No. 641,065. Patented Jan. 9, 1900.

F. S. BALDWIN.

CALCULATING MACHINE.

(Application filed Aug. 3, 1899.)

(No Model.) 6 Sheets—Sheet 1.

Fig. 1.

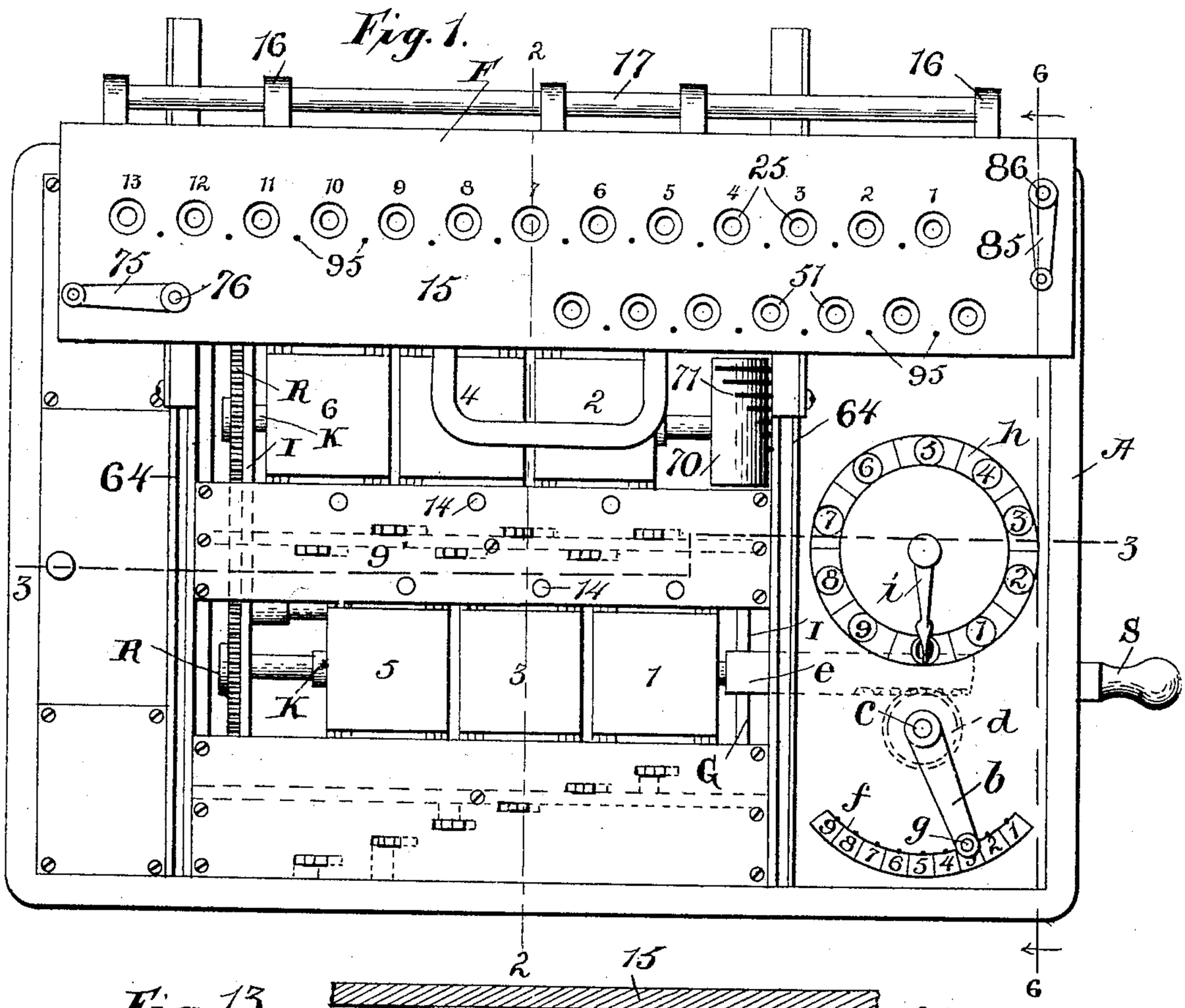


Fig. 13.

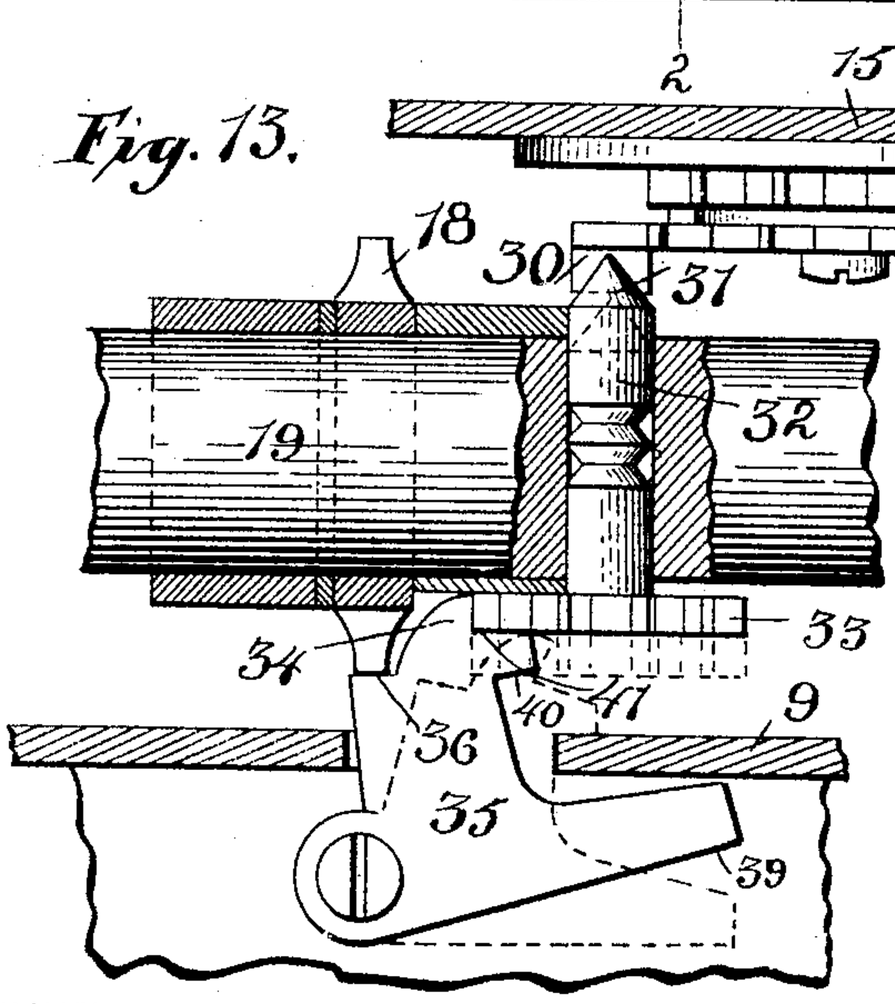
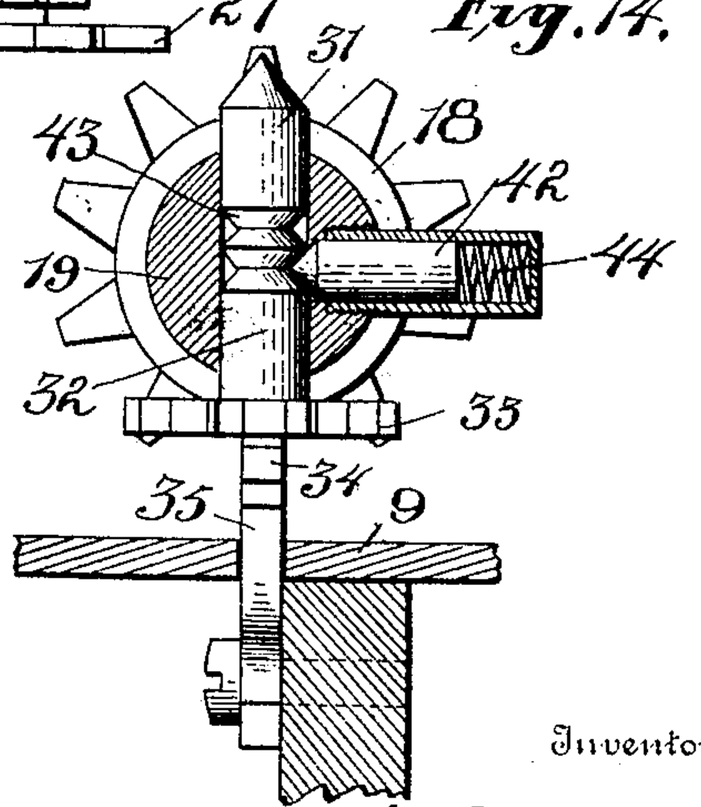


Fig. 14.



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(No Model.) 6 Sheets—Sheet 2.

Fig. 2.

