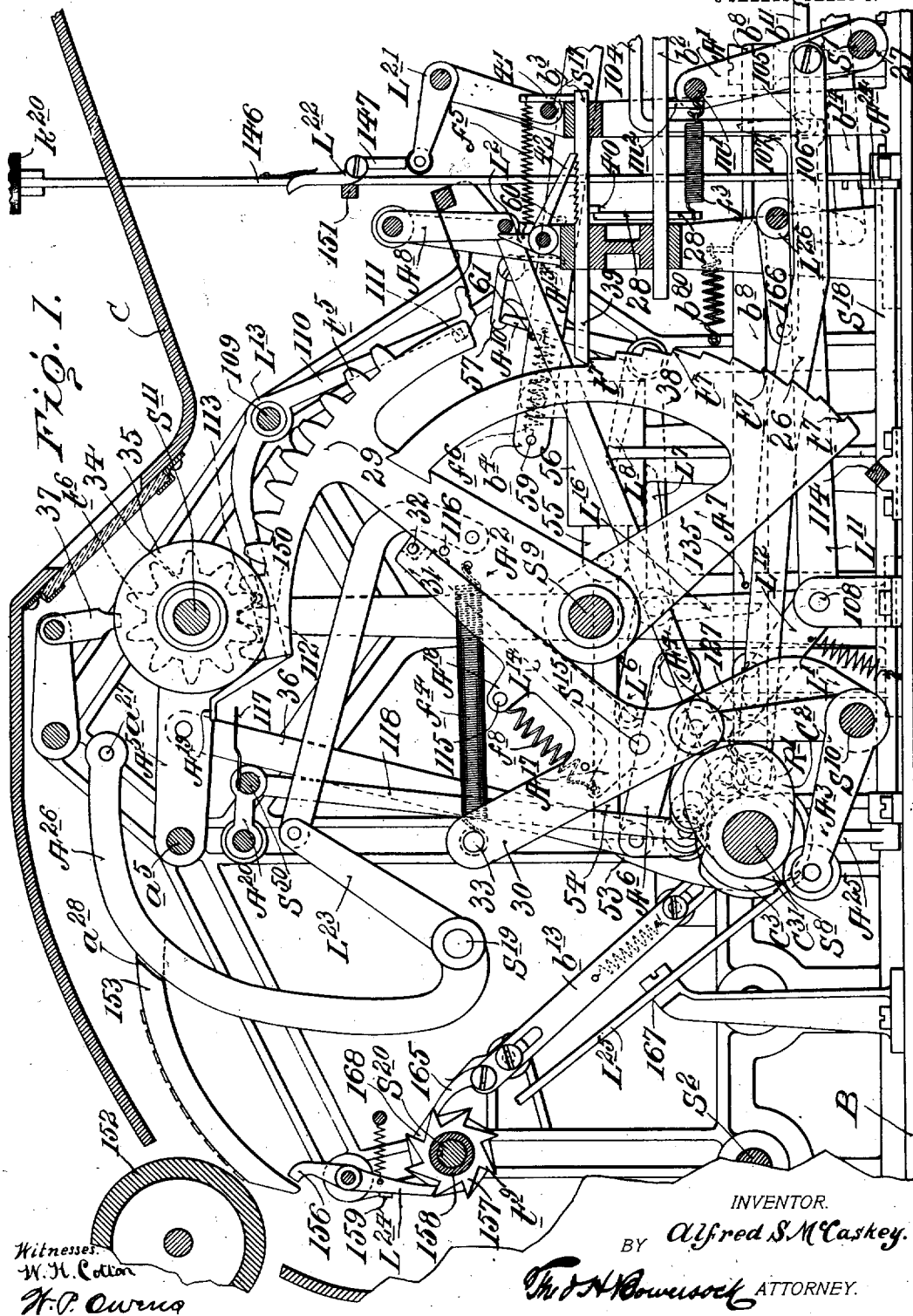


1,018,510.

8 SHEETS—SHEET 1.



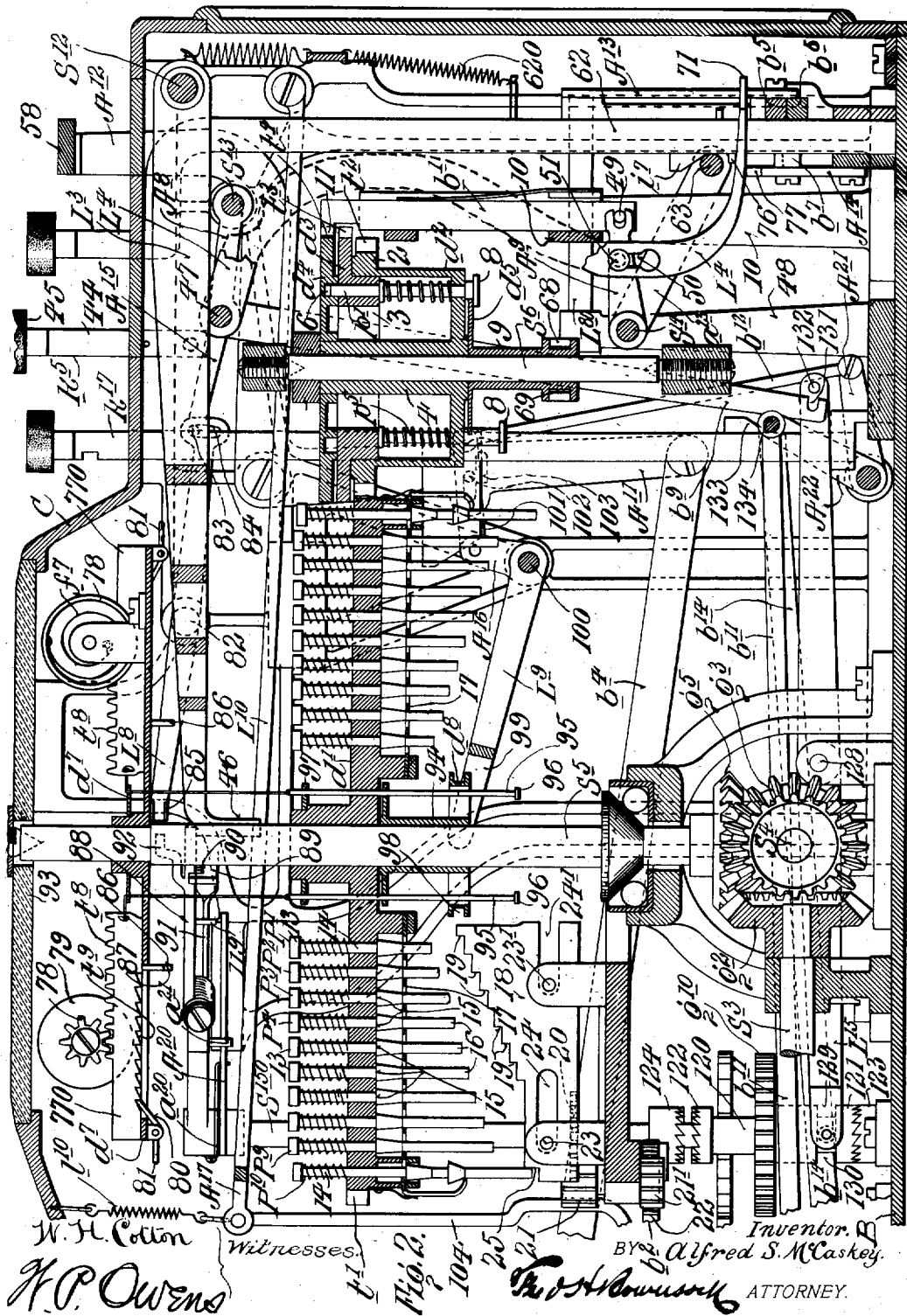
A. S. McCASKEY.
CALCULATING MACHINE.

