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COMPLETE SPECIFICATION.

**Improvements in Calculating Machines.**

I, JAMES MALLMANN, of No. 518, St. Clair Street, in the City of Sheboygan, in the County of Sheboygan State of Wisconsin, United States of America, Real Estate Agent, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and  
5 by the following statement:—

My invention has relation to improvements in calculating machines.

The primary object had in view is to provide an improved construction of calculating machine which has in view simplicity of construction and operation and inexpensiveness in production.

10 A further object contemplated is to provide an improved construction of such character as to adapt the machine to be used in connection with type writing mechanism, the arrangement being such that the calculating mechanism displays the proper numbers through suitable openings, while the type writing mechanism is adapted to print the proper numbers in columns, and provision for the printing  
15 of the correct answer to the problem, after the figures to be calculated are first printed.

A further object contemplated is the provision of an improved means for verification as the operator proceeds with the work.

20 A further object contemplated is the provision of means for bringing forward the actuating bars without disturbing the position to which the calculating wheels have been rotated, so that when it is desired to print the total of the sum, the actuating bars may be moved forward the proper distance to bring the proper numbers on the type wheels to printing position, and the numbers of the actuating bars by reason of the movement of said bars, are brought to view  
25 immediately back of the forward bordering edge of the large opening in the casing in convenient position to be compared with the sum total as displayed by the calculating wheels, whereby the operator is assured that the actuating bars have been moved the proper distance to print the proper total, before he proceeds to operate the printing mechanism for the purpose of printing the sum  
30 total.

A further object contemplated is to provide means, after the longitudinal actuating bars have been forced in a direction to operate the calculating wheels, for returning said bars to their normal position, without the necessity of bringing the printing mechanism into operation.

35 A further object is to provide means to prevent over-rotation in carrying over.

With the above primary, and other incidental, objects in view, the invention consists of the devices and parts, or their equivalents, as hereinafter set forth.

In the accompanying drawings, Fig. 1 is a plan view of the machine, showing the roll of paper at the rear end of the machine, partly broken away.

40 Fig. 2 is a side elevation of Fig. 1.

Fig. 3 is a longitudinal central section, the divisional rods being omitted.

[Price 8d.]

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Fig. 4 is a fragmentary view of the rear portion of the machine, the casing being in section, and other parts broken away.

Fig. 5 is a fragmentary view of the mechanism in the rear portion of the casing, but of the opposite side to that shown in Fig. 4.

Fig. 6 is a detail view of the mechanism for changing back to zero. 5

Fig. 7 is a detail of the mechanism for lifting the actuating bars.

Fig. 8 is a cross section on the line A—A of Fig. 3.

Fig. 9 is a detail of a portion of the mechanism for releasing the actuating bars, to provide for all the bars returning to their normal position.

Fig. 10 is a detail of the calculating wheels and allied mechanism, some of said wheels and adjacent parts being shown in section. 10

Fig. 11 is a detail view of one of the calculating wheels, showing the carrying over disk adjacent thereto.

Fig. 12 is a detail of the opposite side of the calculating wheel to that shown in Fig. 11, also showing the opposite side of the carrying over disk. 15

Fig. 13 is a view similar to Fig. 12, with the carrying over disk removed.

Fig. 14 is a detail view of the operating tool, and

Fig. 15 illustrates mechanism for preventing over rotation in carrying over.

Referring to the drawings, the letter *a* indicates the casing of the machine. In the top of this casing is an opening *b*, preferably of rectangular form, and just in front of this opening is a series of small openings *c*. 20

The operative mechanism of my machine is connected to, or carried by, or supported on, a suitable frame work located within the casing. This frame work may be of any desired form of construction best adapted for supporting the operative parts, and in the accompanying drawings, I have shown as a convenient form a frame work consisting of two horizontal, longitudinal bottom pieces *d, d*, united by means of transverse connecting pieces *e, f, & g*, respectively; and the two upper side pieces *h, h*, connected to the respective bottom pieces, and rigidly connected together by means of the connecting pieces *i, j, k, l & m*. 25

The portion of the framework beneath the opening *b* is provided with a series of groove ways *n* extending in the direction of the length of the opening, and being formed by a series of longitudinal partitions *o*. Seated in each of these groove ways is a longitudinal actuating bar *p*. These several bars are also supported and slide on the transverse pieces *k & l*, the latter having an upper rounded surface to best adapt the actuating bars to slide thereover. The upper surface of the front portion of each longitudinal actuating bar is provided with a series of projections *q*, there being ten of such projections shown. Each projection is preferably formed with a rearwardly and upwardly-inclined face, terminating at its rear in an upright shoulder *r*. The inclined faces of these projections are numbered, as shown in Fig. 1, and the numbers are clearly visible through the opening *b* the first projection at the front end of each bar being numbered 0, and each succeeding projection being numbered with the numerals 1, 2, 3, 4, 5, 6, 7, 8, & 9, respectively. Each bar is also provided on its under edge, and below the projections *q*, with a series of teeth *s*. The upper edge of the rear portion of each longitudinal bar is formed or provided with a series of teeth *t*, which form a rack. Each bar is further provided on its lower edge, at the rear portion thereof, and beneath the teeth *t*, with inclined teeth *u*, the inclined face of each tooth terminating at an abrupt shoulder. 35

Journalled in the side pieces *h h*, at the front thereof, is a shaft *v*. Mounted loosely on this shaft is a series of calculating wheels *w*, nine of said wheels being shown in the accompanying illustration of my invention to correspond to the number of sight openings *c* in the top of the casing, and to also correspond to the number of actuating bars *p*. It is obvious, however, that any desired number of calculating wheels, openings *c* and bars *p*, may be employed. Each calculating wheel has arranged around its periphery a series of numbers running from 0 to 9. Each calculating wheel has also projecting from one side thereof, and integral 50

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with, or fast to, said side, a ratchet wheel  $x$ . A series of disks  $y$  are mounted fast on the shaft  $v$ , and each one of these disks is adjacent to the face or end of one of the ratchet wheels. A portion of the periphery of each disk is cut or squared off, as indicated by the letter  $z$ , and one side of each disk is provided with a lug 1. To the side of each calculating wheel opposite to the side from which projects the ratchet wheel  $x$ , is secured a spring arm 2, the free end of said arm outstanding from the wheel. Also pivotally secured to this side of each calculating wheel is an arm 3, the pivot of said arm being preferably between the ends thereof. One end of each arm 3 is provided with a laterally extending finger 4, said finger normally bearing upon the curved periphery of the adjacent disk  $y$ . The free end of a spring 5 acts on the arm 3 in order to hold the laterally extending finger 4 in engagement with the periphery of the disk. The spring arm 2, the arm 3, and the spring 5 are preferably arranged within a recess cut in the side of each calculating wheel, in order to decrease the width required to accommodate these parts. A spring-pressed pawl 6 is adapted to engage each ratchet wheel  $x$  for the purpose of holding said wheel, and preventing said wheel from going backward and consequently the calculating wheel with which the ratchet wheel is rigid, in adjusted position.

One end of the shaft  $v$  extends through the side of the casing, and is provided with a handle or crank 7. The shaft has also mounted rigidly thereon within the casing, and near the handle end of the shaft, a disk 8 (See Fig. 6). This disk is preferably formed with a cammed or raised periphery, and is also provided with a projecting finger 9, said finger forming one wall of a notch 10. Pivoted medially to an upwardly-projecting lug from one of the side pieces of the frame work is a lever 11, said lever provided at its inner end with a downwardly-extending lug which is in line with the periphery of the disk. Passing through the outer end of the lever 11 is a push rod 12, said rod extending upwardly through the top of the casing, and being provided on its outer end with a button to adapt it to be conveniently operated by finger pressure. The push rod is encircled beneath the lever 11 by a coiled spring 13, which spring exerts an upward pressure against said end of the lever, and thereby normally holds the depending lug of the lever in engagement with the notch 10 of the disk 8, and as said disk is rigid on the shaft, the shaft is thereby normally held stationary.

A shaft 14 is journaled in the side pieces of the frame work, and one end of this shaft is extended through the side of the casing and provided with a handle 15. Extending downwardly near opposite ends of this shaft are crank-arms 16, 16, and to the lower ends of these arms are jointed links 17, 17. To one of these links is connected the rear end of a coiled spring 18, the opposite end of said spring being connected to a lug 19 extending upwardly from one of the transverse connecting pieces of the frame work. To the rear ends of the links are jointed the lower ends of medially pivoted levers 20, 20. These levers extend upwardly through elongated slots 21 in the top of the casing. The upper extremities of the levers 20 form bearings for the shaft or axis 22 of a paper-carrying and feeding cylinder 23. This cylinder has adjacent thereto the usual curved paper clip 24 for holding the paper to the cylinder, said clip extending rearwardly and having its rear ends secured to bosses 25 extending laterally from the levers 20. Bearing against the under side of the cylinder are the usual feed rolls 26. The shaft 22 has also mounted thereon adjacent to one end of the paper-carrying cylinder a ratchet wheel 27, for spacing the paper, which wheel is engaged by two pawls, one of said pawls being indicated by the numeral 28, and the other pawl by the numeral 29. Pawl 28 is pivoted at its lower end to one of the side pieces  $h$ , and pawl 29 is pivoted at a point between its ends to one of the levers 20. The lower arm or depending portion of the pawl 29 abuts against a stop 30. In Fig. 5 both of these pawls are shown as in engagement with the same tooth of the ratchet wheel 27, and this is the normal position of said pawls. The pawl 29 is held firmly in engagement with a tooth of the ratchet wheel by reason of the pull exerted by the coiled spring 18 on

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the lower end of the lever 20, tending to hold said lever in the upright position shown in Fig. 5, and at the same time holding the lower arm or depending portion of pawl 29 firmly against the stop 30. The lower arm of pawl 29 is also acted upon by a spring 31, which further assists in holding said pawl in the engagement shown in Fig. 5, and the pawl 28 is acted upon by a coiled spring 32, the tendency of which is to normally hold said pawl in the Fig. 5 position. It will, therefore, be seen that the ratchet wheel is held firmly against accidental turning from its normal position. On the opposite ends of the shaft 22 are hand wheels 33, 33, by means of which the paper-carrying cylinder may be turned by hand when it is desired to shift the paper by hand. In order to easily accomplish this turning without the resistance offered by the pawl 29 resting against the stop 30, all that is necessary to be done is to grasp one of the hand wheels, and turn the upper ends of the levers 20 rearwardly on their pivots. This will necessarily free pawl 29 from being wedged against stop 30, and enable the paper-carrying cylinder to be readily turned.