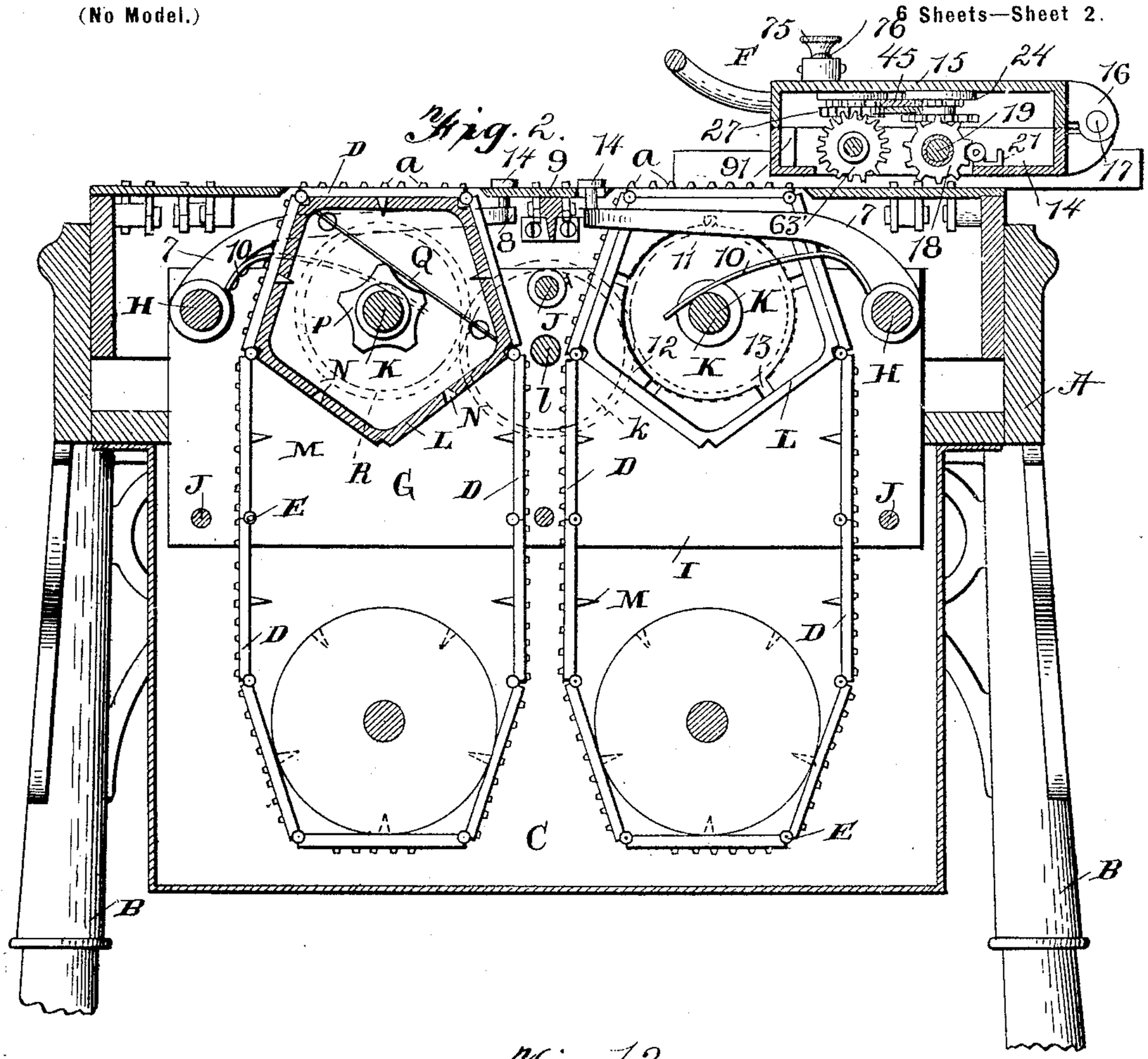
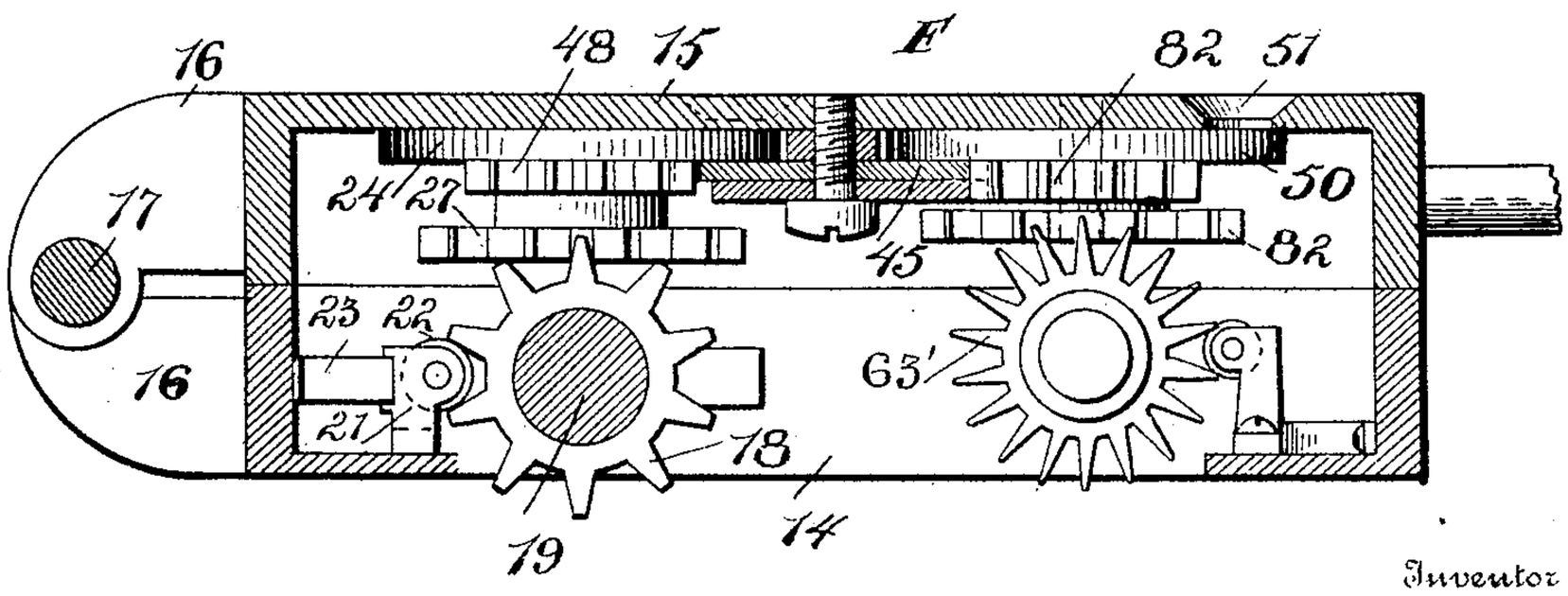


Fig. 12.



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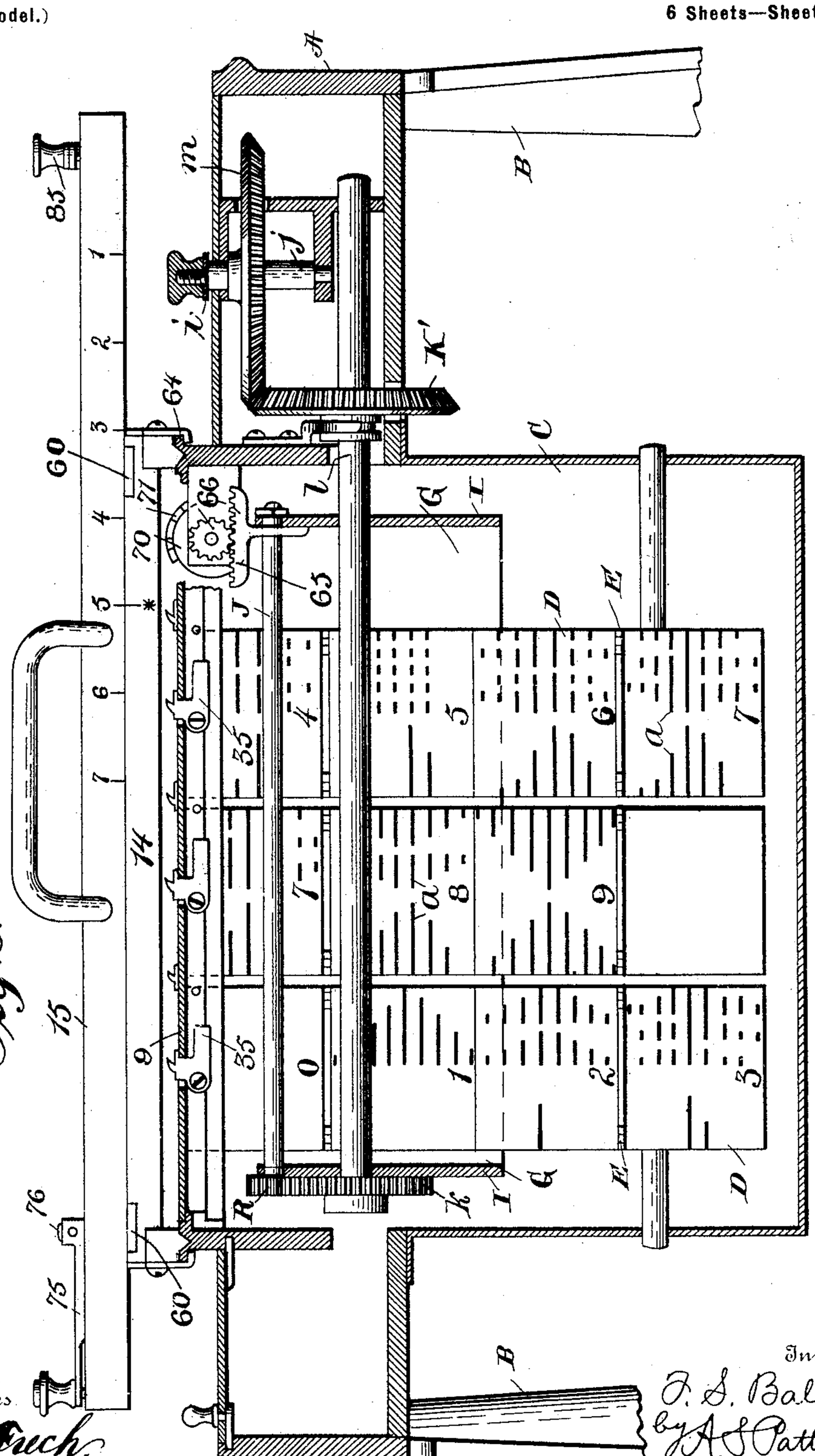

Fig. 3.

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(No Model.) 6 Sheets—Sheet 4.

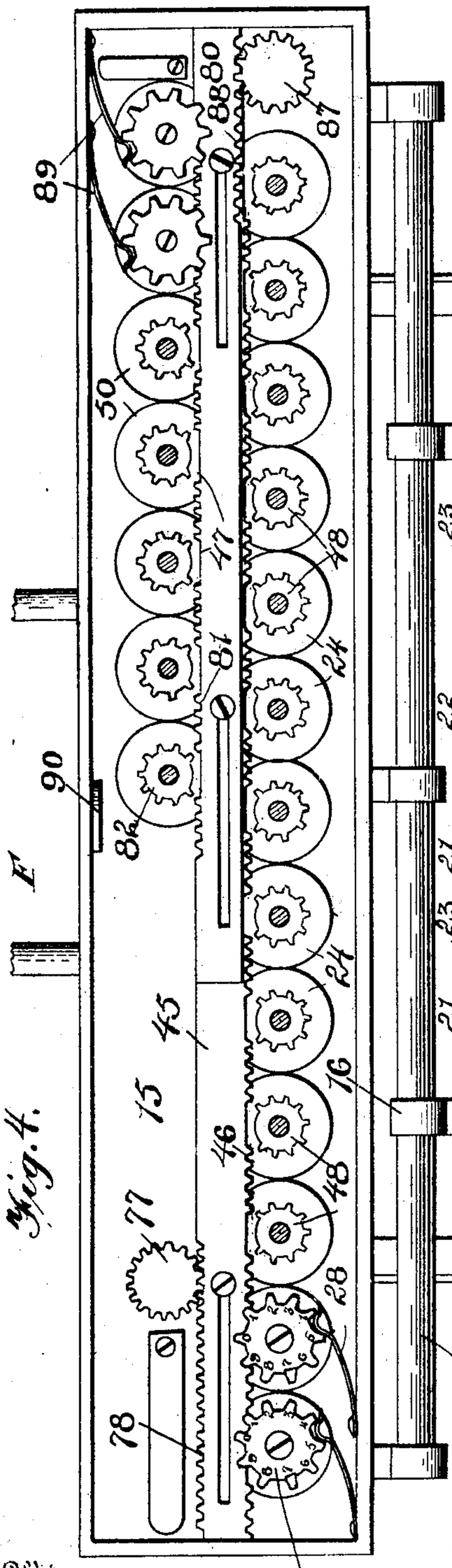

Fig. 4.