APPLICATION FILED MAY 19, 1903.

Patented Feb. 27, 1912.

8 SHEETS—SHEET 2.

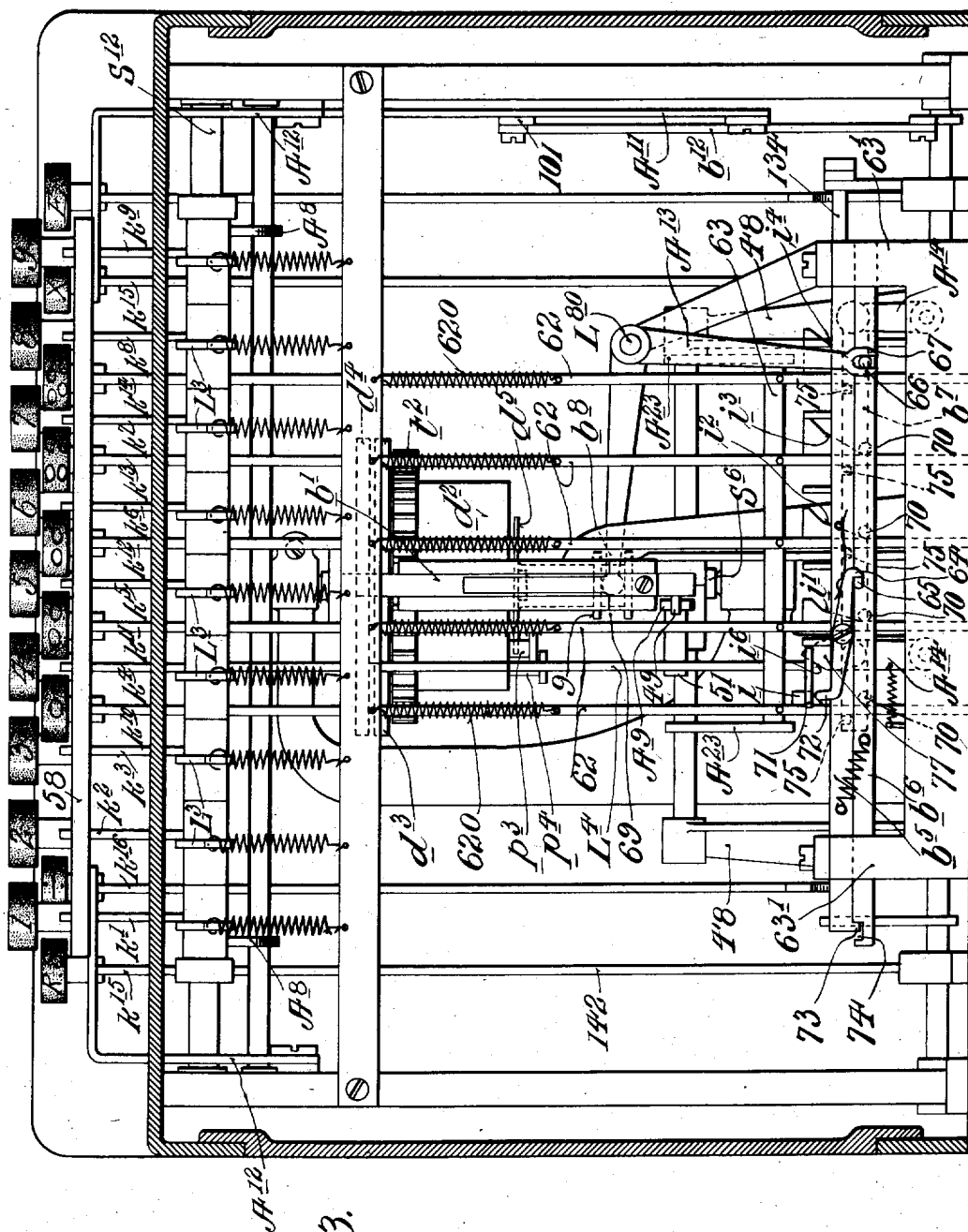
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Patented Feb. 27, 1912.

8 SHEETS—SHEET 3.



W. H. Cotton
H. P. Owens

Fig. 3.