Pivoted to the levers 20 and projecting forwardly therefrom are arms 34, 34, the forward ends of said arms forming bearings for an inking roller 35. The upper edge of each arm 34 is pressed upon the free end of a spring 36.

The top of the casing, just in advance of the longitudinal, elongated slots 21, is provided with a transverse slot 37. The sides of the casing at opposite ends of this transverse slot are provided with bearings 38 for a type-wheel shaft 39. Upon this shaft is loosely mounted a series of type wheels 40 projecting through the slot 37, there being one of said type wheels for each longitudinal bar. Secured to, or integral with, one side of each of the type wheels is a pinion 41, each pinion being so positioned that the teeth thereof are in engagement with the teeth *t* of the respective actuating bars *p*. Each type wheel has arranged peripherally therearound a series of numbers running from 0 to 9. The periphery of each type wheel is also provided with a cut-away or plain portion 42, the purpose of which will be hereinafter explained. If desired, of course instead of having the teeth *t* engaging directly with the pinions 41, an intermediate pinion or pinions could be arranged between the teeth *t* and the pinions 41.

Mounted loosely on a transverse shaft 43 is a series of bell-crank levers 44, there being one bell-crank lever provided for each actuating bar. The upper ends of these bell-crank levers engage the teeth *u* on the under edges of said actuating bars. The lower arm or member of each bell-crank lever has connected thereto the rear end of a coiled spring 45. These springs extend forwardly, and the forward end of each is connected to a finger 46 extending downwardly from each actuating bar.

The numeral 47 indicates a transverse rock-bar or plate (shown in detail in Fig. 9). This bar is provided with end trunnions 48, 48, which are journaled in the sides *h* of the frame work. Pivoted to one of the links 17 is a dog 49, which, after the links have been thrust rearwardly, and on their return movement towards a normal position, is adapted to engage with a lug 50 depending from the lower edge of the bar 47. The upper edge of the bar 47, as clearly shown in Fig's. 3 & 4, normally bears against the depending arms of the bell-crank levers 44. When, therefore, the dog 49 engages the lug 50 in the manner just described, said upper edge of the bar will be thrown rearwardly, and will consequently act against all of the bell-crank levers, and cause a turning of said levers in a direction to release the ends of the upper arms thereof from engagement with the teeth *u* of the actuating bars. The forward side of the upper end of the rock-bar normally bears against a stop-pin 51. The object of releasing the bell-crank levers from engagement with the teeth *u* of the actuating bars is to permit said bars after having been actuated forwardly in a direction to act on the calculating wheels and on the printing wheels, to be returned to their normal position after these operations are completed. It will of course be obvious that the moment the bell-crank levers are released in the manner described, the action of the springs 45 on the actuating bars is such as to draw such bars

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rearwardly. The movements are such, however, that before the actuating bars have completed their full return rearward stroke the dog 49 will have been released from engagement with the lug 50 by reason of the return forward movement of the links 17, and thus the bell-crank levers would be permitted to

5 turn back into engagement with the teeth *u* of the actuating bars and thereby prevent the full return movement of said bars. In order to provide against this, I employ other means for engaging the rock bar 47 in order to hold it, after the disengagement of the dog 49. This means consists of an auxiliary dog 52, which

10 is pivoted at a medial point to one of the side pieces *h* of the frame work. The under edge of this auxiliary dog is acted upon by a coiled spring 53 pressing upwardly thereagainst. The action of this spring against the auxiliary dog causes the rear end of said dog to be forced upwardly back of the rear edge of another

15 lug 54 depending from the under edge of the rock bar. This dog 52 is finally released from engagement with the rock bar, after the actuating bars have fully completed their return rearward movement, by the action of a bell-crank lever 55.

A reduced portion of the rear arm of this lever fits in a recess in the forward end of the dog 52, and the forward arm of this lever extends upwardly in a position to be acted upon by a pin 56 projecting from one of the links 17. This pin comes into play upon the completion of the return forward movement of the links 17,

20 and upon completion of the return rear movement of the actuating bars. Said pin at such time contacts with the end of the forward arm of the bell-crank lever and causes a turning of said lever in a direction to turn the dog 52, so that the rear arm of said dog will be thrown downwardly, against the action of the spring 53, to such an extent as to release the rear arm of said dog from

25 engagement with the lug 54. The rock bar is then free to return to its normal position the return movement being limited by the pin 51, and after its return the spring 53 will cause the rear end of the dog 52 to be forced upwardly to the normal position shown in Fig. 4, the movement of the dog 52 at the same time causing a return of the bell-crank lever 55 to its normal position.

30 The under edge of the rock-bar 47 is also provided with a depending finger 57. To this finger is jointed the rear end of a link 58. The forward end of this link is jointed to the lower arm of a bell-crank lever 59. Passing through an opening in the top of the casing and also through a guide box 60 beneath the top of the casing, is a push-rod 61, the lower end of said rod being in line with

35 the upper arm of the bell-crank lever 59. It is obvious that when this push-rod is depressed by finger pressure on the button at the upper end of said rod, the bell-crank lever will be turned on its pivot, thereby causing a pull on the link 58, and a consequent turning of the rock-bar 47 on its pivot, so as to thrust the upper

40 edge of said rock-bar rearwardly and thereby turn all of the bell-crank levers 44 in a direction to release said levers from engagement with the teeth *u* of the actuating bars, the levers being held out of engagement with said teeth as long as finger pressure is continued on the push-rod. This provides for releasing the actuating bars so as to adapt them to be moved rearwardly to their normal

45 position without the necessity of operating the links 17, and thereby without the necessity of bringing the printing mechanism into action.

Extending transversely beneath the actuating bars is a pivoted bar 62, the trunnions 63 of said bar being at the lower ends of the opposite end edges of the bar. These trunnions are adapted to turn in the side pieces *h* of the frame work. The top edge of one of these side pieces *h* is provided with two recesses 64

50 & 65, and these recesses receive, respectively, projections 66 & 67 extending from the end of the bar 62. These projections are adapted to contact with the bottoms of the recesses, and thereby limit the turning of the bar in either direction. One of the trunnions of the bar is extended outwardly through the side of the casing, and the extremity of this extended end is provided with a thumb lever 68.

55 When this lever is depressed, the upper edge of the bar 62 is thrust upwardly against the under edges of the actuating bars, and lifts the forward ends of said bars so that the teeth on the under edge thereof will be out of line with the

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teeth of the ratchet wheels  $x$ , and consequently by this adjustment of the actuating bars, the calculating wheels will not be turned when said actuating bars are moved forwardly.

For conveniently operating my machine, I prefer to employ the device shown in Fig. 14, which consists of a handle portion 69 in the form of a handle of a pencil, and having one end pointed, with a projection 70 of metal or other hard substance extending from the pointed end. In the use of this tool, the projection 70 is made to engage any particular shoulder  $r$  of the projections  $q$  of an actuating bar. By now pushing forward the bar so engaged, said bar will be actuated the required distance, the limit of the forward movement being regulated by contact of the tool with the forward bordering edge of the opening  $b$ . While I preferably employ this operating tool for actuating the bars  $p$ , yet it is obvious that any other suitable device may be employed for the purpose, such for instance as an ordinary lead pencil, or pen holder, or in fact the bars  $p$  may be actuated by the finger of the operator.

I prefer to provide the rear end of the machine with projecting bearings 71, 71 for a shaft 72, said shaft adapted to have the paper 73 which is to be printed upon wound thereon in a roll. The paper is extended from the shaft 72 forwardly between the paper-carrying cylinder 23 and the clip 24, with the guide rollers 26 bearing thereagainst.