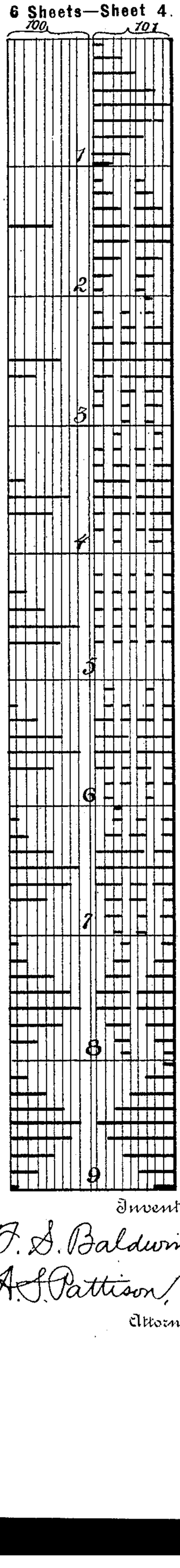

Fig. 5.

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(No Model.) 6 Sheets—Sheet 5.

Fig. 6.

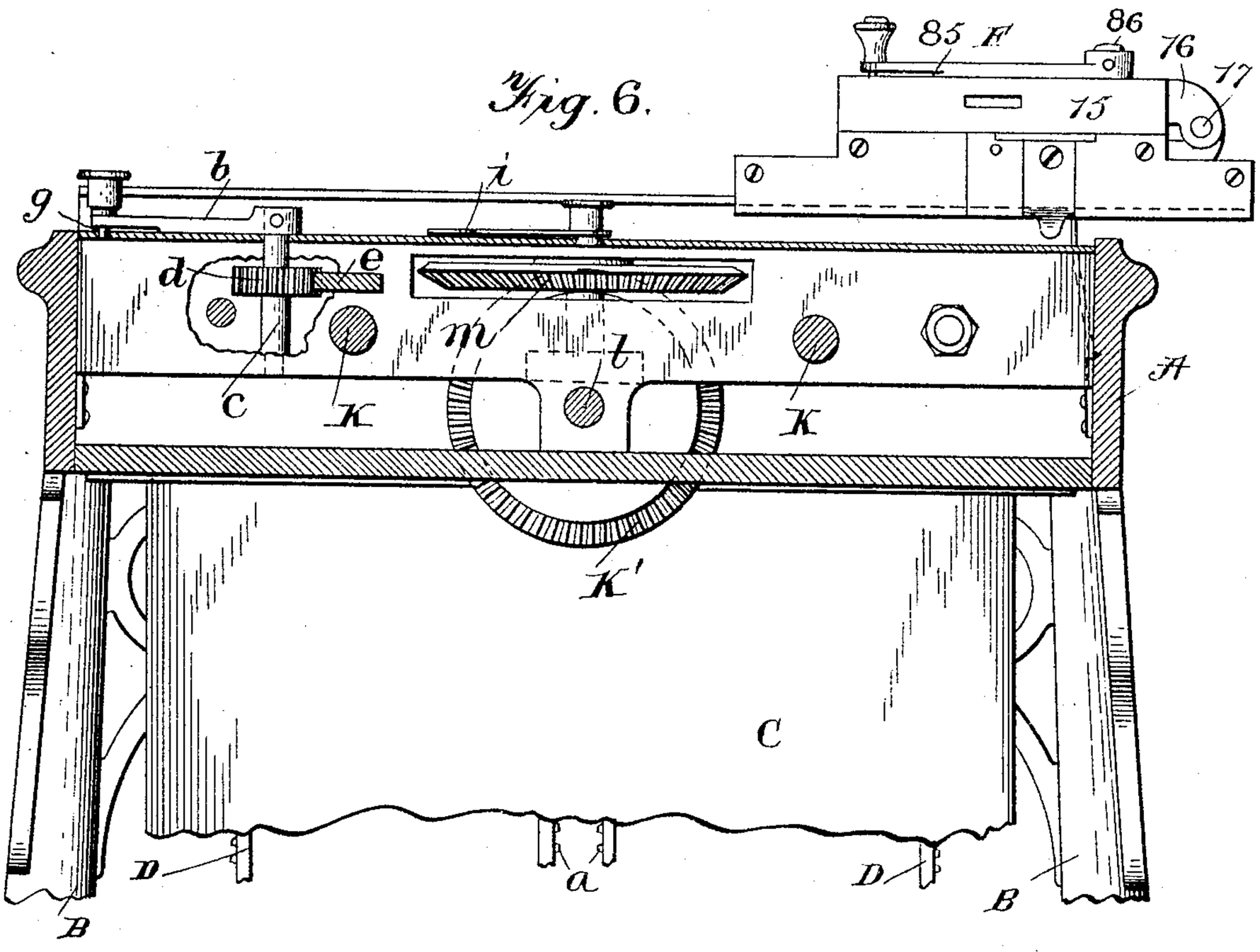
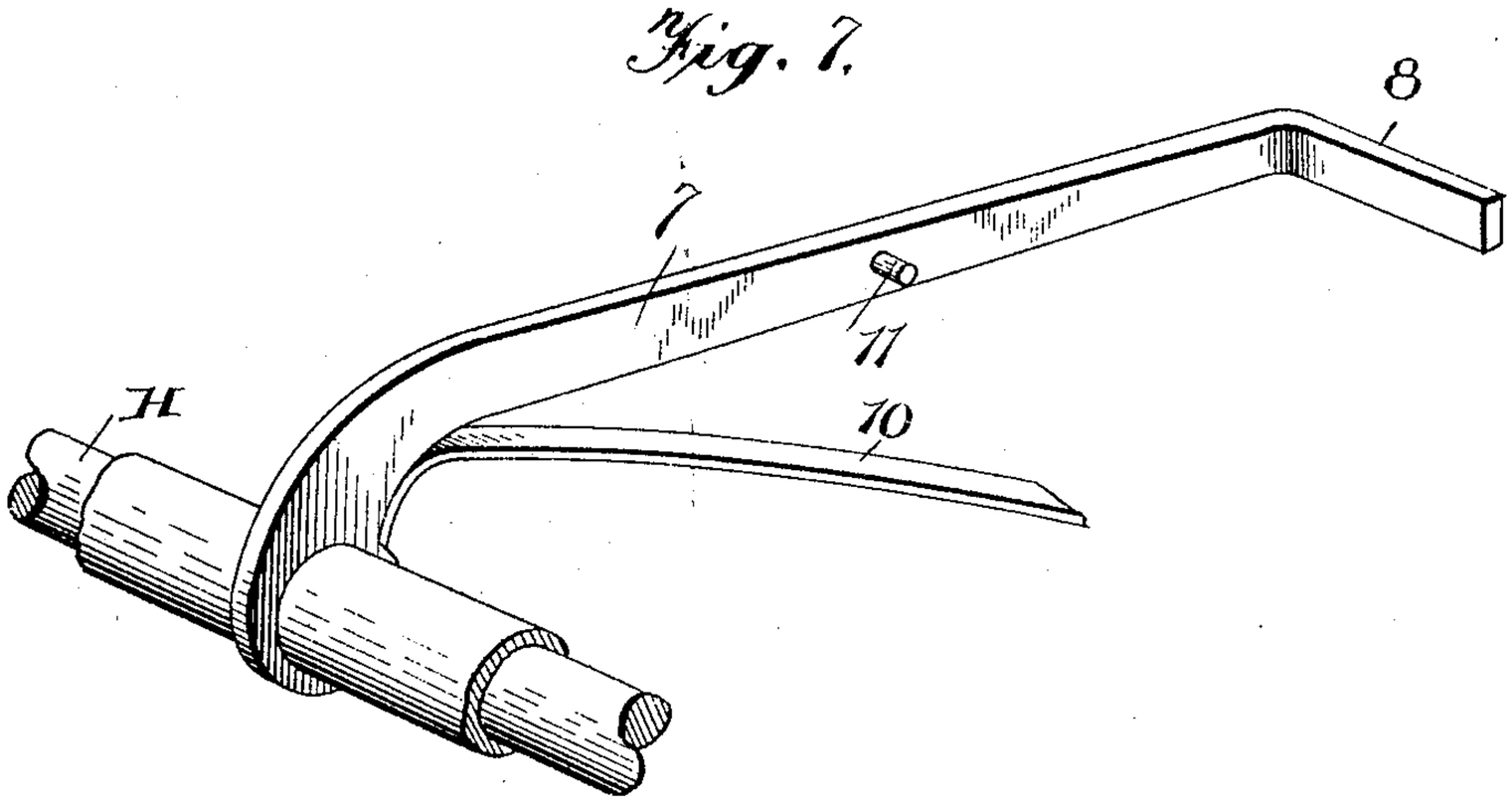


Fig. 7.



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(No Model.) 6 Sheets—Sheet 6.

Fig. 8.