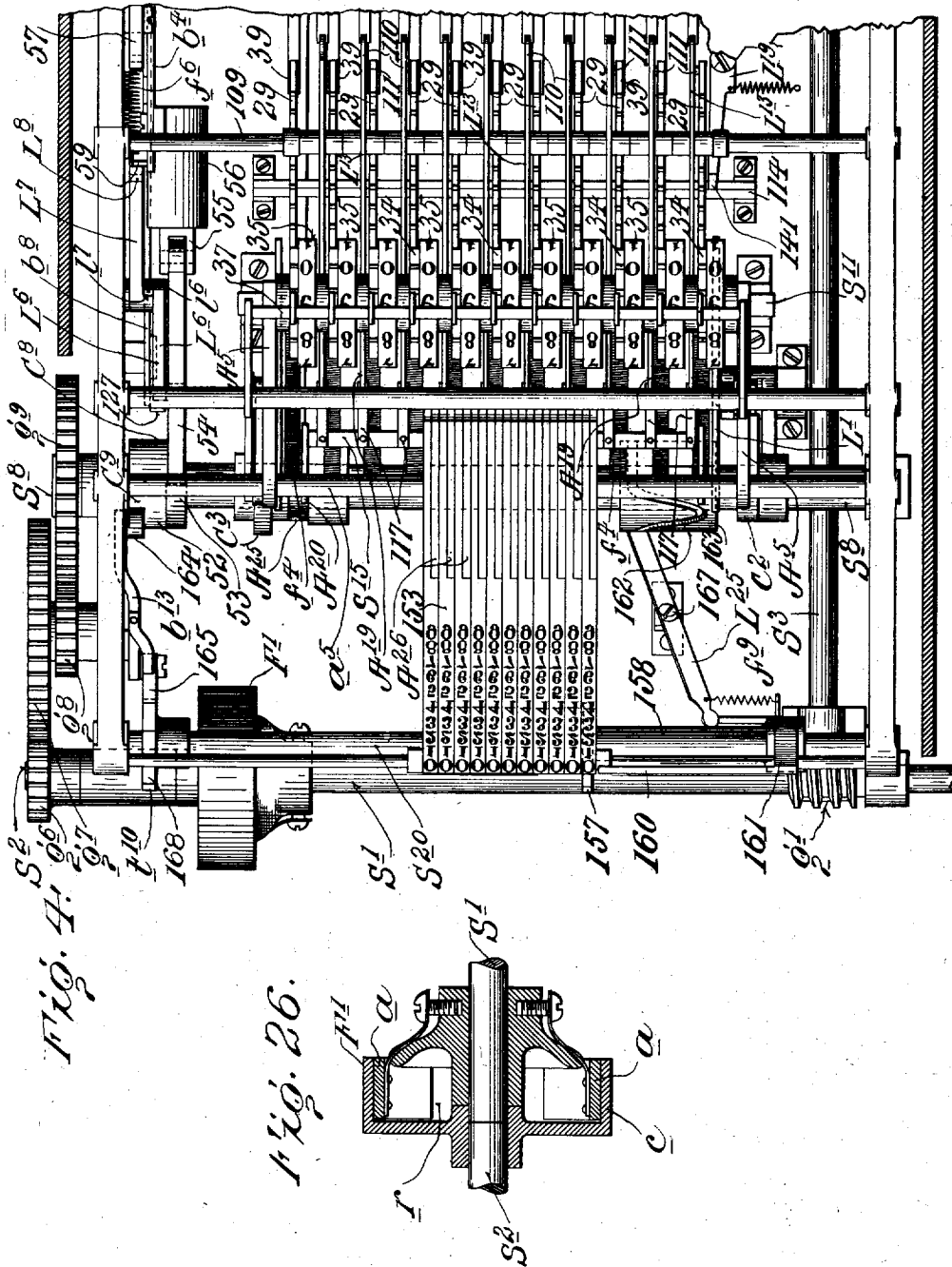
BY *Alfred S. Macaskey.*

BY *Truett Bowersox* ATTORNEY.

1,018,510.

Patented Feb. 27, 1912.

8 SHEETS—SHEET 4.



WITNESSES:
 W. H. Cotton
 W. P. Owens

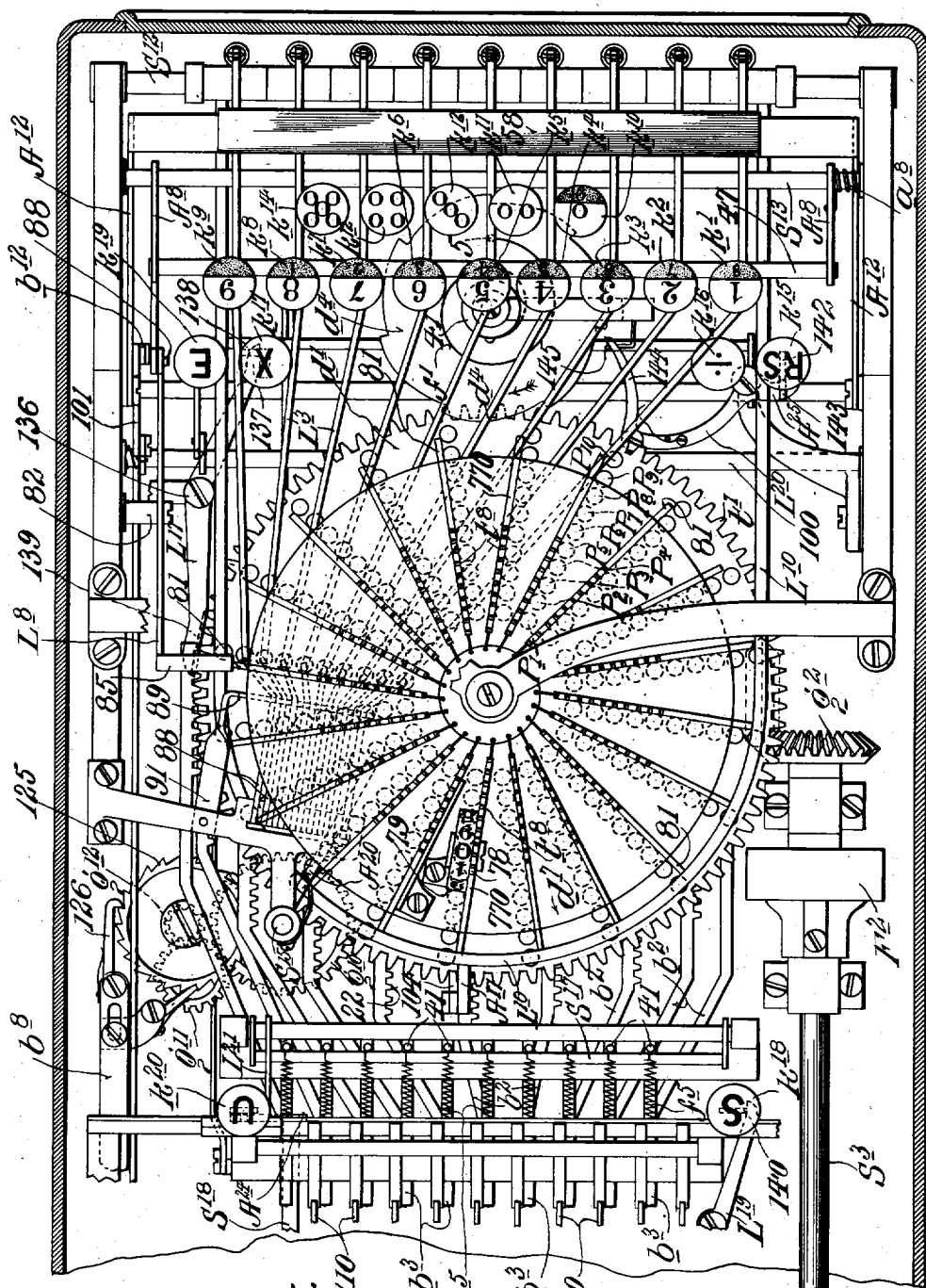
INVENTOR.
 BY Alfred S. McCaskey.
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A. S. McCASKEY.
 CALCULATING MACHINE.
 APPLICATION FILED MAY 19, 1903.

1,018,510.

Patented Feb. 27, 1912.