The numeral 74 indicates a series of divisional rods, shown in Fig. 1, and which are conveniently employed for the purpose of enabling the operator to divide off the space  $b$  so that certain of the actuating bars will be between said divisional rods, or between a divisional rod and the side edge of the opening. In Fig. 1 it will be seen that the first rod towards the left encloses two of the actuating bars between it and the right hand edge of the opening, and between this first rod to the left and the succeeding rod to the left there are included three actuating bars; between the second rod to the left and the third rod to the left there are also three actuating bars; and between the last rod to the left hand edge of the opening  $b$  there is one actuating bar. It will be seen from this that by actuating a bar in the last division at the left of Fig. 1 it will be readily known that a number in the millions column is being taken; by operating the three bars of the next division towards the right that numbers in the thousands columns are being taken; by operating the bars in the next division towards the right that numbers in the units tens and hundreds columns are being taken; and by operating the two bars in the last division to the right that decimal denominations are being taken, or when currency is being added that cents are being taken into consideration. These divisional rods are arranged in the spaces in the groove-ways  $n$  between the actuating bars, and the forward ends of said divisional rods fit removably in openings 75, while the rear ends thereof are bent downwardly at right angles, said bent ends adapted to loosely engage openings 76 in the groove-ways. By this provision the divisional rods may be readily shifted so as to change the number of actuating bars included in any subdivision.

In the operation of my invention the calculating wheels are all first set to 0. It will be supposed that it is desired to add together 2.50 and 3.50. In the first place, the point of the operating tool is made to engage the shoulder  $r$  immediately in advance of the digit 2 of the first actuating bar towards the right in the second subdivision shown in Fig. 1. By now moving this bar to the limit permitted by the contact of the operating tool with the forward edge of the opening  $b$  the digit 2 will be brought to view in the space of the opening  $b$  just back of the forward bordering edge of said opening. This movement of the bar  $p$  also causes the teeth  $s$  on the under side thereof to engage the appropriate ratchet wheel  $x$  and rotate said wheel a sufficient distance to bring the digit 2 on the circumference of the calculating wheel  $w$  pertaining to said ratchet wheel to view through the appropriate sight opening  $c$ . The tool is next made to engage the shoulder  $r$  just in advance of the digit 5 of the next actuating bar towards the

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right in the first subdivision. This bar is now moved in the same manner as explained in regard to the previously referred to bar, and the digit 5 brought to view. The tool is next made to engage the shoulder *r* immediately in front of 0 on the next succeeding actuating bar towards the right in the first subdivision, and this bar in like manner is moved to the limit permitted. The movement, however, is not sufficient to cause an engagement of the teeth *s* on the underside of the forward portion of the actuating bar with the ratchet *x*, so that the calculating wheel for this bar is unaffected, and said calculating wheel will therefore still display 0 through its opening. The zero character on the bar, however, has been moved to the space just to the rear of the front bordering edge of the opening *b*. This space therefore discloses the number 250, while the same number is disclosed in the three sight openings *c* pertaining to these particular bars. It will be understood that the calculating wheels which have been operated remain at the position to which they have been adjusted by means of the engagement of the pawls 6 with the ratchet wheels *x*, and that the bars *p* remain temporarily in the forward positions to which they have been adjusted by means of the engagement of the upper members of the bell-crank levers 44 with the teeth *u* of said bars. It will be further understood that with the forward movement of the actuating bars as explained, the teeth *t* on the upper portion of the rear edges of said bars engage with the teeth of the pinions 41 of the respective type wheels 40. For instance, the first bar which was actuated will act on its type-wheel so as to bring the digit 2 of said wheel into printing position. The second bar which was actuated will bring the digit 5 of its type-wheel into position for printing, while the third bar which was actuated will bring 0 of its type wheel to printing position. The next operation is to grasp the handle 15 and turn the same downwardly. This will cause a turning of the shaft 14 and a consequent rearward movement of the crank-arms 16, said crank-arms in turn causing a rearward movement of the links 17, said rearward movement of the links being limited by reason of contact with stops 77, 77. This movement of the links will cause the turning of the levers 20 on their pivots in a direction to throw the upper ends of said levers forwardly a sufficient distance to bring the paper carried by the cylinder 23 into contact with the type on the type-wheels which have been brought to printing position, and consequently the number 250 will be printed upon the paper. It will be understood that the forward turning of the levers 20 also thrust the arms 34 and the inking roller carried thereby forward to such an extent as to provide a clearance for the down movement of the paper-carrying cylinder, and hence permit said cylinder to bring the paper into contact with the type. The normal position of the inking roller as shown in Fig's 1, 2 & 3 is such that as the type-wheels are revolved the type will contact with the inking roller, said roller being held yieldingly thereto by means of the spring 36. The blank space on type-wheel is cut out to avoid any possible chance of the blank making an impression on paper, especially when a soft rubber covering is used on paper cylinder.

The moving rearwardly of the links 17 in the manner previously described causes the dog 49 to pass back of the lug 50 of the rock-bar 47 without turning said bar and the shoulder of the dog is thereby brought to the rear of the lug 50.

The next step in the operation is to release the handle 15: The moment this release occurs the recoil of the spring 18 will draw the links 17 forwardly towards and to normal position. With this forward movement the levers 20 are turned so as to bring the paper-carrying cylinder 23 back to normal position. When this cylinder by the previous operation was turned forwardly, the pawl 29 remained in engagement with the same tooth of the ratchet wheel 27 as shown in Fig. 5. by reason of the fact that said pawl 29 is carried by one of the levers 20. The pawl 28, however, on said forward movement of the cylinder, jumped into engagement with the next lower tooth of the ratchet wheel 27, by reason of the fact that said pawl 28 is carried by one of the fixed side pieces *h* of the frame work. On the return rearward movement of the cylinder just referred to, however,

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the pawl 28 will necessarily cause the cylinder to be rotated rearwardly the distance of one tooth, thereby shifting the paper the space of a line, and the pawl 29 will then jump into engagement with the said tooth, and the two pawls will be again engaging the same tooth, ready for a repetition of this operation on the next movement of the links 17. 5

The forward return movement of the links 17 also causes the turning of the rock-bar 47 in the manner previously explained, by the operation of the dog 49 and auxiliary dog 52, and hence a turning of the bell-crank levers 44 in a direction to release said levers from engagement with the teeth *u* of the actuating bars. As these actuating bars are now free, those which have been adjusted forwardly will be immediately returned to their normal position by the recoil of the springs 45, and by the time the actuating bars have fully completed their return rearward movement, the bell-crank lever 55 will have acted upon the auxiliary dog 52 so as to release said dog from the rock-bar 47, and thereby permit the bell-crank levers 44 under the action of the springs 45 to return to their normal position in engagement with the teeth *u* of the actuating bar, the return movement of said bell-crank levers at the same time forcing the rock-bar 47 back to its normal position. 10 15

After the display of the numbers 250 in the sight openings as explained, and the printing of said number 250, the shoulder immediately in front of 3 of the first actuating bar towards the right in the second sub-division shown in Fig. 1 is engaged, the said bar being moved forwardly to the limit permitted. This will cause the number 3 to be brought to the space immediately to the rear of the front bordering edge of the opening *b*, and will cause the actuation of the ratchet wheel *x* relating to this particular bar. As the calculating wheel for this bar already discloses 2 through its sight opening *c* and as said calculating wheel by the movement just described is rotated the distance of three more numbers, the number 5 of said calculating wheel will be displayed through its sight openings *c*. The next operation is to engage the shoulder immediately in advance of the digit 5 of next actuating bar towards the right in the first sub-division and this bar moved to the limit permitted. This will cause the digit 5 to be brought to view in the space immediately to the rear of the front bordering edge of the opening *b*, and will also cause a movement of the calculating wheel relating to this bar the distance of five more numbers. As the calculating wheel of this bar already discloses 5 through its opening *c*; and said wheel by the movement just described is rotated the distance of five more numbers, and as the numbers on said wheel only run from 0 to 9, said wheel will be rotated one number past the digit 9, with the result that 0 is brought to view through the sight opening *c* of this wheel. Each time a calculating wheel is thus made to make a complete revolution, the projecting lateral finger 4 thereof will at the final movement ride off the curved periphery of the disk *y* on to the squared or cut off portion *z* of said periphery, and thus extend into position to be engaged with and to actuate the next succeeding ratchet wheel *x*, the distance of one number. As this next succeeding ratchet wheel already discloses 5 through its appropriate sight opening, this movement of said wheel by the finger 4 of the preceding ratchet wheel will turn said succeeding ratchet wheel the distance of one number, and consequently disclose the number 6 on said calculating wheel to view through its appropriate sight opening *c*. The next operation is to engage the shoulder immediately in front of 0 of the first actuating bar to the right of the first sub-division, and move said bar to the limit permitted. This forward movement will disclose 0 in the space immediately to the rear of the front bordering edge of the opening *b*, but this limited movement of the bar will not cause an engagement of the teeth *s* on the under edge of said bar with the ratchet wheel *x*, with the result that the calculating wheel relating to said actuating bar will still disclose 0 through its sight opening *c*. With the movements of the bars just described, the printing of the numbers 350 on the paper immediately below the numbers 250 is also effected in exactly the same manner 20 25 30 35 40 45 50 55



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as described in relation to the printing of the numbers 250. After all the bars have been returned to their normal position, and it is desired to print the total below the numbers which have been printed, the paper roll is moved one space by hand, so as to leave a divisional space between figures and the total.

5 Then the bars are raised by pressing on thumb-lever 68 in order to hold bars out of engagement with the calculating wheels. The shoulder immediately in front of the digit 6 of the first actuating bar towards the right of the second subdivision is engaged, and said bar moved to the limit permitted, and in like manner the shoulders immediately in advance of 0 on the next actuating bar

10 towards the right in the first division, and the shoulder in advance of 0 on the first bar to the right of said subdivision are successively engaged, and the bars moved forwardly, whereby the types on three of the type-wheels have 600 brought to printing position. The links 17 are now actuated rearwardly, and the printing effected in the manner herein before fully pointed out.