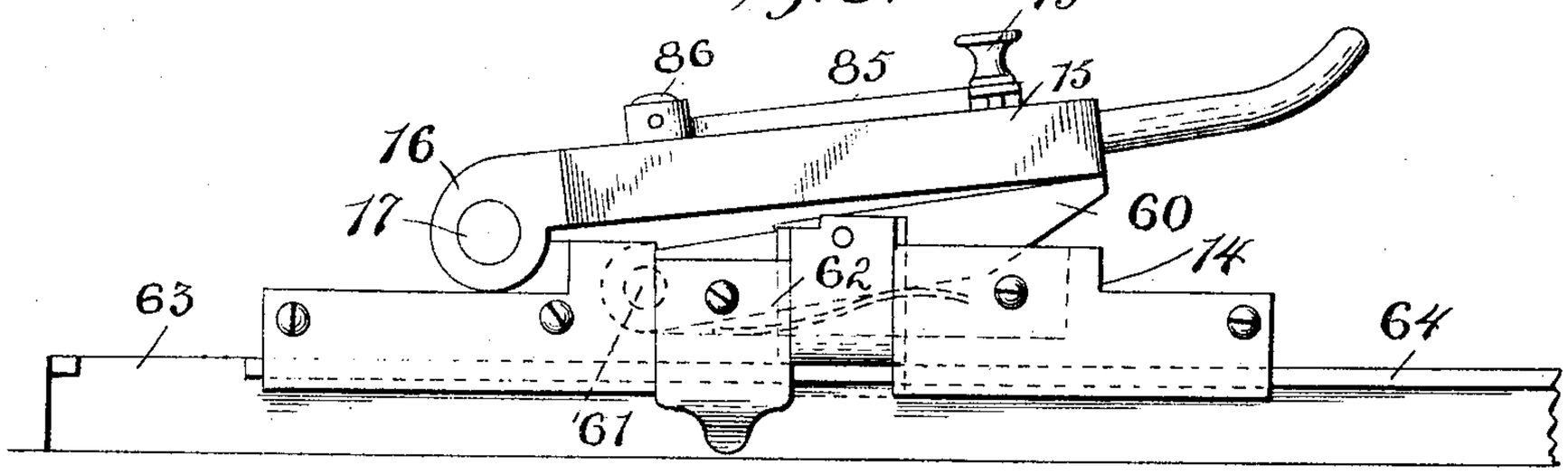


Fig. 9.

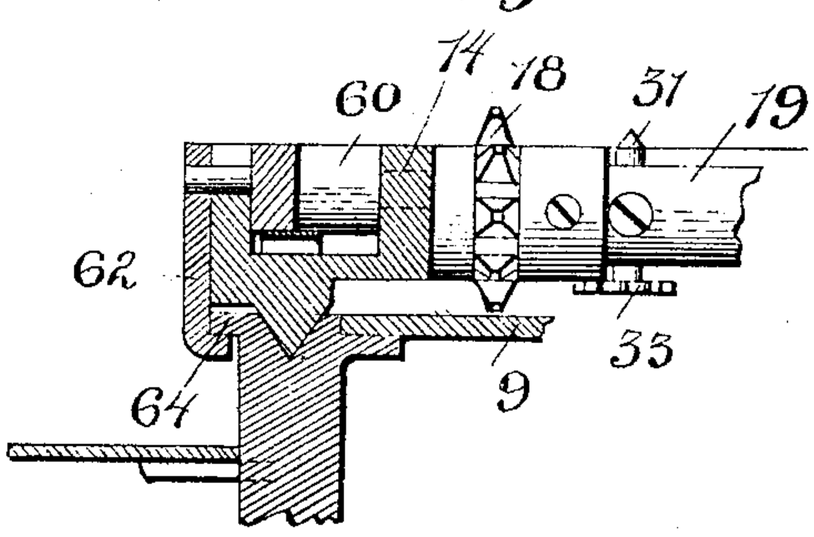


Fig. 10.

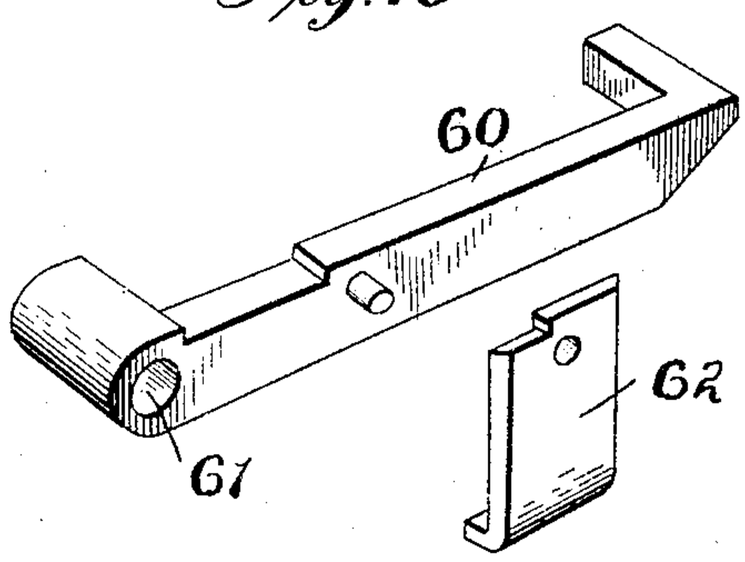
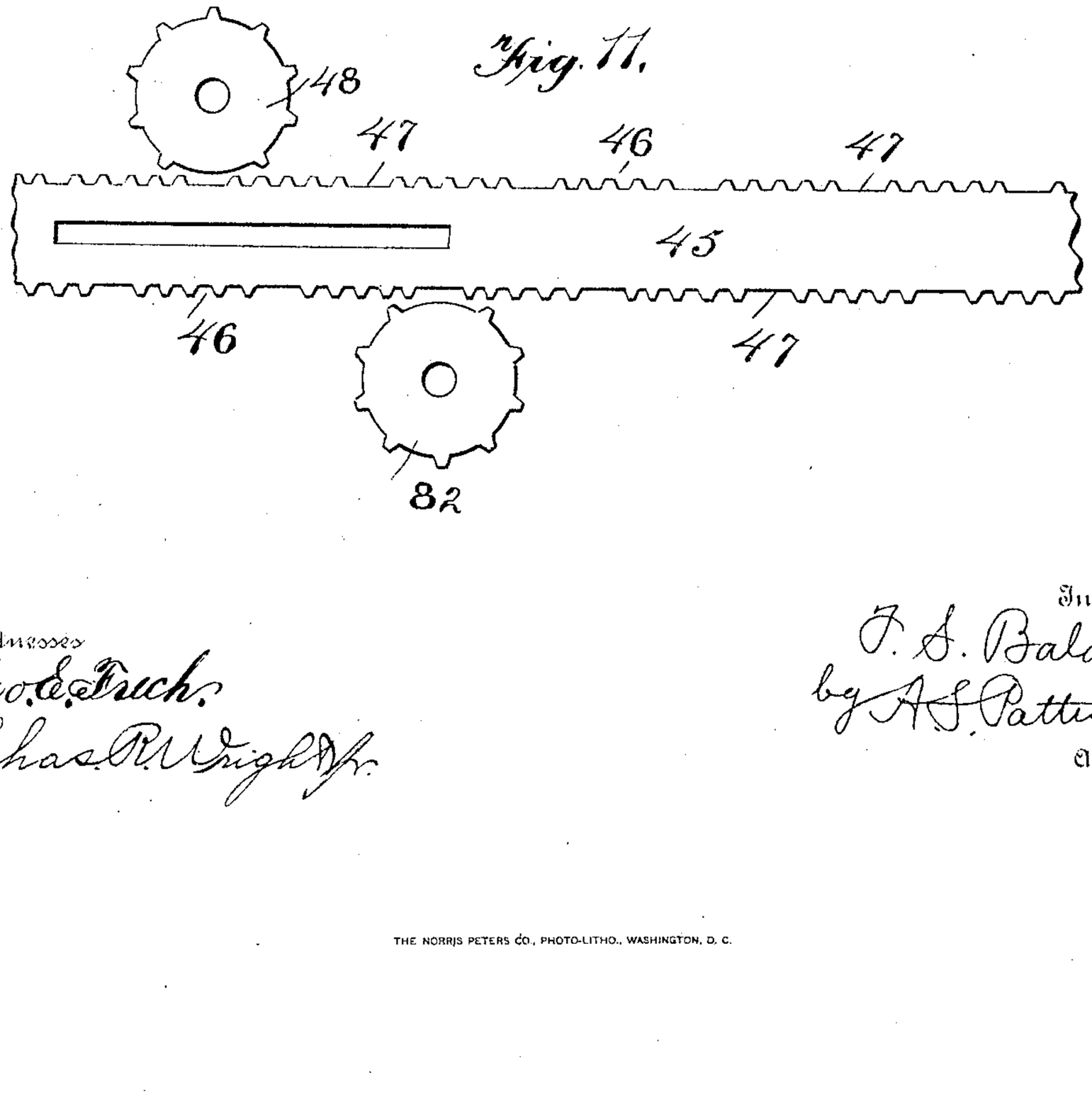


Fig. 11.



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UNITED STATES PATENT OFFICE.

FRANK S. BALDWIN, OF NEWARK, NEW JERSEY.

CALCULATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 641,065, dated January 9, 1900.

Application filed August 3, 1899. Serial No. 726,012. (No model.)

To all whom it may concern:

Be it known that I, FRANK S. BALDWIN, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented new and useful Improvements in Calculating-Machines, of which the following is a specification.

My invention relates to improvements in calculating-machines, and pertains to a machine comprising a plurality of platens having projections or teeth constituting a rack and a frame carrying a plurality of numeral-wheels which are actuated by the projecting rack or teeth upon the platens when the frame or carriage is drawn across the face of the platens, the platens and the carriage having right-angle movements, all of which will be fully described hereinafter, and particularly pointed out in the claims.

The object sought in this machine is to condense or simplify the operation of multiplication and division, thereby insuring greater accuracy, as well as a saving of time, with proportionate less wear upon the moving parts of the machine.

The platens are arranged in series and hinged together in a continuous chain, being placed in consecutive order and revolved upon disks or wheels, so that any number from "0" to "9" can be placed in line with the operating mechanism carried by the movable carrier. Upon these platens the product of every digit multiplied from "1" to "9" is indicated in a series of raised projections, constituting the teeth of the rack, which operates a series of type or numeral wheels contained in a traveling carrier, which is drawn across the face of the series of platens by a sliding or transverse movement. The transverse movement of the platens at right angles to the movement of the carriage thereacross is so arranged and the platens are so disposed in two rows that the tens resulting from the multiplication of the units-platen are in line with the units of the tens-platen, the tens of the tens-platen with the units of the hundreds-platen, and so on, and that when the sliding carriage crosses the field the tens of the units-platen are added to the units of the tens-platen, the tens of the tens-platen to the units of the hundreds-platen, and so on throughout the rest of the operating numbers.

