said keys, substantially as described.

33. In adding attachments for type-writers, the combination with the transversely-movable paper-carriage and the regular type-keys and printing devices of the type-writer, of a supplemental series of adding-keys adapted to separately depress the corresponding type-keys to actuate their printing devices, but leaving the type-keys normally free to be depressed independently of the adding-keys, to actuate said printing devices, and an adding mechanism operated by the adding-keys to add together the amounts printed by the operation of said keys, substantially as described.

34. In adding attachments for type-writers, the combination of a type-carrier, a type-key, and connections for operating said carrier, an adding-key also arranged to operate said carrier, but permitting independent operation of said carrier by the type-key, and an adding mechanism operated by said adding-key, substantially as described.

35. In adding attachments for type-writers, the combination of a type-carrier, a type-key, and connections for operating said carrier, an adding-key also operating said carrier through the same connections, but permitting the independent operation of the carrier by the type-key, and an adding mechanism operated by said adding-key, substantially as described.

36. In adding attachments for type-writers, the combination of a type-carrier, a type-key, and connections for operating said carrier, an adding-key coöperating with the type-key to depress the same when the adding-key is depressed, but permitting depression of the type-key independently of the adding-key, and an adding mechanism operated by the adding-key, substantially as described.

37. In adding attachments for type-writers, the combination of a type-carrier, a type-key, and connections for operating the same, an adding-key, means for automatically coupling the adding-key and type-key together upon the depression of the adding-key, but permitting depression of the type-key independently of the adding-key, and an adding mechanism operated by the adding-key, substantially as described.

38. The combination with a type-writer having a traveling carriage controlling the letter-spacing in the printed line, of a computer having an actuating device arranged to be operated once for each line, and having a connection for moving said type-writer carriage.

39. In combination, a type-writer carriage having paper-feeding devices thereon, a computer having operating mechanism, arranged to be operated once for each line, and a connection between said computer-operating mechanism and paper-feeding devices, substantially as described.

40. In a combined type-writer and computer, the combination with a type-writer carriage, of paper-feeding devices thereon, computer-operating mechanism, arranged to be operated once for each line, and connections between said computer-operating mechanism and type-writer carriage and paper-feeding devices thereon, substantially as described.

41. In a combined type writer and computer, the combination with computer-operating mechanism, arranged to be operated once for each line, of a type-writer carriage, and connections between said carriage and computer-operating mechanism, whereby the carriage may be returned and moved in either direction of its longitudinal movements, at will, for setting the same in different positions for writing a new line, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

HANS HANSON.

Witnesses:
MABEL M. MCGRARY,
F. D. MERCHANT.