15 After the calculating wheels have been operated, and it is desired to return all of said wheels to 0 before commencing a new operation, this is effected by pushing down on the pusher rod 12, in order to release the lever 11 from engagement with the notch 10 of the disk 8 which is fast on the shaft *v*. The handle 7 is now grasped and operated to cause a turning of the shaft *v* and the disk 8

20 carried thereby in a direction towards the left of Fig. 6. After the disk 8 has been rotated far enough to clear the depending lug of the lever 11 from the notch 10, finger pressure on the pusher rod 12 may be removed and said depending lug of the lever permitted to bear on the cam surface of the disk 8. With the turning of the shaft *v* the disks *y* which are fast thereon are turned therewith, and the lugs 1 on said disks are brought into engagement with the ends of the

25 fingers 2. When all the fingers 2 are thus engaged by the lugs 1 of the several disks, the continued rotation of the shaft *v* towards the left will of course carry the calculating wheels back to a normal position wherein 0 on each wheel is in line immediately below a sight opening *c*, the movement towards the left in

30 order to bring 0 to view being limited by the engagement of the finger 9 against the right hand side of the depending lug of the lever 11. The next step is to turn the handle 7 in a reverse direction to that first described. This will carry the fingers 2 out of engagement with the lugs 1, and consequently rotate the shaft *v*, the disks *y*, and the disk 8 without rotating the calculating wheels, and

35 return said disks *y* and the disk 8 to their normal positions, the limit of the turning of the shaft in this direction being determined by the engagement of the depending lug of the lever 11 with the notch 10. The finger 9 is not absolutely essential to the successful operation of the mechanism for turning back to 0, as that function could be accomplished merely by employing the notch 10,

40 and allowing the engagement of the depending lug of the lever 11 with the notch 10 in order to determine the extent of turning in both directions. This finger, however, is necessarily formed where the periphery of the disk 8 is of cam formation as shown in the drawings, and is perhaps advisably employed, inasmuch as by its omission it would be necessary just before commencing to

45 rotate the shaft *v* in a reverse direction for returning the disks *y* and disk 8 to normal position, to again press on the pusher rod 8 in order to release the depending lug of the lever 11 from said notch.

It may sometimes occur that it is desirable simply to actuate the calculating wheels and perform the arithmetical problem without bringing the printing

50 mechanism into play, and consequently without printing the numbers to be added, or otherwise operated upon. To accomplish this all that is necessary to be done is to press downwardly on the push-bar 61 and thereby cause a turning of the bell-crank lever 59 in a direction to cause a forward pull on the link 58, and hence turn the rock-bar 47 in a direction to cause its upper edge to turn rear-

55 wardly. This rearward turning of the rock-bar will cause a release of the bell-crank levers 44 from the teeth *u* of the actuating bars as herein before fully explained, and hence after the actuating bars have been moved forward will

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permit the return rearward movement of said bars without the necessity of turning the handle 15, and consequently without the necessity of throwing the paper cylinder 23 forwardly into contact with the type-wheel. So long therefore as finger pressure is exerted on the push-rod 61, the actuating bars can be operated for the purpose of performing the arithmetical problem on the calculating wheels without the actual necessity of printing the numbers. 5

An important feature of my invention resides in the provision of improved means for verification as the operator proceeds with the work. This is accomplished by reason of the engagement of the bell-crank levers 44 with the teeth *a* of the actuating bars, whereby the actuating bars which have been actuated are held to the position to which they have been adjusted in order to display a number to be mathematically considered in the portion of the opening *b* just back of the bordering edge of said opening, until the calculating mechanism is ready to be again operated for the next succeeding number to be mathematically considered, whereby as each bar is actuated to the extent permitted by the contact of the operating device with the bordering edge of the opening in the casing, the several bars are thereby held in position to display the proper characters for verification in said opening of the casing just back of the bordering edge of said opening, and said bars are then released by the engagement of mechanism with the bell-crank levers 44 and returned to their normal position, before any of the bars are again actuated in a direction to operate the calculating mechanism. It is evident that after the first number to be mathematically considered is operated upon, and the calculating mechanism is then again operated, the number first mathematically considered no longer appears on the calculating wheels, but the result of the two numbers mathematically considered is shown said wheels. By holding the bars temporarily to the position to which they have been actuated, however, the operator can each time after the machine has been operated for each number to be mathematically considered glance at the space just back of the bordering edge of the opening in the casing and plainly see the number which has been mathematically considered on the portion of the bar just back of said bordering edge, and can then compare the number so shown with the number on the slip of paper containing the numbers to be mathematically considered or operated upon, whereby the operator is enabled to verify the work as the work progresses. 10 15 20 25 30

Another important feature of my invention is the means provided for bringing forward the actuating bars without disturbing the position to which the calculating wheels have been rotated, so that when it is desired to print the total of the sum, the actuating bars may be moved forward the proper distance to bring the proper numbers on the type-wheel to printing position, and the numbers on the actuating bars immediately back of the forward bordering edge of the large opening in the casing can then be compared with the sum total as displayed by the calculating wheel, whereby the operator can at once determine that the actuating bars which have been moved forwardly have been moved the proper distance to print the proper total, before the paper-feeding and carrying cylinder is brought forward to engage and receive the impression of the type. Of course if the numbers on the calculating wheels displayed through the sight openings *c*, correspond to the numbers on the actuating bars just back of the bordering edge of the opening *b* of the casing, the operator knows positively that the bars have been properly actuated. The means for accomplishing this consists in the provision of the thumb lever 68, and the pivoted bar 62, by pressing downwardly on the thumb-lever 68 the upper edge of the bar 62 is thrown upwardly against the under edges of the actuating bars *p*, and consequently said bars are raised the necessary distance to clear the teeth *s* of the bars from the teeth of the ratchet wheels *x*, on the forward movement of said bars, and consequently the position of the calculating wheels are not disturbed on said forward movement of the bars. While in the accompanying drawing I have shown the characters on the calculating wheels and on the type-wheels, and likewise on the actuating bars, 35 40 45 50 55

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as being numbers running from 0 to 9, yet it will be readily understood that these characters may be changed to suit characters used in other languages for designating numerals, or to suit currency designations used in any particular country.

5 While in the foregoing description I have only described the operation of addition, yet my invention is capable of performing other arithmetical problems.

While I have herein shown and described specific details of construction, yet I do not wish to be understood as restricting myself thereto, inasmuch as mechanical changes or variations thereof capable of performing the same function  
10 are deemed to be within the spirit and scope of my invention.

In Fig. 15 I illustrate a means for preventing over rotation by the carrying over mechanism. Without provision being made to prevent over-rotation in carrying over, the momentum given to a calculating wheel (the calculating wheel to the left of the wheel operated on by an operating bar) by the carrying over  
15 finger of the calculating wheel operated on by the bar, when this bar is moved too rapidly, is liable to cause over-rotation of the calculating wheel operated by the carrying over finger. With the means adopted by me, however, the machine is absolutely sure to carry over correctly.

The means I have adopted for obviating the above pointed out difficulty consists  
20 in the provision of a series of spring pawls 78 secured to and extending from a transverse beam 79, with their free ends in position to engage a series of projections 80 projecting from the periphery of each calculating wheel. By this construction, when the carrying over finger of a calculating wheel operates on an adjoining wheel it prevents the wheel from turning more than the one point it  
25 is intended to be carried. The spring pawl 78 by its resistance against the projections 80 overcomes the force of the momentum given by the carrying over finger, and thus makes the carrying over absolutely true.

The spring-pressed pawls 6 which engage the teeth of the ratchet wheels and thereby prevents the calculating wheels from moving backwards, also act in con-  
30 nection with the pawls 78 in order to hold the calculating wheels in perfect alinement. It is obvious that instead of the spring-pressed pawls 6, ordinary spring pawls may be employed for the purpose of preventing the calculating wheels from moving backwards and also for the purpose of acting in connection with the pawls 78 for holding the calculating wheels in perfect alinement. I  
35 have therefore shown such a pawl in Fig. 15, and have designated the same by the reference numeral 81.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

40 1. In a calculating machine, the combination, of a casing, a longitudinal bar within the casing, said bar provided with a series of teeth, means for actuating the bar, means for limiting the movement of the bar, calculating mechanism adapted to be actuated by the bar, a rotatable type-wheel, a gear-wheel adapted to rotate the type-wheel, said gear wheel engaged directly by the teeth of the  
45 bar, and adapted to be turned by the bar as said bar is actuated in order to bring different characters on the type-wheel to printing position, paper-carrying mechanism, and means for bringing the paper-carrying mechanism and the type-wheel into contact whereby the type on the type-wheel which has been brought to printing position is printed on the paper.

50 2. The combination, of a casing, a shaft, a type-wheel mounted thereon, a gear wheel mounted on the axis of said type-wheel, and rotatable with the type-wheel, a longitudinal bar provided with a series of teeth, said teeth adapted to engage directly with the teeth of the gear wheel, means for actuating the bar to bring different characters on the type-wheel to printing position, a paper-  
55 carrying cylinder, and means for bringing said paper-carrying cylinder into

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contact with the type on the type wheel which has been brought to printing position.