8 SHEETS—SHEET 5.



WITNESSES:
 W. H. Cotton
 W. P. Owens

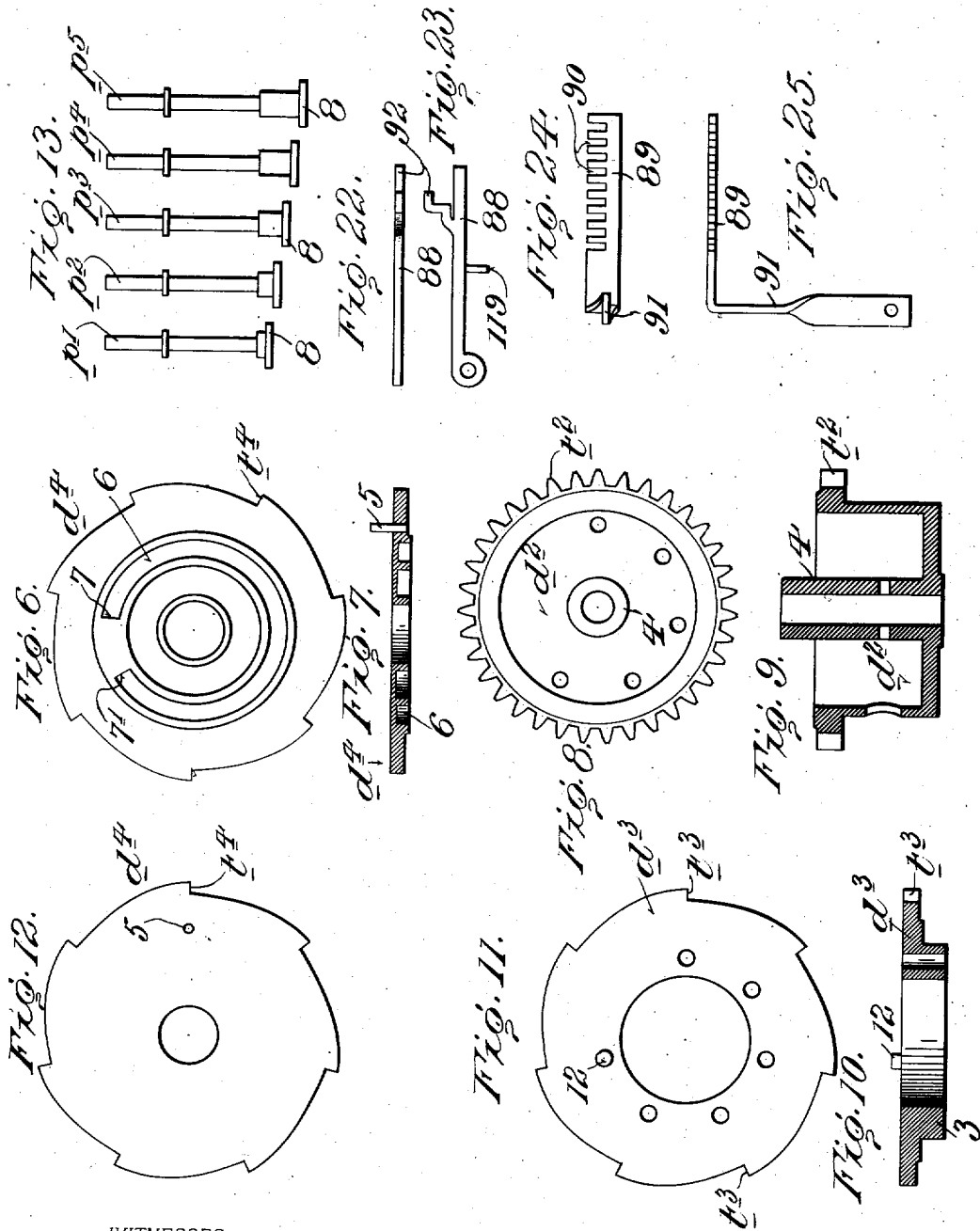
FIG. 5.

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1,018,510.

Patented Feb. 27, 1912.

8 SHEETS—SHEET 6.



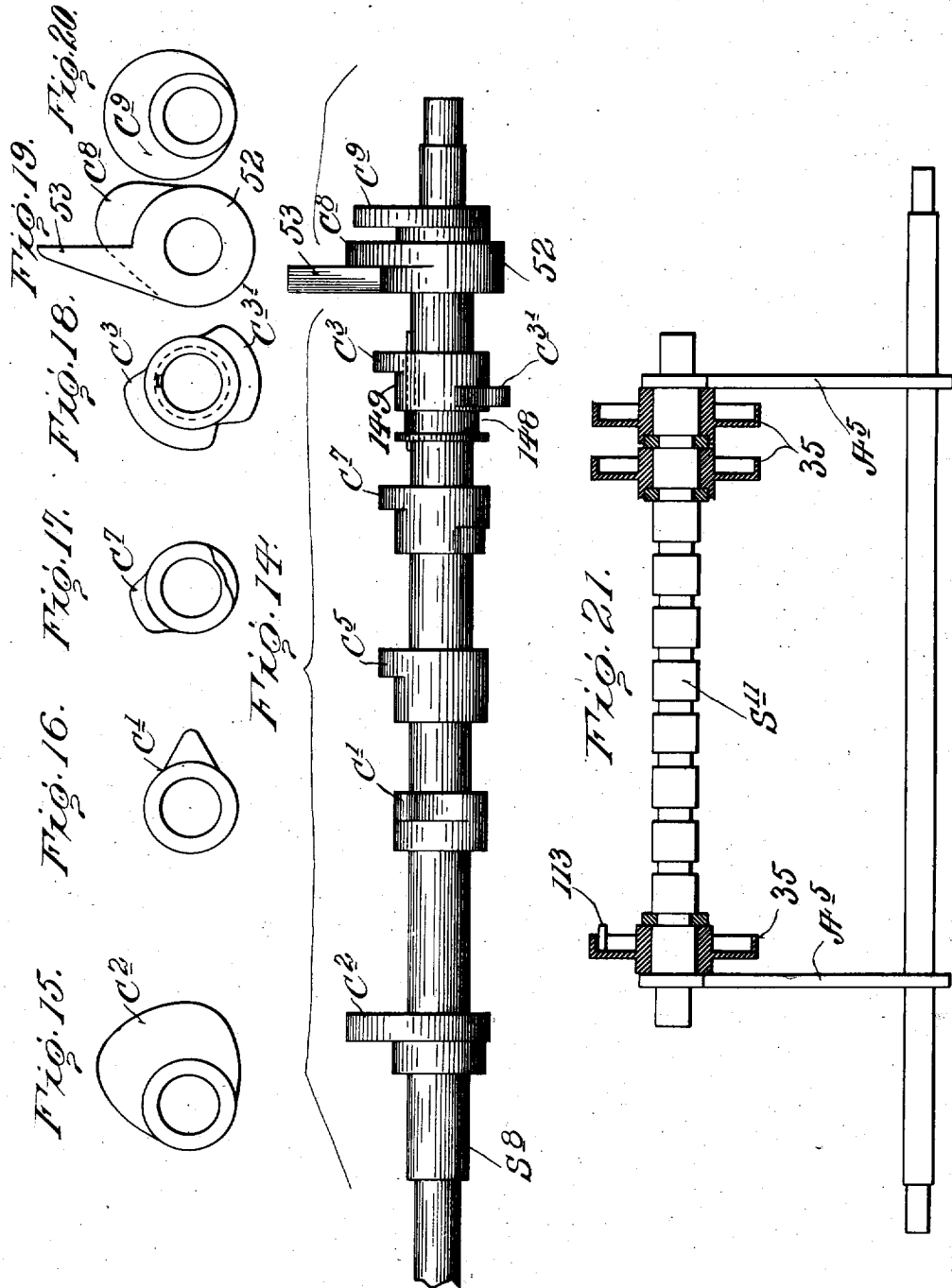
WITNESSES:

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1,018,510.

Patented Feb. 27, 1912.

8 SHEETS—SHEET 8.

Fig. 27.

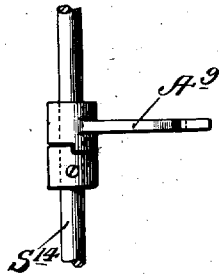


Fig. 28.

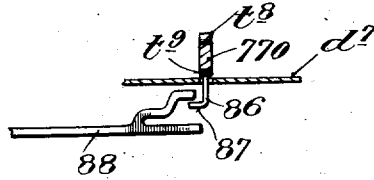


Fig. 29.

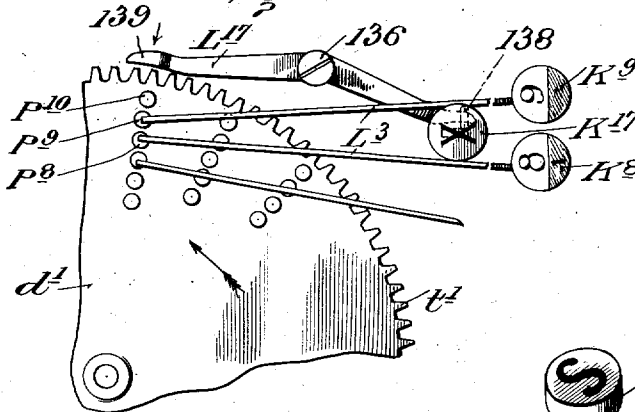


Fig. 31.