In the accompanying drawings, Figure 1 is a top plan view of a calculating-machine embodying my invention. Fig. 2 is a vertical sectional view taken on the line 2 2 of Fig. 1. Fig. 3 is a vertical sectional view taken at right angles to Fig. 2 and on the line 3 3 of Fig. 1 looking in the direction indicated by arrow. Fig. 4 is an enlarged plan view of the traveling carriage and its operating parts, the indicating-disks of some of the numeral-wheels being omitted. Fig. 5 is a detached enlarged plan view of one series of the hinged platens spread out in a line. Fig. 6 is an enlarged vertical sectional view taken on the line 6 6 of Fig. 1, the traveling carriage being moved laterally in this figure to bring the right-hand end inward at a point inside of where said section is taken. Fig. 7 is an enlarged perspective view of one of the locking-levers used for locking, respectively, the several platen series. Fig. 8 is an enlarged end elevation of the traveling carriage and one of its side tracks or ways, showing an automatic means for holding the calculating mechanism of the carriage out of contact with the operating-platens when the carriage is drawn over the face thereof. Fig. 9 is an enlarged detail cross-sectional view on the line 9 9 of Fig. 4. Fig. 10 is an enlarged detail perspective view of the automatically-acting supporting-lever shown in Fig. 8 in connection with the traveling carriage. Fig. 11 is an enlarged detail plan view of a portion of one of the "wiping-out" bars for throwing all of the numeral-wheels to zero. Fig. 12 is an enlarged detached transverse sectional view of the traveling carriage. Fig. 13 is an enlarged detail view, partly in section, showing the mechanism for "carrying" from one numeral-digit to the other in the operation of calculating. Fig. 14 is a sectional view at right angles to Fig. 13, the numeral-wheel being omitted.

I will first describe the construction and relative engagement or operation of the parts of my machine and then the manner of operating the same for multiplying and dividing.

Referring now to the drawings, A is a rectangular frame provided with depending supports or legs B, whereby the machine can be supported independently of any other object, though it will be readily understood that this part of the machine can be constructed to

rest upon a desk or other similar support. Depending from the lower edge of this frame A is a casing or box C for the purpose of inclosing and protecting the depending parts of the machine, as clearly shown in Fig. 2.

The machine consists, essentially, of a series of platens D, which are hinged together at their opposite edges, as shown at E, and constituting an endless chain, the said platens being provided with a plurality of teeth *a*, constituting, in operation and effect, a rack, and a traveling carriage F, carrying the calculating mechanism adapted to be actuated through the medium of said teeth *a* of the platens when the carriage is drawn across the face thereof. Each of the series 1, 2, 3, 4, 5, and 6, Fig. 1, of the platens consist of ten platens representing "1" to "0" and which are arranged, preferably, in numerical order.

Situated within the stationary frame A is a transversely-movable platen-frame G, said frame being supported upon the transverse shafts H, which have their ends suitably connected with or supported by the ends of the stationary frame A. This frame G consists of the vertical end pieces I, which are connected by means of the transverse rods J, and passing through the upper edges of these end pieces I are the two parallel platen-carrying shafts K. These shafts K carry loose polygon-shaped wheels L, around which the platen-chains pass and by which they are revolved. The platens are held in their proper relative position upon these wheels L by means of pins M, which project inward from the inner faces of the platens and engage openings N in the peripheries of the said wheels or plates. Each of the polygon plates or wheels, as just stated, is loose upon its shaft K, whereby said plates are capable of independent movement to permit either platen of each series or chains to be brought in a position with its face in a line with the upper face of the machine, as illustrated in Fig. 2, whereby in calculating any desired figure from "1" to "0" of either of the chains or series can be brought in its operative position for actuating the calculating or numbering wheel in a manner which will be described hereinafter. For the purpose of holding the polygon disks or wheels in their proper position in relation to the upper face of the machine and for the purpose of causing the said disks to rotate with their carrying-shafts K, I provide a friction device which consists of the five-toothed disks P, secured firmly to the shaft adjacent the polygon disk, with which the spring Q, carried by said disk, engages, and whereby the said toothed disk P constitutes for the purpose stated a five-sided wheel for holding the series of chain-platens in proper relative alinement for operation. One end of each shaft K is provided with a gear-wheel R, which wheels mesh with an intermediate gear *k* upon the adjacent end of an operating-shaft *l*, and this shaft is provided with an operating-handle S, by means of which the series of platens are rotated by causing the shafts K and K to revolve through the medium of said gears. From this description it will be noted that the series of chain-platens are all situated within a transversely-movable frame and held in fixed relation in respect to each other within said frame, except in respect to their independent rotary movement, and that the rotary movement gives the platens a movement in a direction at right angles to the movement given them when the transversely-movable frame in which they are carried is moved upon its supporting rods or shafts. This enables me to give the platen two movements, one at right angles to the other, the purpose and function of which I will explain presently.

The transversely-movable frame is operated by means of an index handle or crank *b*, which has its inner end connected with a shaft *c*, the said shaft carrying a pinion *d*, engaging a rack *e*, which is connected with the transversely-movable platen-frame and by which it is moved in opposite directions for the purpose of carrying the platens in the proper position for causing their projections or racks to engage the calculating or numeral wheels to correspond with the calculations it is desired to make, which will be made clear in the explanation of the operation of the machine. The upper face of the machine is provided with a segment-index *f*, with which a spring-pin *g*, carried by the handle *b*, is adapted to engage and by means of which the platen-carrying frame can be carried to any point from "1" to "9" for use in the various calculations, the index indicating the exact position and calculating value of the platens. The top of the frame is also provided with a circular index *h* and a pointer *i*, which is connected with a shaft *j*, carrying a gear-wheel *m*, which meshes with a gear-wheel *k'* upon a shaft *l*, said shaft *l* carrying the intermediate gear *k*, situated between and meshing with the gears R upon the ends of the shafts K and K. This index is intended to indicate the particular numeral of the chain-platens that is presented to the face of the machine, it having no other value and is of but little importance in the use of the machine for the reason that each of the platens has represented thereon the numeral which it represents, as clearly shown in Figs. 3 and 5.

When the platens are in their desired position for the purpose of effecting a calculation, in which event the desired platens have their faces in a line with the top of the machine, it is essential that they should be locked and held immovably in the said adjusted position until the calculation or operation is performed by the movement thereover of the traveling carriage F. This locking effect may be produced in a number of ways; but I prefer to provide a separate locking device for each series of platens, whereby each series can be separately and independently released for permitting it to be rotated by

means of the operating-crank S in the manner before described to bring the desired platen in the desired position. These independent locking devices consist of inwardly or oppositely extending levers 7, which have their outer ends pivoted upon the shafts H and their inner and adjacent ends turned laterally, as illustrated at 8, Fig. 7, and lying under the plate 9, which is situated between the two parallel series of platen-chains, as clearly illustrated in Fig. 1. Springs 10 serve to hold these locking devices normally upward, and consequently their laterally-projecting pins 11 normally in engagement with the rings 12, carried by the polygon disks L, so that the pins 11 of the locking-lever will normally engage one of the notches 13 in the said rings and hold the polygon disks in the proper position for supporting the particular platen of any one of the series of chains in a position for operation at the upper face of the machine. These levers are depressed downward for the purpose of releasing the driving members L of the platen-chain by means of buttons 14, which project upward through the said central plate 9 in a position to be depressed by the fingers of the left hand of the operator while the actuating-crank F is being turned by the right hand of the operator. In the operation of this mechanism when it is desired to release one or more of the platen-chains, and thus permit it to be rotated when the crank S is turned for bringing any one of the platen or platens of any particular chain or chains to the operative position, it is only necessary to depress that button or buttons which locks the chain it is desired to rotate, and the released chains will be permitted to rotate until the proper number is brought to operative position, when the release of the button will lock the chain and hold it in its adjusted position. In this manner the several platens of the several series or chains can be quickly rotated for bringing the desired platen to operative position and accomplishing what is termed the "setting up" of the machine for a calculation.

The carriage F, by the movement of which the calculating mechanism is set in motion, is composed, essentially, of a lower rectangular frame 14 and an upper case or frame 15, the two frames being hinged together by means of the bearings or eyes 16, projecting from one edge of the lower frame 14, and a longitudinally-extending pivotal rod 17, supported at the adjacent edge of the upper frame 15, and by means of which the upper frame can be moved longitudinally upon and in respect to the lower frame, as will be clearly understood by reference to Fig. 4. The lower frame 14 carries a mechanism which is operated by engagement with the rack or teeth upon the platens as the carriage is moved across the face thereof, and the upper frame or case 15 carries a plurality of calculating or numeral wheels which are actuated by the intermediate mechanism carried and supported in the frame 14. These respective mechanisms and their relative engagement and operation I will now proceed to describe. The intermediate actuating mechanism carried in the frame 14 consists of a plurality of gears 18, which have teeth constructed similar to an ordinary sprocket-wheel, and these gears are journaled upon a shaft 19, which extends longitudinally the frame 14. These gears 18 are yieldingly held by spring-checks, which consist of levers 21, pivoted at one end to the frame 14 and carrying at their opposite ends the rollers 22, adapted to rest between the teeth thereof and the springs 23, having their ends engaging, respectively, the free ends of the levers, and thus serving to hold the rollers normally in contact with the gear-wheels, but which will permit the said gear-wheels to rotate when engaged by the rack or teeth upon the platens. The upper or hinged portion 15 of the carriage is provided with a line of numeral-wheels 24, which have at their upper faces numerals from "1" to "0," and the upper face of this frame or case 15 is provided with the openings 25, through which the numerals upon the said wheels are exposed. The inner or lower end of these numeral-wheels are provided with the gears 27 and with which the upper sides of the intermediate driving-gears 18 are adapted to engage when the upper portion 15 of the carriage is closed, as illustrated in Figs. 1 and 6. Each of these numeral-wheels is provided with a retaining-spring 28, engaging the gears 27 for positively, but yieldingly, holding the numeral-wheels to their operative position. From this description it will be readily understood that when the carriage is in its closed position and is drawn across the face of the platens, the lower side of the gears 18, engaging the teeth of the platens, and the upper side or periphery of the gears 18, engaging the gears 27 of the numeral-wheels, the gears 18 and the numeral-wheels are turned one tooth for every tooth or projection engaged upon the platens with which the gear-wheels 18 engage. The gears 18 and the gears 27 each have ten teeth representing the digits "1" to "0."

Especial attention is directed to the fact that these numeral-wheels are separate and independent of each other and that the carrying in the process of calculation from one numeral-wheel to the other, whereby the final product is exhibited through the openings 25 in the top of the upper portion 15 of the carrier, is effected after and independent of the operation produced by the platens.