3. In a calculating and printing machine, the combination, of a casing, a longitudinal bar within the casing, said bar provided with a series of teeth, means for actuating the bar, means for limiting the movement of the bar, calculating mechanism adapted to be actuated by the bar, a shaft, a type-wheel, mounted thereon; a gear wheel mounted on the axis of said type-wheel and rotatable with the type-wheel, said gear wheel engaged directly by the teeth of the bar, and adapted to be turned by the bar as said bar is actuated, in order to bring different characters on the type-wheel to printing position, a paper-carrying cylinder, and means for bringing said paper-carrying cylinder into contact with the type on the type-wheel which has been brought to printing position.

4. In a calculating machine, the combination, of a casing having an opening therein, a series of longitudinal bars beneath the opening, the exposed edge of each bar having a series of characters thereon running in regular sequence, and each of said bars also provided with a series of teeth, means for actuating each bar, said means contacting with a bordering edge of the opening in the casing in order to limit the movement of each bar, calculating mechanism adapted to be actuated by the longitudinal bars on the movement of said bars in one direction, a series of levers, each lever adapted to engage the teeth of a bar in order to hold the bars which have been actuated to thereby display a number to be mathematically considered in the opening of the casing just back of the bordering edge of said opening, until the calculating mechanism is ready to be again operated for the next number to be mathematically considered, whereby as each bar is actuated to the extent permitted by contact of the actuating mechanism with a bordering edge of the opening in the casing, the several bars are held in position to display the proper characters for verification in said opening of the casing just back of the bordering edge of said opening, means for simultaneously turning the levers for the purpose of releasing them from engagement with the teeth of the bars, and means for acting on the bars to simultaneously return such bars as have been actuated to normal position, after the levers are so released from the bars.

5. The combination, of a casing, a longitudinal bar within the casing, said bar provided with a series of teeth, means for actuating the bar, said means adapted to be inserted through an opening in the casing in order to engage the bar, a stop which the actuating means contacts in order to limit the movement of the bar, mechanism adapted to be actuated by the longitudinal bar on the movement of said bar, a bell-crank lever engaging a tooth of the bar to hold said bar to adjusted position, mechanism carrying a dog, and means for causing a movement of the mechanism which carries the dog, whereby the dog is caused to turn the bell-crank lever, and thereby release said bell-crank lever from engagement with a tooth of the bar.

6. The combination, of a casing, a longitudinal bar within the casing, said bar provided with a series of teeth, means for actuating the bar, said means adapted to be inserted through an opening in the casing in order to engage the bar, a stop with which the actuating means contacts in order to limit the movement of the bar, mechanism adapted to be actuated by the longitudinal bar on the movement of said bar, a bell-crank lever engaging a tooth of the bar to hold said bar to adjusted position, a rocking bar provided with a projecting lug, mechanism carrying a dog, and means for causing a movement of said mechanism carrying the dog, whereby the dog is caused to act on the lug of the rock-bar to cause said bar to contact with the bell-crank lever and thereby turn said lever in order to release it from engagement with a tooth of the bar.

7. The combination, of a casing, a longitudinal bar within the casing, said bar provided with a series of teeth, means for actuating the bar, said means adapted to be inserted through an opening in the casing in order to engage the bar, a stop with which the actuating means contacts in order to limit the move-

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ment of the bar, mechanism adapted to be actuated by the longitudinal bar on the movement of said bar in one direction, a bell-crank lever engaging a tooth of the bar to hold said bar to adjusted position, a spring engaging the bell-crank lever to normally hold said lever in engagement with a tooth of the bar, mechanism carrying a dog, and means for causing a movement of said mechanism, whereby the dog carried thereby is caused to turn the bell-crank lever and thereby release said lever from engagement with a tooth of the bar.

8. In a calculating machine, the combination, of a casing having an opening therein, a series of longitudinal bars beneath the opening, the exposed edge of each bar having a series of characters thereon running in regular sequence, and each of said bars also provided with two series of teeth, means for actuating each bar, said means contacting with a bordering edge of the opening in the casing in order to limit the movement of the bar, calculating mechanisms, each provided with a ratchet wheel adapted to be engaged by one of the series of teeth of each bar, whereby the calculating mechanism is actuated, a series of bell-crank levers, each lever adapted to engage the other series of teeth of each bar, in order to hold the bar in the position to which it has been actuated, whereby as each bar is actuated to the extent permitted by the contact of the actuating-mechanism with a bordering edge of the opening, the several bars are held in position to display the proper characters through the opening in the casing and just back of a bordering edge of said opening, means for simultaneously releasing all of the bell-crank levers from engagement with the series of teeth of the bars and means for returning the bars which have been actuated to normal position, upon the release of the bell-crank levers.

9. The combination, of a casing, a series of longitudinal bars within the casing, said bars having a series of teeth, means for actuating the bars, said means adapted to be inserted through an opening in the casing in order to engage the bars, a stop with which the actuating means contacts in order to limit the movement of the bars, mechanisms adapted to be actuated by the longitudinal bars on the movement of any of said bars in one direction, bell-crank levers adapted to engage the teeth of the bars in order to hold said bars to adjusted position, a rock-bar arranged adjacent to the bell-crank levers, and means for turning said rock-bar to cause it to engage the bell-crank levers and thereby release said levers from engagement with the teeth of the actuating bars, in order to permit the return of said bars to normal position.

10. The combination, of a casing, a longitudinal bar within the casing, said bar provided with a series of teeth, means for actuating the bar, means for limiting the movement of the bar, a rotatable type-wheel, a gear wheel adapted to rotate the type-wheel, said gear wheel engaged by the teeth of the bar and adapted to be turned thereby, as said bar is actuated, in order to bring different characters on the type-wheel to printing position, an inking roll adapted normally to be held in position to contact with the type on the type-wheel, a paper-carrying cylinder, means for bringing said cylinder into contact with the type on the type-wheel which has been brought to printing position, means for throwing the inking roll out of the path of movement of the paper cylinder, when said paper cylinder is thus thrown into contact with the type-wheel, and means for returning said inking roll to normal position, as the paper cylinder is returned to normal position.

11. The combination, of a casing, a longitudinal bar within the casing, said bar provided with a series of teeth, means for actuating the bar, means for limiting the movement of the bar, a rotatable type-wheel, a gear wheel adapted to rotate the type-wheel, said gear-wheel engaged by the teeth of the bar and adapted to be turned thereby as said bar is actuated, in order to bring different characters on the type-wheel to printing position, pivoted levers, a paper-carrying cylinder journaled in said levers; arms extending from the levers, and having an inking roller journaled in their ends, said inking roller normally resting on the periphery of the type wheel, means for turning the levers so as to bring

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the paper-carrying cylinder into contact with the type on the type-wheel which has been brought to printing position, said turning of the levers also throwing the inking roll out of the path of the movement of the paper cylinder, and means for returning the paper-carrying cylinder and inking roll to normal position.

12. The combination, of a type-wheel, means for rotating said wheel to bring different characters thereof to printing position, links, levers pivotally connected to the links, a paper-carrying cylinder having its axis journaled in the levers, a ratchet wheel rotatable with the paper-carrying cylinder, a pawl pivoted to a fixed part and having its free end engaging the ratchet wheel, another pawl connected to one of the levers and having one end engaging the ratchet wheel, and means for actuating the links, whereby on one actuation thereof the paper-carrying cylinder is thrust to a position to contact with the type on the type-wheel which has been brought to printing position, and on the reverse actuation of said links the paper-carrying cylinder is returned to normal position.

13. The combination, of a type-wheel, means for rotating said wheel to bring different characters thereof to printing position, links, levers pivotally connected to the links, a paper-carrying cylinder having its axis journaled in the levers, a ratchet wheel rotatable with the paper-carrying cylinder, a spring-pressed pawl pivoted to a fixed part and having its free end engaging the ratchet wheel, another pawl pivoted medially to one of the levers and having one end engaging the ratchet wheel, a stop adapted to contact with and limit the movement of the depending arm of the last mentioned pawl in one direction, means for actuating the links in one direction, whereby the paper-carrying cylinder is thrown into a position to contact with the type on the type-wheel which has been brought to printing position, and a spring acting on the links to cause a reverse actuation, thereof, whereby the paper-carrying cylinder is returned to normal position.

14. The combination, of a casing, a longitudinal bar provided with a series of teeth, means for actuating the bar, mechanism operated by the bar, a bell-crank lever normally engaging a tooth of the bar to hold said bar in adjusted position, links, a dog carried by one of the links, mechanism between said dog and the bell-crank lever, a shaft having an operating handle on one end thereof, a connection between said shaft and the links, whereby on the operation of the handle the links are caused to move in one direction, and means for causing the movement of the links in the opposite direction, whereby the dog carried by the link is caused to contact with the mechanism which operates the bell-crank lever, thereby causing a disengagement of said bell-crank lever, and a release of the bar to adapt said bar to return to normal position.

15. The combination, of a casing, a longitudinal bar provided with a series of teeth, means for actuating the bar, mechanism operated by the bar, a bell-crank lever normally engaging a tooth of the bar to hold said bar in adjusted position, mechanism carrying a dog, a rock-bar provided with a depending lug, said rock-bar being in position to engage the bell-crank levers, means for causing a movement of the mechanism which carries the dog in one direction, and means for causing a movement of said mechanism in the opposite direction, whereby the dog carried thereby is caused to contact with the depending lug of the rock-bar, to turn said rock-bar in a direction to act on the bell-crank lever and thereby causing a disengagement of said bell-crank lever and a release of the longitudinal bar to adapt said longitudinal bar to return to normal position.