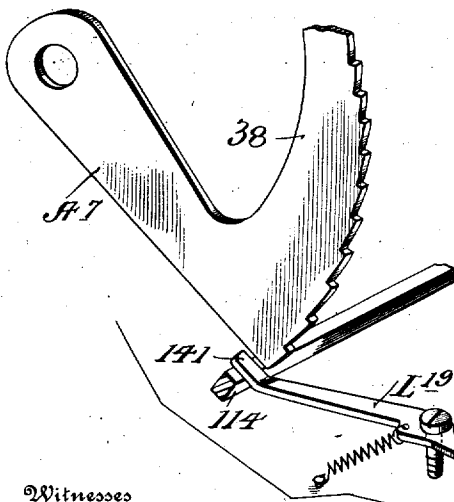
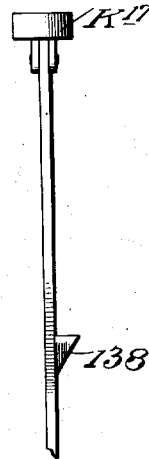
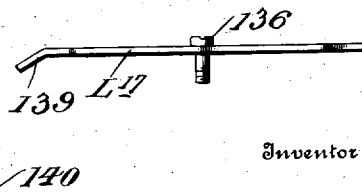


Fig. 30.



Inventor

Witnesses

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 Frederick A. Holton.

Fig. 32.

Alfred S. McCaskey.
 Moore, Cameron & Lewis, Attorneys.

UNITED STATES PATENT OFFICE.

ALFRED S. McCASKEY, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO McCASKEY ELECTRIC CALCULATOR COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

CALCULATING-MACHINE.

1,018,510.

Specification of Letters Patent.

Patented Feb. 27, 1912.

Application filed May 19, 1903. Serial No. 157,769.

To all whom it may concern:

Be it known that I, ALFRED S. McCASKEY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Calculating-Machines, of which the following is a specification.

This invention relates to calculating or computing machines, and has for its general object the construction of a device of this class of a much wider range of usefulness than those best known in the art today, coupled with the greatest possible simplicity of operation and a maximum of speed.

I have in view a machine requiring a minimum of manual labor in operation,—except for a slight depression of the proper keys, the operating power being supplied from a substantially constant source, such as a motor or engine directly connected therewith or indirectly through suitable power-transmitting means.

Devices for carrying out mechanically ordinary processes of mathematical calculations must depend, obviously, upon as nearly as possible perfect control of distances of motion. Taking it for granted that a conveniently located series of figure wheels provides the best means for indicating results, it will be at once apparent that the problem which presents greatest difficulties in the construction of a calculating machine is not so much the means which may be employed to rotate said wheels, as the means for abruptly, positively and accurately stopping each thereof at a predetermined point in its rotation. Where working parts are positively operated from the source of power—particularly in machines in which the energy generated by a motor or engine is employed to do the work—and series of temporary stops provided to check this positive movement at various predetermined points, it is obvious that the wear and tear upon the machine as a whole and the delicate parts thereof will be great, and the door left open for inaccuracies for which inertia and the sudden application of counteracting forces are responsible. I prefer to determine and limit distances of motion, so far as possible, by varying the starting point and not the stopping point of the moving parts which do

the work, not least among the advantages of which is the fact that heavier and more damaging impacts are received upon permanent stops. Furthermore, I am enabled in this manner to effect a gain in speed and accuracy and to enter upon new fields of practical utility, as will hereinafter appear.

Underlying my invention is the controlling idea of a plurality or series of reciprocating elements, normally checked against movement, and operating means which, first, positively and accurately determine the arcs or distances of reciprocation; secondly, impart yielding impulses simultaneously to said checked elements; thirdly, release one or more of said elements, which, under said yielding impulses, are free to move through the predetermined arcs or distances of reciprocation, and, fourthly, return said elements to their normal or retracted positions under positive applications of power to do the required work.

In the following specification I shall, for the sake of brevity, use the expression "set up" or "setting up" as referring to the operation of determining values by limiting distances through which parts or elements will subsequently move, as accomplished in the usual manner by the depression of keys. Similarly, I shall use the word "transmitting" as referring to the operation of moving these parts or elements to indicate results.

I have in view a machine in which the mechanism intermediate of the keys and the indicating figure wheels or printing mechanisms provides for proper transmission of a number which has been set up in such a manner as not to interfere with the immediate setting up of the next succeeding number or combination of figures, whereby no time need be lost in waiting for the machine to complete the calculating or computing, indicating and printing operations.

I have in view, further, what is generally termed a "nine-key" machine, dispensing with the series of rows or columns of digit keys, the employment of which necessarily increases the mental effort required to successfully operate a machine of this class and places an unavoidable limitation upon speed. I have in view, therefore, a machine in the operation of which no attention need be paid to the relative locations of

digit keys, or effort made to locate figures in particular columns or spaces. In other words, the figure last set up by the depression of a key invariably occupies the position farthest to the right, whereby, if the number contains more than one figure, the setting up of one automatically removes or transfers the other or others one space or column to the left, so that the successive depression of the proper digit key in a single series thereof automatically places each figure in its proper digital position.

I have in view, further, a machine in which the powerful and positive cam movement is employed wherever possible to provide the working force and to insure accurate timing of the various movements.

I have in view, further, the employment of yielding means for power transmission in setting the parts for subsequent work, whereby the parts or elements to be moved may be held or checked against movement, either in their normal positions or at other points in their paths of movement, yet subject to a constant tendency to move. A positive force being applied to return these parts to their normal positions, and the actual work being done upon the return and not upon the primary stroke or movement, I am thus able to avail myself of a number of what I may term storehouses of energy to set stops and otherwise limit distances of motion of the various working parts, with resultant economy of energy and simplification of construction.

I have in view, further, such an arrangement, adjustment and combination of parts as will enable me to take advantage of numerous mathematical laws to increase the range of usefulness of my machine. For example, it is well known that the process of multiplication is merely a method of facilitating a series of repeated additions. My invention, therefore, contemplates mechanisms which will, when it is desired, automatically repeat the process of addition a predetermined number of times, and that with exceeding rapidity, whereby a problem in multiplication may be rapidly and accurately solved. It is also well known that the remainder obtained from the subtraction of one number from another is made up of a combination of figures identically the same as is obtained by adding to the minuend the complement of the subtrahend, with the exception of the fact that as a result of the latter process the digit "1" is carried into, or added to the digit already occupying the column or space to the left of that occupied by the first figure in the complement of the subtrahend. I take advantage of this law to enable me to carry out expeditiously, by the use of my machine, any ordinary problem in subtraction. The

process of division may be termed the simplification of a series of repeated subtractions, which fact enables me to employ my machine to great advantage in calculations involving problems in division.

With the above and other general objects in view, my invention consists in the novel means employed for separating or segregating those parts of my machine which determine and control the values of the amounts or numbers to be employed in the calculations, from the computing, result-indicating and printing means, whereby their operations are sufficiently independent that the operator may proceed to set up the next succeeding number or amount while the machine is transmitting to the indicating and printing means the number just previously set up.