The mechanism by means of which the carrying from one of the numeral-wheels to the succeeding one is effected, while, in fact, the numeral-wheels are separate and independent, is fully illustrated in Figs. 1, 13, and 14. The inner faces of the gears 27 of the numeral-wheels 24 are each provided with a laterally or inwardly projecting wedge-

shaped cam 30, which as the numeral-wheels revolve is adapted to engage the upper projected cone-shaped end 31 of a vertically-movable shaft 32, which passes transversely through the shaft upon which the gear-wheels 18 are journaled. These cams 30 are so situated at a point upon the faces of the gear-wheels 27 that they will engage the cone-shaped ends 31 of the shaft 32 and force the said shaft 32 downward into the position shown in dotted lines, Fig. 13, when passing in either direction from "9" to "0." Now by referring particularly to Figs. 13 and 14 it will be seen that when the shaft 32 is depressed by the cam 30 the gear-wheel 33 upon the lower end of the shaft 32 is carried downward into the position indicated in dotted lines. When in this position, the gear-wheel 33 will engage the upper projection 34 upon the projecting ends of the carrying pawls or elements 35, said carrying pawls or elements being pivoted within the frame of the machine and projecting through the top plate 9 thereof and pivoted to swing in a direction transverse the movement of the carrier. The engagement of the gear-wheel 33 with the projection or tooth 34 of the pawl 35 forces the carrying-pawl laterally into the position indicated by solid lines, Fig. 13, and carries the shoulder 36 thereof in the path traveled by the gear 18, which operates the next succeeding numeral-wheel. It will thus be understood that as the carriage moves across the face of the machine and the wheel 33 being depressed it will carry the carrying-pawl 35 over in contact with the gear 18, and the movement of the carriage will cause the gear 18 to be moved one tooth, and consequently the succeeding numeral-wheel to be correspondingly rotated one tooth to carry over a digit "1" from the preceding numeral-wheel. It should be noted that these carrying elements or pawls 35 are situated between the two parallel series of chains and at opposite sides thereof, whereby the carrying is not effected until the numeral-wheels have been operated by the respective platens with which they engage. By reference to Fig. 13 it will be observed that the pivotal point of the carrying-pawl 35 is eccentric to the axis of the shaft 32 and that the pawl is provided with an inwardly-projecting arm 39, which by its weight normally holds the pawl in the position indicated in dotted lines, Fig. 13, and in this position a shoulder formed by a projection 40 engages the upper face of the plate 9 to hold the pawl in its proper normal position. When the pawls are in their proper normal position, (which is indicated in dotted lines, Fig. 13,) the projection or tooth 34 is in a plane below the path traveled by the gear-wheel 33 when the gear-wheel is in its upward normal position. When, however, the gear-wheel is moved downward in the manner before described, the pawl is engaged thereby and carried laterally in engagement with a tooth of the gear-wheel 18. Attention is also directed to the fact that the peculiar shape of the upper end of this pawl forms a shoulder 41, which engages the under face of the gear 33, and as the pawl is being tilted in the direction indicated in solid lines this shoulder 41 carries the gear-wheel 33 and its shaft 32 upward and restores it to its normal position, ready to be again depressed by its coöperating numeral-wheel. The shaft 32, and consequently the gear-wheel 33, are held in their upper and lower positions by means of a spring-actuated pin 42, which has its inner end cone-shaped and adapted to engage the correspondingly-shaped grooves 43, formed in the shaft 32. When the shaft 32 is in its upper position, as indicated in Fig. 14, the spring-pin 42 engages the lower groove and will hold the wheel and its shaft in its elevated position, and when the shaft is forced downward by the cam 30 upon its corresponding numeral-wheel the pin 42 retracts within its case against the spring 44, permitting the shaft to be lowered by the cam, when the pin 42 will engage the upper groove and hold the shaft in its depressed position until it is moved upward again by the lateral movement of the carrying-pawl 35, as before explained. From this description it will be seen that the machine is constructed with separate and independent calculating or numeral wheels and that the carrying is effected from one wheel to the other by an intermediate mechanism, which though set in operative position by one of the numeral-wheels the numeral-wheels do not engage each other for effecting the carrying operation and which enables me to produce a machine which will carry from one numeral-wheel to the other by means and mechanisms operated at a period subsequent to the movement of the numeral-wheels in producing the digit result.

It is frequently desirable to wipe out the result which will appear through the openings 25 in the upper face of the hinged portion 15 of the carrier. This is effected by means of an endwise-moving rack 45, having teeth 46 on both edges, (illustrated in detail view Fig. 11,) and the edges of this rack are provided with teeth 46, arranged in series of five, leaving a blank space 47 therebetween. The numeral-wheels are provided with gears 48 at a point intermediate their end disks, which are adapted to be engaged by the teeth of the said rack. By reference to Figs. 4 and 11 it will be noted that these gears 48 have one tooth missing, and hence are provided only with nine teeth. Owing to this construction when the rack-bar is in the position illustrated in Figs. 4 and 11 it is out of engagement with the gears 48 and all of the numeral-wheels are in position to exhibit the digit "0" through the openings in the top of the upper portion 15 of the carrier. The rack also permits the numeral-wheel to be freely turned by the mechanism heretofore described for effecting a calculation without engaging the rack or being interfered with in any of its movements. This rack 45 has an

endwise movement equal to the space occupied by two of the series of teeth, this causing a full rotation of the numeral-wheel when it is moved endwise, and as soon as any one or more of the numeral-wheels have been carried to the point to exhibit the figure "0" the rack will fail to engage that numeral wheel or wheels, leaving them in this position, and hence a single movement of the rack in either direction will restore all of the numeral-wheels to the position indicated in Fig. 4, which will exhibit the digit "0" of each numeral-wheel through its exposing-opening and effect a wiping out of the calculation previously produced.

Referring now to Fig. 1 and noting the position of the carriage F, the movement of said carriage across the face of the platens will not produce any result excepting the operation of the series of numeral-wheels 50, which expose their figures through the inner series of openings 51, formed in the face of the hinged portion of the carriage, for the reason that all of the platens have their blanks or digits 0 in the operative position. The purpose and function of the numeral-wheels 50 will be presently described. Now, assuming that the platens are turned to exhibit some number and the carriage is drawn to the opposite side of the machine to that illustrated in Fig. 1, this will cause the operation of the numeral-wheels in the manner before described. If the carriage is moved back to its original position, (shown in Fig. 1,) it will operate all of the wheels in the reverse direction, and consequently wipe out the calculation. For the purpose of preventing this "wiping out" of the calculation by the reverse movement of the carriage the two parts are hinged together, as before described. This permits the operator to draw the carriage across the machine for effecting the desired calculation and to leave the product or result exposed through the openings 25 and to carry the machine back to its position (shown in Fig. 1) by simply raising the hinged portion of the carriage to the position shown in Fig. 8. This will elevate the numeral-wheels and carry them out of engagement with the wheels 18, which cause their rotation, as before described. The machine is then ready to have another calculation added to the product already produced or not, as the operator may wish.

When the machine is being used for multiplication, it is necessary to prevent an operation of the calculating mechanism when the carriage is being moved across the machine in one direction, and it is necessary to prevent the operation of the calculating mechanism in computing division when the carriage is moved in the opposite direction, and for the purpose of preventing the operator accidentally lowering the upper portion 15 of the carriage as it is being carried over the face of the platen I provide an automatic device consisting of a spring-lever 60, hinged at its inner end 61 to the rectangular frame 14 and held normally upward by means of the spring, (shown in dotted lines, Fig. 8,) and pivoted at its upper end to this lever is a supporting sliding block 62, which is elevated above the track or way upon which the frame 14 slides back and forth across the face of the machine. When the carriage is in the position shown in Fig. 1, this block 62 is opposite the cut-away portion or slot 63 in the horizontal flange 64 of the said way or track, whereby when the upper portion 15 of the carriage is elevated the block 62 is carried upward above the said track and a slight lateral movement of the carriage will cause the lower edge of the block to engage the horizontal flange of the track and support the upper portion of the carriage in this position as it travels across the face of the machine and until it reaches the opposite side of the machine, when the block will again drop out of engagement with the track, owing to the weight of the upper portion of the carriage. This automatic mechanism for holding the upper portion of the carriage elevated will operate at each side of the machine, so that the carriage can be held out of operation when it is being moved in either direction, as is desirable according to whether a multiplication or a division calculation is being made.

Reverting now to the lower series of numeral-wheels 50, I will explain the purpose and operation of these. The purpose of these wheels is to indicate to the operator the "multiplier" in making multiplications and the "divisor" in calculating division, whereby the operator will have what may aptly be termed a "check," by means of which he can tell as soon as the operation is performed whether he has used either the proper multiplier or the proper divisor, thus testing the accuracy of his calculation. If he has used the wrong divisor or the wrong multiplier, it is only necessary to draw the carriage back to its first position, when the original calculation will again reappear and which will also be another test or check to the accuracy of the operator, and then the operator can set the machine to the correct multiplier or divisor, as the case may be, and carry the carriage again across the face of the machine and produce the desired product.

The numeral-wheels 51 are operated by a rack which in operation is practically the same as the rack or projections provided upon the platens. Instead of having a flat-faced platen, however, I provide a roller 70, which has a plurality of concentrically-arranged ridges 71, said ridges beginning at one edge short and gradually increasing in length, whereby the rotation of the roller will cause the operating-gear 63′ to engage the said ridges and in turn to operate the numeral-wheels 50. The roller 70 is rotated by the lateral movement of the platen-frame, in that said platen-frame is provided with a short rack 65, Fig. 3, engaging a pinion 66 upon the shaft

of the roller 70. The arrangement of these parts is such that the roller is given a sufficient rotation to bring the ridges thereon in the proper position to actuate one of the numeral-wheels 50 a corresponding number of notches or teeth according to the number of ridges engaged thereby, and this is indicated by the indicator-hand *b*, Fig. 1—that is to say, if the operator is multiplying a given number which is set up upon the platen by the multiplier 3, as shown in Fig. 1, the roller 70 is turned to the position to cause the gear-wheel 63 to be rotated a corresponding number of teeth—namely, three—and consequently the numeral-wheel 50 at the right-hand end of the lower series to the figure "3." The operator will then at once see whether he has made any mistake in the setting up of the platen by comparison of the platen with his multiplicand and by a comparison of the numeral exposed in the right-hand opening of the lower series of openings with his multiplier, thus giving an absolute check to him as to the correctness of his calculations. If he has made a mistake in either the setting up of the multiplicand or of the multiplier, he can restore the calculations previously exposed in the machine to its original condition by carrying the carriage back to the position occupied thereby before the error was made, and then by correcting either his multiplicand or his multiplier he can continue on with his calculations. It should also be noted that the upper hinged portion of the carriage is considerably longer than the lower portion and that it has a transverse movement in respect thereto. The object of this is to multiply or divide by tens, hundreds, thousands, &c., as well as by units—that is to say, if the operator desires to either multiply or divide by thirty instead of by three the indicating-hand *b*, which will indicate either the quotient or the multiplier, as the case may be, will be placed at "3," and the upper hinged portion of the carriage will be placed so that its numeral 2 (exposed upon the edge of the hinged portion of the carriage, as indicated in Fig. 3) will be at the point *. The operator will then be multiplying in the tens instead of in the units or will be dividing by tens instead of by units, as will be readily understood.