16. The combination, of a type-wheel, means for rotating said wheel to bring different characters thereon to printing position, a longitudinal bar provided with a series of teeth, means for actuating the bar, mechanism operated by the bar, a bell-crank lever normally engaging a tooth of the bar to hold said bar in adjusted position, mechanism carrying a dog, levers pivotally connected to said mechanism, a paper-carrying cylinder having its journals mounted in the levers, a rock-bar provided with a depending lug, said rock-bar being in position to engage the bell-crank lever, means for causing a movement of the mechanism

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which carries the dog in one direction, whereby the levers are rocked and the paper-carrying cylinder thrown into engagement with the character on the type wheel which has been brought to printing position, and means for causing a movement of the mechanism carrying the dog in the opposite direction, whereby  
5 said dog is caused to contact with the depending lug of the rock-bar and said rock-bar thereby swung in an opposite direction to act on the bell-crank lever and cause a disengagement of said bell-crank lever and a release of the longitudinal bar, to adapt said longitudinal bar to return to normal position.

17. The combination, of a casing, a longitudinal bar provided with a series of  
10 teeth, means for actuating the bar, mechanism operated by the bar, a bell-crank lever normally engaging a tooth of the bar to hold said bar in adjusted position, mechanism carrying a dog, a rock-bar provided with depending lugs, said bar being in position to engage the bell crank lever, an auxiliary dog pivoted to a  
15 fixed part, and in position to engage one of the depending lugs of the rock-bar on the return movement of the mechanism carrying the other dog, a spring acting against said auxiliary dog, a bell-crank lever engaging the auxiliary dog, said bell-crank lever adapted to be turned on its pivot and thereby release the auxiliary dog from engagement with the depending lug of the rock-bar, on the return  
20 movement of the mechanism which carries the other dog, means for causing a movement of the mechanism carrying the dog in one direction, and means for causing a movement of said mechanism in the opposite direction, whereby the dog carried by said mechanism is caused to contact with one of the depending lugs of the rock-bar, and the auxiliary dog also caused to engage said rock-bar by the action of the spring against said auxiliary dog, whereby the rock-bar is swung  
25 in a direction to act on the bell-crank lever, thereby causing a disengagement of said bell-crank lever and a release of the longitudinal bar, to adapt said longitudinal bar to be returned to normal position.

18. The combination, of a casing, a longitudinal bar provided with a series of teeth, means for actuating the bar calculating mechanism operated by the bar,  
30 a lever normally engaging a tooth of the bar to hold said bar in adjusted position, a pivoted bar beneath the longitudinal bar, means for turning said pivoted bar so as to act against the longitudinal bar and raise said bar in such position as to prevent said bar from acting on the calculating mechanism, a type-wheel, and a pinion adapted to rotate the type-wheel, said pinion being engaged by other  
35 teeth on the longitudinal bar.

19. The combination, of a casing having an opening in the top thereof, longitudinal bars within the casing, said bars provided with a series of teeth, means for actuating the bars, said means adapted to be inserted through the opening in the casing, a stop with which the actuating means contacts in order to limit  
40 the movement of a bar, mechanisms adapted to be actuated by the longitudinal bars on the movement of said bars in one direction, bell-crank levers engaging teeth of the bars to hold said bars to adjusted position, type-wheels a pinion adapted to rotate each type-wheel, said pinions engaged by other teeth on the longitudinal bars, a rock-bar in position to act on the bell-crank levers, and when  
45 turned in one direction to release said bell-crank levers from the teeth of the longitudinal bars, a link connected at one end to the rock-bar, a bell-crank lever connected to the opposite end of the link, and a push-rod adapted to act on the bell-crank lever.

20. The combination, of a shaft, a series of calculating wheels, a finger secured  
50 to each calculating wheel, a series of disks fast on the shaft, each disk provided with a projecting lug in position to engage the finger of the calculating wheel, another disk mounted fast on the shaft and provided with a notch in its periphery, a medially-pivoted lever having one end adapted normally to engage the notch of the disk, means acting on the lever to disengage the same from the notch,  
55 and means for turning the shaft.

21. The combination, of a shaft, a series of calculating wheels, a finger secured

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to each calculating wheel, a series of disks fast on the shaft, each disk provided with a projecting lug in position to engage the finger of the calculating wheel, another disk mounted fast on the shaft and provided with a notch in its periphery, and also a finger projecting outwardly from one side of the notch, a medially pivoted lever, a spring acting on the lever to cause one end thereof normally to engage the notch, means acting on the lever, to disengage the same from the notch against the action of the spring, and means for turning the shaft. 5

22. The combination, of a casing having an opening in its top, a series of longitudinal actuating bars beneath said opening and visible through the opening, means for operating the actuating bars, mechanism operated by the actuating bars and a series of divisional rods removably fitted to the opening in the casing, so as to divide said opening into a series of changeable divisions, each division having therein one or more of the actuating bars. 10

23. The combination, of a casing, a series of calculating wheels having characters thereon adapted to be displayed through the casing, and each calculating wheel provided peripherally with projecting teeth, means for rotating the calculating wheel, carrying over mechanism adapted, upon the complete revolution of one calculating wheel to cause the rotation of the next succeeding calculating wheel the distance of one number and pawls for each calculating wheel, each pawl having its free end in position to be engaged by the teeth of a calculating wheel. 15 20

24. The combination, of a casing, a shaft mounted therein, a series of calculating wheels mounted on the shaft, and having characters thereon adapted to be displayed through the casing, and each calculating wheel provided peripherally with projecting teeth, ratchet wheels mounted upon the shaft of the calculating wheels, one ratchet wheel being provided for each calculating wheel, means engaging the ratchet wheels for the purpose of rotating the same and consequently the calculating wheels, pawls for each calculating wheel, each pawl having its free end in position to be engaged by the teeth of a calculating wheel, and pawls for each ratchet wheel, and adapted to prevent backward rotation of said ratchet wheels, and both sets of pawls adapted to hold the calculating wheels in perfect alinement. 25 30

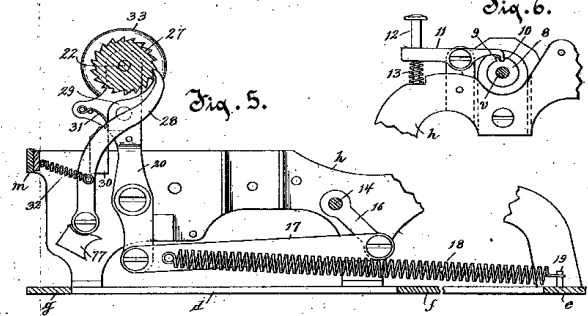
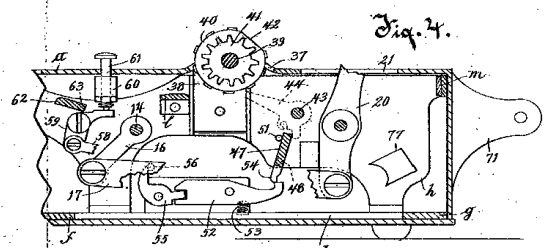
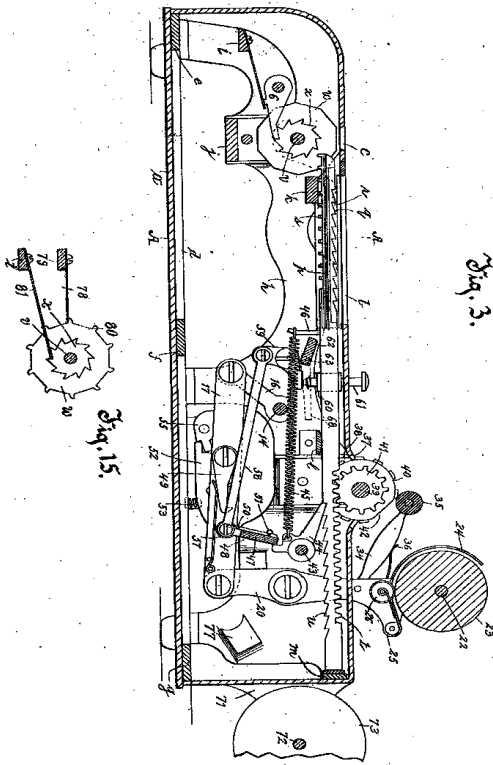
Dated this 20th day of March 1900.

HERBERT HADDAN & Co.,  
Agents to Applicant,  
18, Buckingham Street, Strand, London, W.C.

35



SHEET 3.



[This Drawing is a reproduction of the Original on a reduced scale.]