My invention further consists in the novel means for setting up a number or originally imparting values to the machine.

My invention further consists in novel means for transmitting or transferring these values to the computing mechanisms and to the indicating and printing means.

My invention further consists in an endless or continuous series of rows of normally inoperative stops, movably supported and adapted to be automatically advanced as one stop in each row is rendered operative, and otherwise at will, to limit distances of movement of reciprocating parts.

My invention further consists in means for controlling in various ways the movement of this stop-support.

My invention further consists in novel means for automatically and otherwise erasing values or numbers which have been set up, and in erasing means which do not interfere with the transmitting mechanism, whereby another number may be immediately set up for subsequent transmission without waiting for the completion of the previous transmitting operation.

My invention further consists in a series of figure wheels with novel means for operating and controlling the same, and in the means for "carrying" the digit "1" to each succeeding wheel to the left as the "0" upon each wheel passes a predetermined point, and in novel means for simultaneously returning all of said wheels to zero.

My invention further consists in novel means for verifying the operation of the original value-determining means.

My invention further consists in each of a plurality of auxiliary keys, having separate, distinct and novel functions, and in the novel means employed for carrying out these functions.

My invention further consists in the various novel means for applying power to the moving parts, and in the means for storing

energy whereby parts may be given a constant tendency to move while checked against movement, and will move immediately upon release of the checking or retaining means.

My invention further consists in a single shaft, having a constant tendency to rotate and normally checked against rotation, for supplying the power to the various working parts of my machine, and in the means for releasing said shaft for one or a predetermined number of rotations, and in a series of cams thereon, and in each one thereof, of suitable configuration and suitably located to impart the proper motion at the proper time to the parts in operative proximity thereto.

My invention further consists in a novel escapement mechanism, and in the various means for controlling said mechanism, the step-by-step movement thereof, and the number of steps through which moved at one operation.

My invention further consists in the automatic printing and listing mechanism, and in the novel manner of operating and controlling said mechanism. And my invention further consists in the various details of construction, and in the location, adjustment, relationship and combinations of parts, all as hereinafter described and particularly pointed out in the claims.

My invention will be more readily understood by reference to the accompanying drawings, forming a part of this specification, in which is illustrated a practical and convenient embodiment of my invention, and in which—

Figure 1 is a partly sectional side elevation of the computing, indicating and printing mechanisms, occupying the space of substantially the rear half of the casing, and being a continuation of Fig. 2, which is a similar view of the value-determining mechanisms, occupying the front or remaining portion of the casing. Fig. 3 is a front elevation, the plate or plates of the casing having been removed. Fig. 4 is a top plan view of that portion of the machine shown in Fig. 1. Fig. 5 is a top plan view of that portion shown in Fig. 2. Figs. 6, 7, 8, 9, 10, 11, 12 and 13 are detailed views of parts of the escapement mechanism, hereinafter described. Fig. 14 is a plan of the cam shaft, showing the relative location thereon of each of the cams, detailed views of which appear in Figs. 15, 16, 17, 18, 19 and 20. Fig. 21 is a partly sectional elevation of the series of figure wheels and support therefor. Figs. 22, 23, 24 and 25 are details, subsequently described. Fig. 26 is a central section of the preferred form of friction clutch, hereinafter identified and described, and Figs. 27, 28, 29, 30, 31 and 32, are de-

tail views hereinafter referred to and described.

Referring now to the drawings in detail, I prefer to mount my machine upon a suitable base-board B, all the operating mechanisms being preferably inclosed within a permanent casing C, of suitable configuration, made up of a plurality of sections detachably connected and adjusted to facilitate access to the working parts when desired.

Journalled in bearings in suitable supports mounted upon the base-board B, is the main power shaft S¹, designed to be connected in any suitable manner to a motor or other source of power (these connections not being shown in the drawings). A friction clutch F¹ (shown in detail in Fig. 26), or other suitable form of clutch, divides this shaft into two members, the major portion or member S¹ thereof rotating constantly while the machine is in use, while the portion or member S² thereof has constantly, under operation of said clutch, a tendency to rotate, although normally held against rotation in a manner and for a purpose which will be hereinafter set forth. This friction clutch F¹ may be of any preferred construction which will accomplish the purpose desired, the one shown in the drawings comprising the usual cup member c rigidly attached to the shaft S², the shaft S¹ being provided with a head carrying the spring-pressed shoes a a slidable against the inner face of the rim r of the cup. The shaft S² being held against rotation, it is obvious that the frictional contact between said shoes and rim, upon rotation of said shaft S¹, may be made to provide the necessary energy to rotate the shaft S² upon release of the checking means, said shoes sliding against the inner face of the rim when the shaft S² is held against rotation. To insure alinement, I have shown (Fig. 26) the shaft S¹ extending a slight distance into the collar at the extremity of the shaft S² which forms a part of the cup c.

The shaft S¹ is provided with a worm in operative relation to the worm-gear g¹ Fig. 4 at the extremity of a shaft S³, which is similarly journalled in bearings in supports upon the base-board B. The other extremity of the shaft S³ is provided with a bevel-gear g², (Figs. 2 and 5) meshing with a similar bevel-gear g³ at the extremity of the shaft S⁴, which is provided with a similar gear at its other extremity (not shown in the drawings) meshing with the bevel-gear g⁵ at the lower extremity of the vertical shaft S⁵. The shaft S³ is similarly divided by the friction clutch F², (or other suitable form of clutch,) which, in construction and function, is preferably identical in all respects to the clutch F¹, whereby the

major portion of the shaft S^5 , rotating constantly at a relatively reduced rate of speed under action of the power shaft S^1 , will rotate the shaft S^5 when the latter is free to rotate and provide a constant source of energy to keep said shaft S^5 at all times under a positive tendency to rotate when checked or held against rotation.

Rigidly mounted upon the vertical shaft S^5 is the circular disk d^1 , which I have shown provided with preferably one hundred peripheral teeth t^1 . A vertical shaft S^6 , freely rotatable in supports suitably carried by the frame of the machine, has fixed thereon the cupped disk or barrel d^2 , said barrel being provided with a flange or rim 2 which I have shown provided with preferably thirty-five peripheral teeth t^2 meshing with the teeth t^1 of the disk d^1 . As a preferred construction, a ring d^3 , provided with seven equidistant, peripheral ratchet teeth t^3 , has a cupped portion or flange 3 adapted to be wedged into or otherwise suitably attached to the barrel d^2 . Loosely mounted upon the bearing sleeve 4 of the barrel d^2 , to rotate independently of said barrel and shaft, is the disk d^4 , provided with a similar number of similarly disposed ratchet teeth t^4 . A collar 4' secured to said shaft S^6 limits the movement of said disk d^4 to that of rotation only, while a coil spring f^1 (shown in Fig. 5 but not shown in Fig. 2) suitably secured at one extremity to said collar 4' and at the other extremity to a pin 5 on the face of the disk d^4 , provides a constant force tending to rotate said disk. The disk d^4 is provided on its under side (as shown in Figs. 6 and 7) with an annular groove or channel 6, extending substantially six-sevenths of the distance around said disk, the extremities 7 and 7' of which provide stops for a purpose subsequently made clear.