When the machine is used for multiplying, the carriage is in the position indicated in Fig. 1 and is drawn across to the opposite side of the machine, which will effect a multiplication if the indicating-hand *b* is set for multiplying. If the operator desires to divide, the carriage is brought to the opposite side of the machine from that indicated in Fig. 1 and then carried over to the position indicated in said figure, which will reverse the operation, and consequently effect a division, as is readily understood by those skilled in the art, for a division is simply an inverse calculation from a multiplication. Whether the machine is operated for multiplication or division and no matter in which direction the carriage is moved when the calculating operation is performed the carrying element operates in the same way—that is to say, it operates to carry when the machine is moved backward as for dividing as well as operating to carry when the machine is moved forward as for multiplying.

I heretofore referred to the rack 45, which has teeth on opposite edges, and this rack is adapted to operate both the upper and lower series of numeral-wheels, whereby a single movement thereof in either direction through the medium of the operating-handle 75, connected with the shaft 76, carrying at its inner end a pinion 77, which engages the teeth 78 thereon, will simultaneously wipe out the product of both series of numeral-wheels. However, it is frequently desired in both multiplication and division to leave the product upon the upper series of numeral-wheels and to wipe out either the quotient or the multiplier, and this is effected by a separate endwise-moving rack 80, (shown superimposed in respect to the rack 45 in Fig. 4,) carrying teeth 81 at one edge only, which are constructed and adapted to operate by engagement with gears 82, carried by the numeral-wheels 50, as does the rack 45 in respect to both sets of wheels, as before explained. This short rack, which is adapted to coöperate only with the numeral-wheels 50, is moved endwise by means of a handle 85, connected with a short shaft 86, carrying at its inner end a pinion 87, engaging rack-teeth 88 upon the rack 80. As the operation of this rack-bar is identically the same in respect to the numeral-wheels 50 as the operation of the rack-bar 45 in respect to both sets of numeral-wheels, a specific explanation of its operation is deemed unnecessary. The lower series of numeral-wheels 50 are held in their proper position by means of the retaining-springs 39, similar to the springs for holding the upper series of the numeral-wheels in their position.

The upper hinged portion of the carriage is held in its proper lateral adjustment in respect to the lower portion thereof, as for dividing and multiplying in tens, hundreds, and thousands instead of units, as before described, by providing the free edge of the hinged portion 15 of the carriage with the depending lip 90, adapted to fit between the inwardly-extending projections 91, formed upon the front edge of the frame 14, and by means of which the hinged portion of the carriage is adapted to be moved to and accurately held in the proper position for multiplying or dividing by tens, hundreds, thousands, &c., as the case may be.

Each of the platens D has its teeth arranged upon opposite sides of a center line, and by reference to Fig. 5 and for the purpose of explanation the platens have been arranged in diagrammatical relation and divided into the units-column 101 and the tens-column 100. Referring now to platen 2, it will be seen that there are two rows of teeth in the units-col-

umn and one row in the tens-column. The first row in the units-column has two teeth in the first division, whereby the calculating mechanism is moved two numbers; four teeth in the second division, whereby the calculating mechanism is moved four numbers; six teeth in the third division, whereby the calculating mechanism is moved six numbers, and eight teeth in the fourth division, whereby the calculating mechanism is moved eight numbers. The second row of teeth in the units-column has the fifth division blank, the sixth division has two teeth, the seventh has four, the eighth has six, and the ninth has eight. The tens-column is divided into nine divisions, as shown, and counting from the center the first four divisions are blank and the succeeding five divisions have each one tooth, the said teeth in both the units and tens columns being so placed as to work out the calculation, which will be presently described in respect to platen 2, and the teeth upon all of the other platens are arranged in units and tens columns and in the proper position in respect to the divisions to work out the calculation according to the numeral represented by said platens.

Each of the platens D has its multiplication calculated upon the face thereof by the arrangement or location of the projections or teeth, and in order to enable this to be specifically understood reference will be made to Fig. 5. Calling attention to platen 2 of Fig. 5 I will explain how the calculation of multiplication is worked out by the said projections. First, it should be noted that this platen 2 (as has also the other platen with the exception of the platen 1) has two columns 100 and 101, one at each side thereof, the column 101 at the right being the units and the column 100 at the left indicating tens. Now if the operator desires to multiply two by one the indicating-handle *b* is placed at the numeral "1," Fig. 1, and this will move the platen-carrying frame to the extreme left-hand side of the machine, and consequently bring the units-wheel of the upper series of the numeral-wheels in a position to be operated by those projections which are in a line with the first division indicated by the longitudinal lines upon Fig. 1. To multiply figure "2" by two the platen-carrier is moved slightly to the right sufficiently to bring the next division in line, which will cause the engagement with four of the said projections. Another slight movement equal to the division-line of the said platen will change it in a line with six of said projections, thus multiplying the two by three, and so on until the fifth division. Then to multiply two by five will carry the unit-wheel in a line with the fifth division, which is blank; but it will carry the tens-wheel in a line with the fifth division of the platen, (counting from the left-hand or opposite side of the platen,) thus moving the tens-wheel one tooth, exhibiting the digit "1" and leaving the unit-wheel "0," making ten. Now to multiply the two by six the platen is shifted to bring it to the sixth position or division, which will expose the two figures in the sixth position of the units side of the platen and will operate the tens-numeral "1," making twelve. This calculation continues on in this same way and the calculations upon all of the platens can be readily worked out from the above-described explanation.

For the purpose of indicating the decimal points in computing or reading the product in the two series of openings of the upper portion of the carriage I provide a series of openings 95, adapted to receive pins which will act as indicators to represent decimal points, as will be readily understood.

To facilitate the reading of the product of a given calculation and also to facilitate the "setting up" of the numeral-wheels to any desired number, I provide the exterior of the hinged portion of the carriage with numerals from "1" to "13" placed, respectively, at the openings 25, whereby the operator in reading the product can tell by the number opposite any of the openings whether the product begins in the hundreds, thousands, millions, &c., and by the same means the operation of setting up any given number is facilitated, in that said numbers at the openings will indicate to the operator at which wheel to begin for setting up the given amount or number without the mental calculation of beginning at the right-hand opening and counting units, tens, hundreds, &c., in which mental operation he is liable to an error.

One of the features of my construction is the simplicity and cheapness of the recording mechanism, wherein all expensive gearing, such as bevel-gears, is avoided by simply placing right-angle gears between and engaging directly the recording or numeral wheels and the driving members or platens. All lost motion or "backlash" is prevented by providing both the recording-wheels and the right-angle gears with yielding checks which form positive but yielding stops therefor at each tooth thereof, making a reliable, direct, and simple construction which I find in practice to be exceedingly well adapted for calculating-machines, and which enables me to very materially cheapen the cost of construction.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A calculating-machine comprising a plurality of platens having teeth thereon, and a calculating mechanism movable across the platens and actuated by the teeth thereon, substantially as described.

2. A calculating-machine comprising a plurality of series of platens, each series consisting of a plurality of platens, the platens of each series having projections so arranged as to have the platens represent respectively the numerals "1" to "0," and a calculating mechanism adapted to be moved across the platens

and to be actuated thereby, substantially as described.

3. A calculating-machine comprising a plurality of series of platens, the platens of each series provided with teeth or projections arranged to have them represent the numerals "1" to "9," said platens movable to bring either in operative position and a calculating mechanism actuated by engagement with the said platens, substantially as described.

4. A calculating-machine comprising a plurality of series of toothed platens, a carriage adapted to travel across said platens, said carriage carrying a plurality of numeral-wheels, and intermediate mechanism operated by the toothed platens and in turn actuating the numeral-wheels, substantially as described.

5. A calculating-machine comprising a plurality of series of toothed platens, said platens movable in two directions one at right angles to the other, and a calculating mechanism operated by the toothed platens, substantially as described.

6. A calculating-machine comprising a plurality of movable series of toothed platens, a plurality of numeral-wheels rotating in a plane parallel the plane of the platens and a plurality of intermediate gears rotating in a plane at right angles to the numeral-wheels, and meshing therewith and adapted to also engage the teeth upon the platens when one is moved in relation to the other, substantially as described.

7. A calculating-machine comprising a plurality of series of toothed platens, a carriage movable across the said platens, the carriage having a member movable away from the platens, said member carrying a plurality of numeral-wheels adapted to be actuated when the movable member is in one position and carried out of operation when in the other position, substantially as described.

8. A calculating-machine comprising a plurality of series of toothed platens, a plurality of numeral-wheels, a carrier therefor movable across the face of the platens, the platens adapted to actuate the numeral-wheels, and carrying elements for the numeral-wheels situated at points beyond the platens in the direction in which the carrier is moved whereby the carrying is effected independent of the operation of the platens upon the numeral-wheels, substantially as described.

9. A calculating-machine comprising a plurality of series of toothed platens, a numeral-wheel carrier, a plurality of separate and independent numeral-wheels, a plurality of carrying elements supported independent of the numeral-wheel carrier, and also independent of the platens, said numeral elements adapted to actuate the numeral-wheels for carrying from one to the other, substantially as described.

10. A calculating-machine comprising a plurality of series of toothed platens, a numeral-wheel carrier, a plurality of independent numeral-wheels, a plurality of carrying mechanisms comprising members set in operative position by the numeral-wheel, and elements actuated by the set elements, substantially as described.

11. A calculating-machine comprising a plurality of series of toothed platens, a numeral-wheel carrier movable across the said platens, a plurality of independent numeral-wheels carried by the carrier, a plurality of gears situated intermediate the numeral-wheels and the platens and adapted to be actuated by the platens and in turn to actuate the numeral-wheels, and a carrying mechanism comprising a movable gear moved laterally by the numeral-wheel, and an element engaged by the carrying-gears and moved into engagement with the said intermediate gears for actuating the succeeding numeral-wheel, substantially as described.