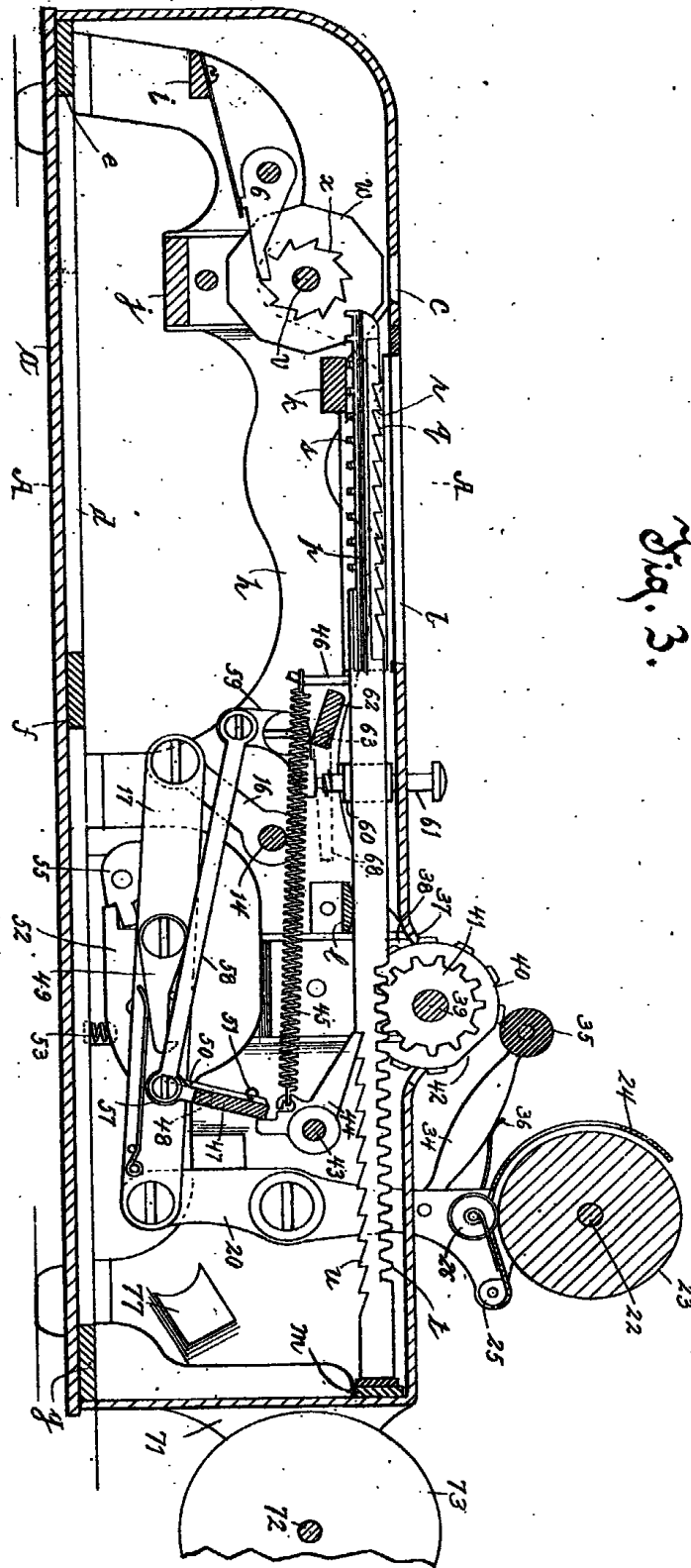


Fig. 3.

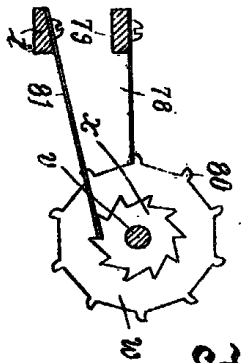


Fig. 15.

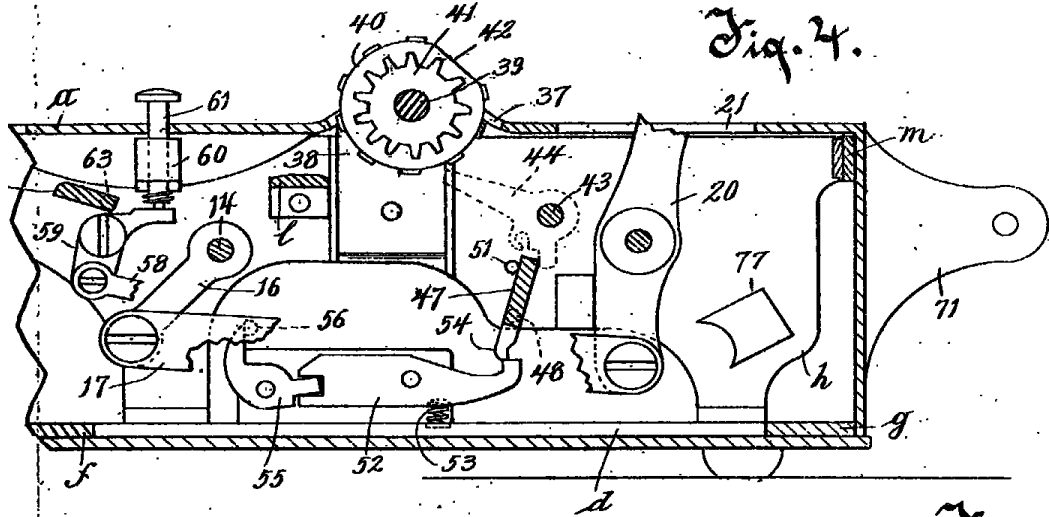


Fig. 4.

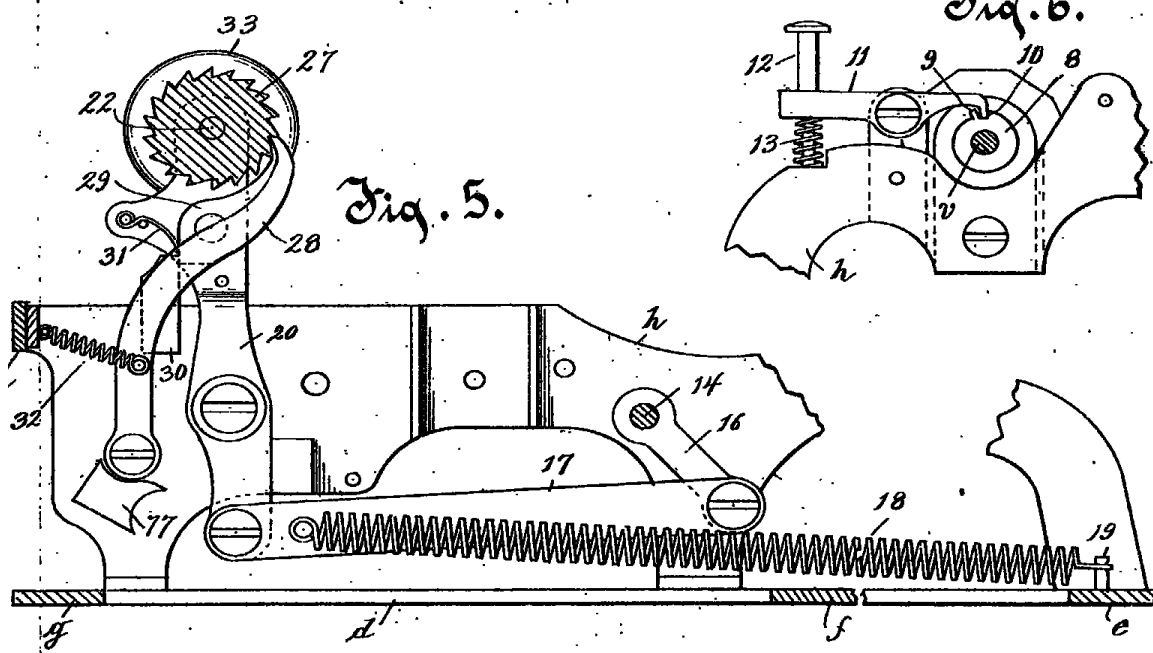


Fig. 5.

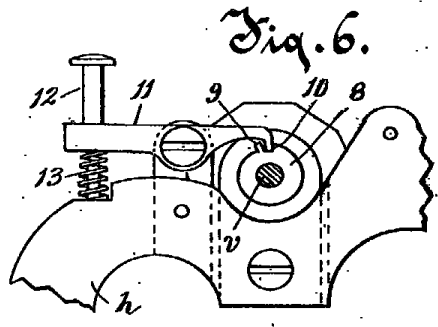


Fig. 6.