Extending through apertures in both the barrel d^2 and the ring d^3 , vertically disposed and mounted for limited longitudinal sliding movement through said apertures, are the spring-pressed pins p^1 , p^2 , p^3 , p^4 and p^5 , the upper end of each normally projecting slightly into the groove or channel 6. These pins constitute a series of graduated lengths, and are provided with similar shoulder-heads 8 8 which project below the lower face of the barrel d^2 through regularly varying distances. A sleeve 9 is mounted for longitudinal sliding movement only upon the shaft S^6 and carries a disk d^5 , adapted upon depression of said sleeve 9 to engage successively each of the shoulder-heads 8 8 of said pins to overcome the force of the spring which normally retains each pin in its raised position and withdraw the same from the groove 6. The vertical movement of this sleeve 9 and disk d^5 is controlled in a manner which will

be hereinafter set forth to withdraw one, two, three, four or all of said pins, as may be desired, depending, obviously, upon the distance through which the disk d^5 is depressed.

A vertical bar b^1 Fig. 2 (not shown in Fig. 5) is mounted in slide bearings upon a suitable support or bracket 10, and is capable of a limited vertical, reciprocating movement. This bar b^1 is provided with a laterally-projecting detent 11, engaging, when in its normal position, a tooth t^4 of the disk d^4 , and adapted to similarly engage, when depressed, a tooth t^3 of the ring d^3 and thereby clear the path of the teeth t^4 of the disk d^4 . It will be remembered that the disk d^1 is constantly under application of a force tending to rotate said disk, which force is transmitted through the meshing teeth to the barrel d^2 and the ring d^3 carried thereby. It will also be remembered that the disk d^4 , mounted for independent rotation, is under a constant spring pressure, rotation thereof being normally checked by the detent 11. A pin 12 on the upper face or side of the ring d^3 , registering with the groove 6 in the under side of the disk d^4 and at all times projecting thereinto, is adapted to engage the stop 7 provided by one extremity of said groove, and thereby check rotation of said barrel d^2 under the force provided through the disk d^1 . As the bar b^1 is depressed, the detent 11 enters the path of one of the teeth t^3 of the ring d^3 prior to releasing a tooth t^4 of the disk d^4 . Upon complete release of the latter, it is rotated in the direction indicated by the arrow Fig. 5, by the spring f^1 . Under normal conditions, this rotation of the disk d^4 will be stopped by the engagement of the projecting extremity of the pin p^1 with the extremity 7' of the groove 6, whereupon, the bar b^1 being released and returning under spring pressure to its normally raised position and releasing the barrel d^2 immediately after engagement is effected with a tooth of the disk d^4 , said barrel d^2 will be free to rotate until stopped by the reengagement of the pin 12 with the extremity 7 of the groove 6. Normally, and except under conditions hereinafter described, this escapement mechanism provides for a simple, step-by-step rotative movement of the disk d^1 upon reciprocation of the bar b^1 . Having provided thirty-five teeth on the barrel d^2 , meshing with one hundred teeth on the disk d^1 , and seven equidistant ratchet teeth on each of the rings d^3 and the disk d^4 , effecting an escapement through an arc corresponding to five teeth on each of the disks d^2 and d^4 , one complete rotation of the disk d^1 will require twenty steps. The barrel d^2 and the disk d^4 operating alternately, in the same direction, the former being fixed upon the shaft S^6 , as is the collar 4', it is

obvious that the coil spring f^1 , operating therebetween, will provide a constant source of energy to rotate the disk d^1 .

The disk d^1 is provided with twenty equidistant, radial rows of apertures, Figs. 2 and 5 each row containing ten apertures. Within these apertures are mounted, for limited vertical reciprocating movement, an endless or continuous series of rows of spring-pressed pins P^1 P^2 P^3 , etc. Each of these pins P^1 to P^9 in each row comprises a head 13, a cylindrical shank or body 14 slidable within the aperture in which it is mounted, a shoulder 15 to limit its upward movement under action of the spring, and a stem 16 the length of which is gradually increased for each pin as the periphery of the disk is approached. Underneath each row of pins I provide an apertured slide or plate 17, each mounted for a limited longitudinal sliding movement in downwardly-projecting supports upon said disk. The apertures in each side correspond in location and number to those in the disk above, but are of greater diameter or larger size to permit of the passage therethrough of the shoulder 15. Each slide is normally spring pressed toward the center of the disk, and each pin is provided with a bevel or taper from the shoulder 15 to the stem, whereby, upon depression of any one of the pins in the row above this bevel or taper will force the slide longitudinally against the action of its spring until the shoulder 15 is reached, whereupon said slide will be returned toward the center, engaging said shoulder and checking the pin in its depressed position.

A series of preferably ten vertically-disposed plates 18 are radially arranged about the shaft S^5 at intervals corresponding to the distances between the rows of pins in the disk d^1 , and each having a limited, horizontal, reciprocating movement between suitable fixed supports. Each plate 18 is provided with a series of steps 19, nine in number, and is normally held in a retracted position in a manner which will be hereinafter described. A pin in a certain row thereof in the disk d^1 being depressed, forward movement of said plate 18 corresponding to said row will effect engagement between the stem of the pin depressed and its corresponding step 19 on said plate 18 to stop movement of the latter. Each of said plates 18 carries a rack 20 (shown in dotted lines in Fig. 2) suitably attached to one side thereof, the teeth of which mesh with the teeth of a pinion 21 fixed upon the upper extremity of a short stud-shaft to the other extremity of which is fixed a similar pinion 21', rotated by a rack 22 at the extremity of the reciprocating bar b^2 mounted in slide bearings in the frame of the machine. These bars b^2 are bent as shown to bring their extremities into conveniently parallel prox-

imity. It will be noticed that the racks 20 and 22 are located upon opposite sides of the pinions, whereby movement of the bar b^2 in one direction will move the plate 18 in an opposite direction. Each of said plates 18 is permanently held against movement toward the shaft S^5 by pins 23 and 23' which engage the ends of the slots 24 and 24', respectively, in each plate. Movement of said plate in the opposite direction is temporarily checked by means of a pin P^{10} , similarly mounted in the tenth or last aperture in each row thereof in the disk d^1 . This pin P^{10} is similarly spring-pressed to a raised position, but is normally held in its depressed position—and therefore in engagement with the shoulder 25 of the plate 18—by the plate or slide 17, which is provided with a similar aperture through which a similar shoulder upon said pin P^{10} may pass and be thereby retained in a depressed position. It will be apparent that depression of any one of the remaining nine pins P^1 to P^9 in a certain row, operating, as stated, through the beveled or tapered shoulder to force said slide longitudinally against the action of its spring, will release the pin P^{10} , which is immediately raised by its spring to an elevated and inoperative position, at the same time permitting of the return to normal of said slide 17 to engage the shoulder of the pin P^1 to P^9 depressed. It will be noted that the plate 18 is now free to move from its normal position until stopped by the engagement of the extremity of the particular pin P^1 to P^9 depressed with its corresponding step or stop 19 on said plate.