12. A calculating-machine comprising a plurality of series of toothed platens, a numeral-wheel carrier movable across the face of said platen, a plurality of independent numeral-wheels carried thereby, a plurality of gears situated intermediate the numeral-wheels and the toothed gears and coöperating therewith for actuating the numeral-wheels, a movable carrier-gear revolving upon an axis in a plane at right angles to the said platens, and carried by the said carrier, the numeral-wheels provided with an actuating member for moving the said movable gear, a movable element supported independent of the carrier, and moved laterally by the said movable gear, the said carrying element constructed to engage the intermediate gear for operating the succeeding numeral-wheel, substantially as described.

13. A carrying mechanism for calculating-machines comprising a movable numeral-wheel carrier, a plurality of independent numeral-wheels carried thereby, actuating-gears for the numeral-wheels rotating on an axis at right angles thereto, a shaft extending at right angles to the axis of the actuating-wheels, and carrying a gear, and movable members 35 supported independent of the carrier and traveling in the path of but situated eccentric to the said movable gear, the movable gear engaging the carrying member 35 and moving it laterally in the path traveled by the driving-gear, substantially as described.

14. A carrying mechanism for calculating-machines comprising a movable numeral-carrier, a plurality of independent numeral-wheels carried thereby, an operating-gear engaging the numeral-wheels for actuating them, the numeral-wheels provided with cams, an endwise-movable shaft 32 carrying a gear 33, and a laterally-moving member supported independent of the carrier and situated in a line between the gear 33 and the actuating-gear 18, said member adapted to be moved laterally by engagement with the gear 33 and carried in engagement with the gear 18, substantially as described.

15. A carrying mechanism for calculating-

machines comprising a movable numeral-carrier, a plurality of independent numeral-wheels carried thereby, actuating-gears engaging the numeral-wheels, a transversely-movable shaft carried by the carrier, said shaft provided with a gear 33, the numeral-wheels provided with a member for actuating the shaft, and a transversely-movable member supported independent of the carrier and situated in a line between the driving-gear and the gear carried by the movable shaft, said member constructed to move laterally in engagement with the driving-gear and to move the transversely-movable shaft to its original position, substantially as described.

16. A carrying mechanism for calculating-machines comprising a movable numeral-wheel carrier, a plurality of independent numeral-wheels carried thereby, driving-gears for the said numeral-wheels, transversely-movable gears carried by the carrier and situated at a point between the numeral-wheels and the actuating-gears, and an element supported independent of the carrier and situated at a point between the transversely-movable gear and the actuating-gear, said member constructed to engage the movable gear when in its lowered position and to be carried thereby in engagement with the actuating-wheel, substantially as described.

17. A carrying mechanism for calculating-machines comprising a movable numeral-wheel carrier, a plurality of numeral-wheels carried thereby, a plurality of driving-gears 18, a plurality of shafts 32, numeral-wheels provided with cams adapted to engage one end of the shafts, and the opposite end of the shafts carrying gears 33, said shafts provided with two grooves, a retaining member adapted to engage the grooves, and a movable actuating member supported independent of the carrier, and adapted to coöperate with the gear 33 and to be thrown in engagement with the actuating-gear for carrying to the succeeding numeral-gear, substantially as described.

18. A carrying mechanism for calculating-machines comprising a movable numeral-wheel carrier, a plurality of independent numeral-wheels 18 carried thereby, a plurality of actuating-gears carried by the carrier and in engagement with the numeral-wheels, a longitudinally-movable shaft carrying a gear 33, the numeral-wheels carrying members for moving the shaft longitudinally, and an element 35 supported independent of the carrier and provided with a tooth 34 for engaging the wheel 33 to carry the carrier laterally in engagement with the actuating-wheel, and also provided with a shoulder 41 for elevating the gear 33 and moving its shaft longitudinally to restore it to its original position, substantially as described.

19. A calculating-machine comprising a plurality of series of toothed actuating members having two movements one at right angles to the other, and a numeral-wheel carrier movable across the face of the toothed members and adapted to be actuated thereby, substantially as described.

20. A calculating-machine comprising a plurality of series of platens movable in two directions one at right angles to the other, a mechanism and an index for moving the said platens simultaneously, and correspondingly, and a calculating mechanism movable across the face of the platens substantially as described.

21. A calculating-machine comprising a plurality of series of toothed platens movable in two directions one at right angles to the other, a numeral-wheel carrier carrying a plurality of numeral-wheels actuated through the medium of the toothed platens when moved across the face thereof, said carrier having two movements one at right angles to the other, substantially as described.

22. A calculating-machine consisting of a plurality of series of flat platens hinged together and movable in two directions one at right angles to the other, and a calculating mechanism movable across and actuated by the said toothed platens, substantially as described.

23. A calculating-machine comprising a frame, a plurality of series of flat platens, the platens of each series of platens hinged together, a revolving member for each series of platens, and a calculating mechanism movable across the face of the platens and actuated by engagement with the teeth thereof, substantially as described.

24. A calculating-machine comprising two parallel rows of separate series of toothed platens, each series of platens being movable independent of the other, a locking mechanism for the said series of platens, and a calculating mechanism movable across the face of the platens and actuated by the engagement with the teeth thereof, substantially as described.

25. A calculating-machine comprising two parallel rows of series of movable toothed platens, the series of one row of platens being staggered or out of line in respect to the series constituting the other row, and a calculating mechanism movable across the face of said platens and adapted to be actuated by the engagement of the teeth thereof, substantially as described.

26. A calculating-machine comprising a plurality of series of independently-movable toothed platens, independent locking and releasing members for said platens, actuating members for moving the platens, and a calculating mechanism movable across the face and adapted to be actuated by engagement with the teeth of said platens, substantially as described.

27. A calculating-machine comprising a plurality of series of flat platens, each series being movable independent of the other, a calculating mechanism consisting of a carriage

made in two parts, one movable transverse the other, the transversely-movable member provided with a plurality of numeral-wheels, and the relatively stationary member of the carriage provided with independent actuating mechanisms adapted to engage the toothed platens and to actuate the numeral-wheels, substantially as described.

28. A calculating-machine comprising a plurality of series of toothed platens, a numeral-wheel carrier provided with a plurality of numeral-wheels adapted to be actuated by the said platens, the said numeral-wheel carrier provided with a second set of numeral-wheels to represent the quotient or multiplier, and a movable toothed member adapted to actuate the quotient or multiplier numeral-wheel, substantially as described.

29. A calculating-machine comprising a plurality of series of toothed platens, a numeral-carrier carrying numeral-wheels to indicate the product, and a separate set of numeral-wheels to indicate the quotient or multiplier, the said platens movable transverse the said numeral-wheel carrier, and a toothed member actuated by the movement of the platens and adapted to actuate the quotient or multiplier numeral-wheels to indicate the multiplier or quotient digit or digits, substantially as described.

30. A calculating-machine comprising a stationary frame, a transversely-moving frame carrying a plurality of series of toothed segment-wheels carrying toothed platens, a carriage comprising a lower portion supported independent of said platens and provided with gears adapted to engage the teeth thereof, and also of an upper portion carrying a plurality of numeral-wheels engaged by said gears, substantially as described.

31. A calculating-machine comprising a stationary frame, a movable platen-frame carrying a plurality of series of toothed platens, a numeral-wheel carrier consisting of a frame movable across the stationary frame in a direction at right angles to the movement of the platen-frame, and means for moving the platen-frame, substantially as described.

32. A calculating-machine comprising a stationary frame, a movable platen-frame carrying a plurality of series of toothed platens, the stationary frame provided with a track extending in a direction transverse the movement of the platens, and a calculating mechanism, movable upon the said track and adapted to be actuated for engagement with the teeth of the platen when moved thereacross, substantially as described.

33. A calculating-machine comprising a frame, a plurality of series of platens hinged together to form a chain, a plurality of revoluble polygon wheels, the shaft passing loosely through said wheels, the shaft provided with a wheel having a number of teeth corresponding to the sides of the polygon wheel, the polygon wheel having a tension member engaging the said toothed wheel, substantially as and for the purpose described.

34. A calculating-machine comprising a plurality of actuating members, a calculating device comprising a carriage consisting of a lower portion movable across the face of the actuating members and provided with wheels actuated by said actuating members, and a vertically-movable portion carrying numeral-wheels, and a support for the vertically-movable portion, substantially as described.

35. A calculating-machine comprising a plurality of series of actuating members, a calculating mechanism movable across the face thereof, said calculating mechanism comprising a carriage, a track therefor, said carriage having a vertically-movable portion, said vertically-movable portion carrying a plurality of numeral-wheels, the carriage having intermediate actuating members, a supporting member carried by the carriage and adapted to engage the vertically-movable portion thereof, said supporting member adapted to be supported by the track, and the track constructed to release the supporting member when the carriage is at the limit of its movements, substantially as described.

36. A calculating-machine comprising two parallel shafts carrying a plurality of series of toothed platens, an actuating member common to both shafts, and a calculating mechanism adapted to be moved across and actuated by the toothed segments, substantially as described.

37. A calculating-machine comprising a stationary frame, a relatively-movable platen-frame carrying a plurality of series of toothed platens, an index-hand operatively connected with the platen-frame for moving it, the index-hand provided with a stop member and the stationary frame with a coöperating stop member constituting an index, and a calculating mechanism adapted to be moved across and be actuated by the teeth of the said platen, substantially as described.

38. In a calculating-machine, a platen having two parallel sets of teeth, one representing the unit-digits and the other the tens-digits, in combination with a calculating mechanism having a units-wheel actuated by the units set of teeth and a tens-wheel actuated by the tens set of teeth of said platen, substantially as described.

39. A calculating-machine comprising a plurality of series of platens having an independent movement in one direction and arranged in fixed relations in respect to the other direction of movement.

40. A calculating-machine comprising a plurality of series of platens having two movements one at right angles to the other and arranged and constructed to move independently in one direction and in fixed relations in the other direction.

41. A calculating-machine comprising a plurality of toothed platens hinged together

to constitute an endless chain and revoluble upon a support to bring either of said platens to operative position.

42. A calculating-machine comprising a plurality of platens arranged to move independently of each other in one direction and moved together and simultaneously in a direction at right angles to said first movement.

43. A calculating-machine comprising a plurality of series of platens, each series constituting an independently-movable endless chain, and a carrier for all of said platen-chains movable in a direction at right angles to the independent movement of the chains.

44. A calculating-machine comprising a plurality of series of platens arranged and constituting independent chains, and means supporting and adapted to actuate said chains to bring the desired platen to operative position.

45. A calculating-machine comprising a plurality of series of endless-chain platens and means arranged and constructed to move said chains independently in one direction and simultaneously and correspondingly in a direction at right angles to said independent movement.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FRANK S. BALDWIN.

Witnesses:
A. S. PATTISON,
GEO. E. FRECH.