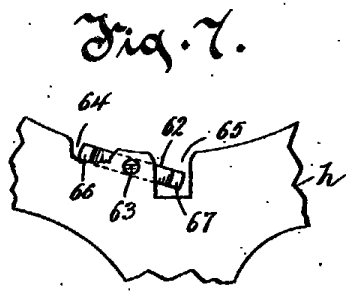
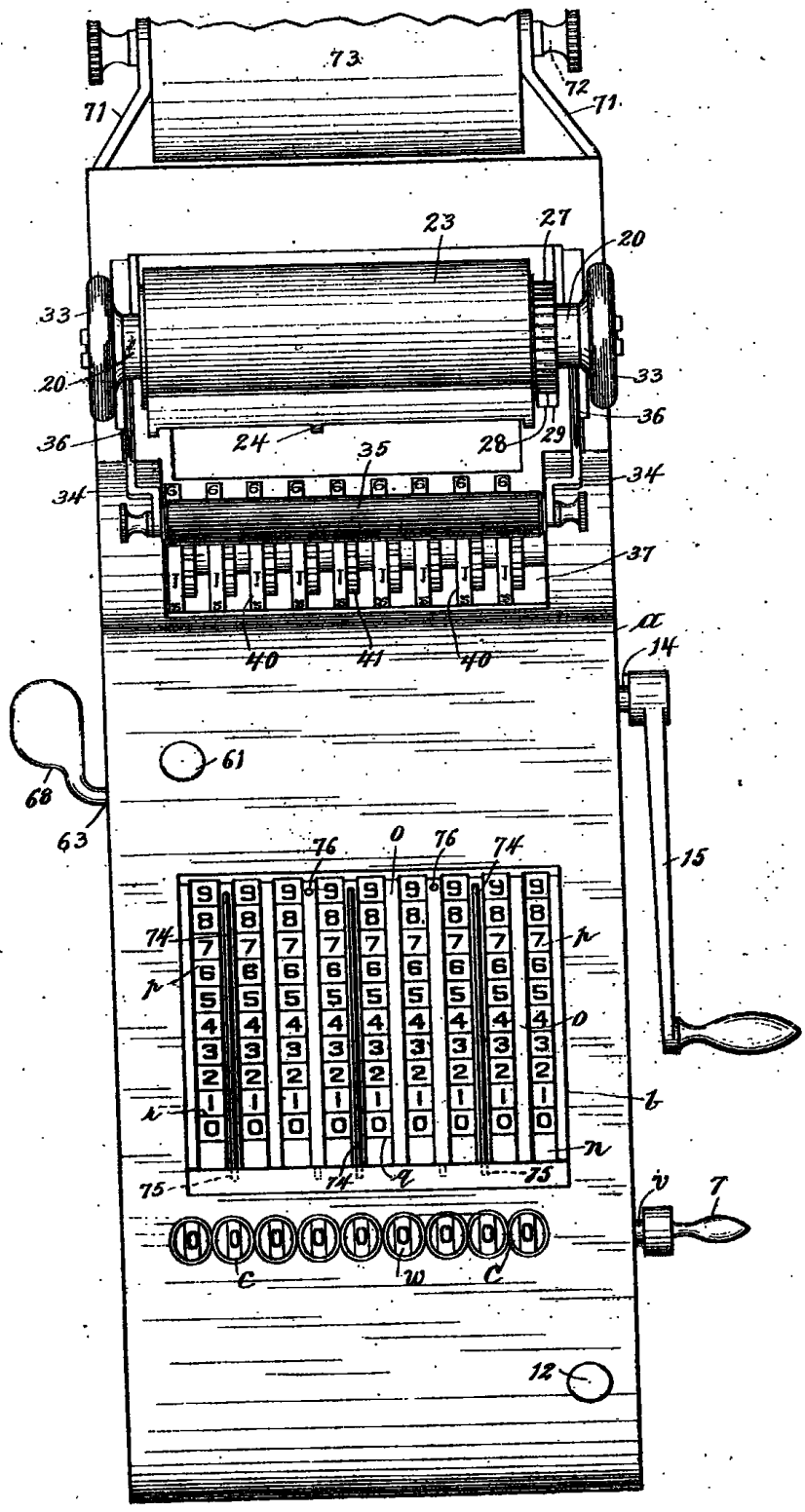


Fig. 7.

[This Drawing is a reproduction of the Original on a reduced scale.]



Fig. 1.



[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 2.

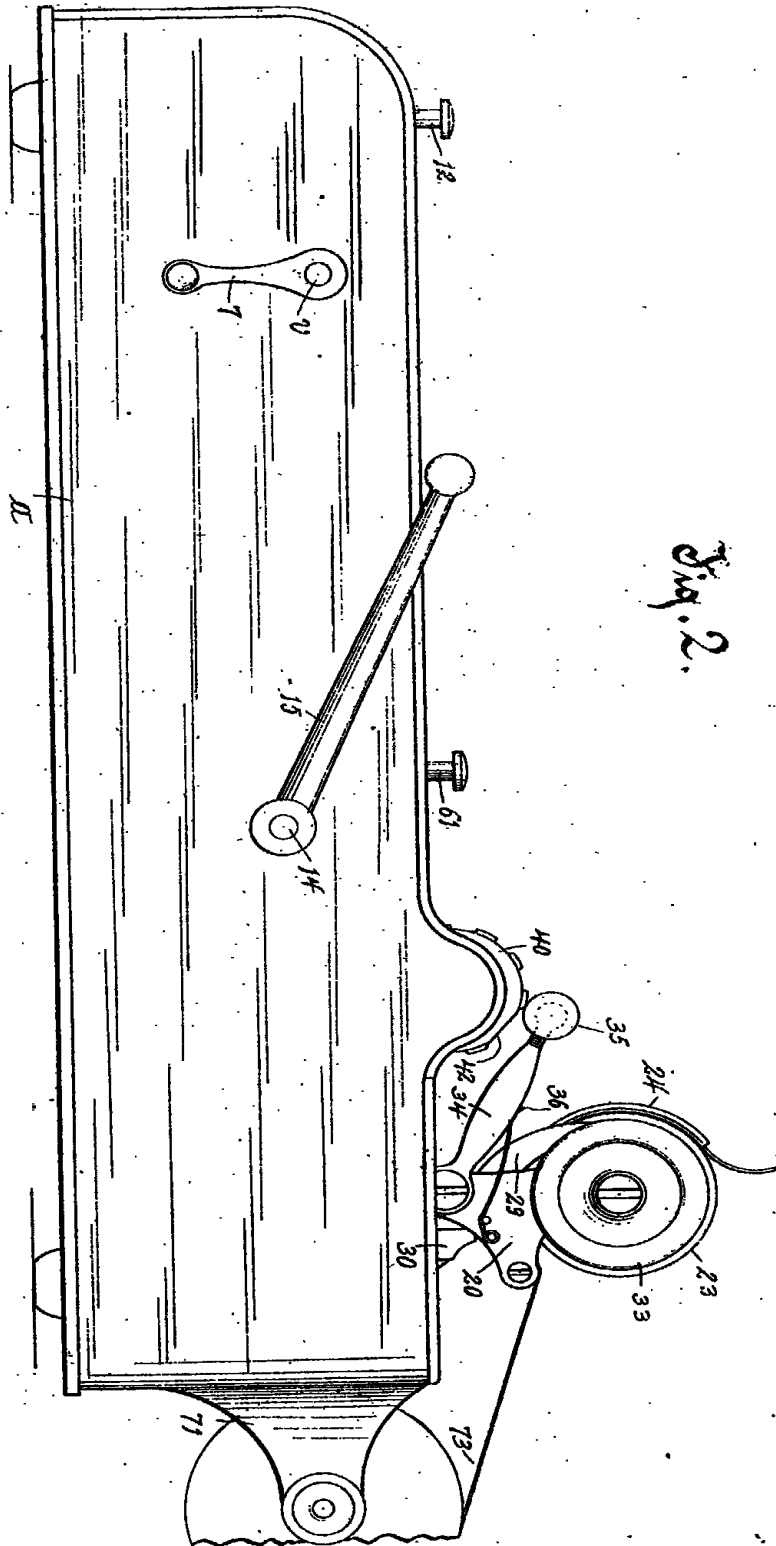


Fig. 14.



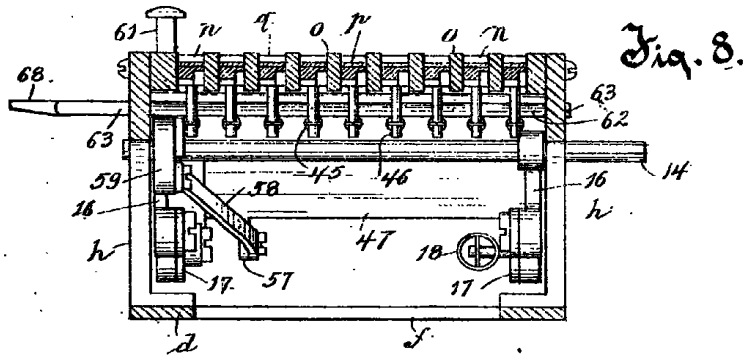


Fig. 8.

Fig. 9.

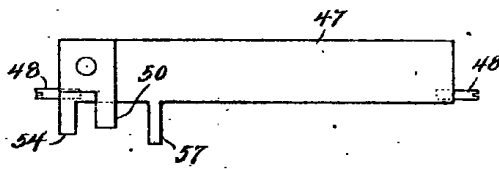


Fig. 10.

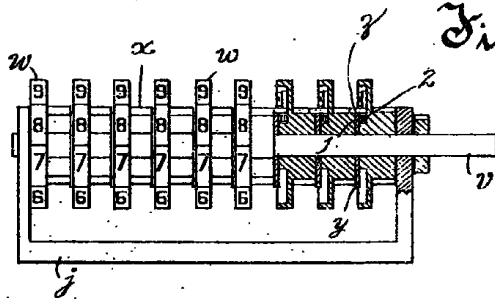


Fig. 11.

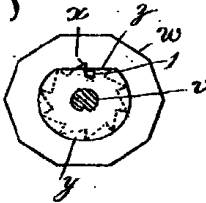


Fig. 12.

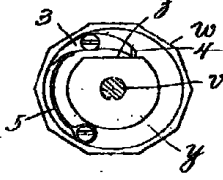
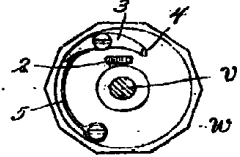


Fig. 13.



[This Drawing is a reproduction of the Original on a reduced scale.]

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