Each of the reciprocating bars b^2 , of which there are ten in the series, effects the movement of a corresponding plate 18, as described, and is operated in one direction by means of a spring f^3 in tension between a pin 28 secured in and extending through an aperture in each of said bars b^2 and the rod or bar m^1 carried between the extremities of the pair of rocker arms A^1 fixed upon the rock-shaft S^7 . This rock-shaft is operated by means of a crank 27 pivoted to the connecting-rod or pitman 26 spring pressed against the cam C^1 on the cam-shaft S^8 , the extremity of said pitman being preferably provided with a roller R^1 against which the cam C^1 operates. One rotation of the cam-shaft S^8 will therefore effect at the proper time one reciprocation of the arms A^1 , distending all of the springs f^3 simultaneously and exerting a yielding force against all of the bars b^2 tending to move the whole series thereof longitudinally. As has been described, none of these bars b^2 is free to move until the plate 18 corresponding thereto has been released by the withdrawal of the pin P^{10} from its path. Consequently, unless one of the pins P^1 to P^9 in this row

has been depressed to release the pin P^{10} , the plate 18 is withheld against movement and there is no corresponding movement of the bar b^2 under the yielding force of the spring.

- 5 If one of the pins P^1 to P^9 has been depressed, however, releasing the plate 18 and providing a stop to limit its movement, said bar b^2 will be free to move under the tension of said spring f^2 when said rocker arms A^1 are operated, and will move through a distance equal to the distance through which the plate 18 travels, determined by the particular pin P^1 to P^9 depressed.

- Rotatably mounted upon the rigid shaft 15 S^9 , suitably carried by the frame of the machine, is a series of ten rock arms A^2 , each carrying an eleven-tooth sector 29. A rock-shaft S^{10} is suitably journaled in bearings in the frame of the machine, and rigidly 20 mounted thereupon is a pair of levers L^1 , each of which is divided at its upper extremity into the branches 30 and 31. A rod 32 connects the extremities of the branches 31, and is adapted to impinge against any 25 or all of said sector arms A^2 to return said sectors 29, or such thereof as have been moved, to their normally retracted positions. The other branches 30 of said lever L^1 are connected by a rod 33, providing a support 30 for a series of tension springs f^4 , the other end of each of said springs being suitably attached to a sector arm A^2 . It will be apparent that when said levers L^1 are rocked or reciprocated, that branches 30 and 31 35 thereof operating in unison, the rod 32 will be withdrawn from contact with all of said sector arms A^2 and advanced to a point beyond the maximum distance of movement of said sectors 29, the branches 30 of said lever 40 operating through the rod 33 to simultaneously distend all of said springs f^4 to impart a yielding force against each of said sector arms A^2 , tending to move each individually from its normal position. Such 45 of said arms A^2 as are free to move will therefore advance under the spring tension, while such thereof as are checked against movement will remain in their normal positions. To oscillate said lever L^1 in the manner and for the purpose described, I have 50 shown a cam C^2 mounted upon the cam-shaft S^8 , adapted to operate, when said shaft is rotated, upon rollers at the extremities of the pair of arms A^3 and A^4 fixed upon the 55 shaft S^{10} . The cam C^2 is preferably of the configuration shown to insure contact therewith at all times by both rollers, the arms A^3 and A^4 being oppositely disposed with reference thereto, whereby movement is 60 positively controlled in both directions.

- The teeth t^5 of each sector 29 mesh with the teeth t^6 of one of a series of ten-toothed pinions 34, each rigidly secured to and controlling the rotative movement of a figure 65 wheel 35, provided with the usual peripheral

characters, equidistantly disposed, indicating the digits from "1" to "0." Each figure wheel with its corresponding pinion is freely and independently rotatable on a shaft S^{11} rigidly supported between the extremities of a pair of rock arms A^5 suitably 70 pivoted at their other extremities on a bar a^5 (Figs. 1 and 4) connecting the sides of the frame of the machine. The entire series of figure wheels and pinions is therefore 75 capable of a limited, vertical, reciprocating movement, controlled by the rod or pitman 36 pivoted at one end to one of said arms A^5 and the other end being provided with a suitable roller against which operates the 80 cam C^3 on the shaft S^8 . A rock arm A^6 , pivoted near the power-receiving extremity of said pitman 36 and to a suitable support on the frame of the machine, retains the 85 lower end of said pitman constantly in operative relation to said cam. It will be apparent that upon rotation of said shaft S^8 , the cam C^3 will operate to raise and lower the entire series of figure wheels and pinions 90 out of and into engagement with the teeth of the sectors 29. In order that there may be no rotary motion of said wheels except as controlled by said sectors, I have shown an adjustable detent 37 mounted above each 95 pinion and adapted to engage the teeth thereof as said wheels are raised free of the teeth of the sector, to hold or lock the same against movement until released by the return of said shaft S^{11} to normal position. 100 The position of the cam C^3 upon the shaft S^8 is so adjusted that the shaft S^{11} is raised and the teeth of the pinions disengaged from the teeth of the sectors 29 just prior to the operation of the cam C^2 to distend the 105 springs f^4 to move the released sectors from their normal positions. If one or more of the arms A^2 are free to move, and under the tension of the springs do move, the corresponding sectors 29 will be advanced or carried certain distances, limited and controlled 110 as hereinafter described. The series of pinions 34 having been just previously raised free of the teeth of the sectors, this movement of the released sectors will have no effect upon the figure wheels. Prior to 115 the return of the sectors to their normal positions, however, said pinions are returned into engagement with the teeth of said sectors (preferably by gravity). It will be apparent, therefore, that as each arm 120 and sector is returned to its normal position, rotation of the corresponding pinions will be effected and consequently the rotation of corresponding figure wheels through a distance or arc determined by the distance of 125 movement of said sectors.

I have shown rigidly secured to each sector arm A^2 a laterally extending arm A^7 , carrying at its extremity a sector 38, the end of which is preferably dovetailed in or 130

otherwise secured to the arm A^2 . Each of these sectors is provided with a series of ten ratchet teeth t' , successive teeth being disposed at gradually increasing distances from the axis of shaft S^9 , whereby any one of said teeth may be engaged by an adjustable stop or detent 39, said detent being free or clear of the teeth t' in advance of the one engaged.

10 A series of bars b^3 , the extremities of which provide the detents 39, are mounted in slide bearings in suitable supports and capable of a limited longitudinal movement therethrough. Each bar b^3 is provided on
15 its lower face with a pin 40, located and adjusted for engagement with the pin 28 extending through the bar b^2 when the detent 39 is in engagement with the first tooth t' of its cooperating sector 38, or when the
20 sector 29 is in its normal position. I have explained the manner of operating the reciprocating bar b^2 , and limiting the distance through which it moves by the plate 18 and the particular pin P^1 to P^9 depressed.
25 Movement of the bar b^2 will thus, through the pins 28 and 40, effect the movement of the corresponding detent-bar b^3 through an equal distance, and against the action of a
30 spring f^6 in tension between the pin 41 on said bar b^3 and the short lever L^2 pivotally mounted upon the frame of the machine. It will be apparent that the spring f^6 and the lever L^2 also serve to press the pawl 42
35 against the rack or ratchet 43, the teeth of which are spaced to retain the detent 39 at the proper distance from the sector 38 to engage a particular tooth thereupon. Thus, upon movement of the bar b^2 through a certain distance, the bar b^3 will be moved in
40 the same direction through an equal distance against the action of the spring f^6 , the bar b^2 being free to return to its normal position upon oscillation in a reverse direction of the rock arms A^2 , the bar b^3 ,
45 however, being held or checked in the position to which it has been moved by the engagement of the pawl 42 with the proper tooth of the ratchet 43. In this manner the bar b^3 is withdrawn from engagement with
50 the first tooth of the sector 38 to the proper distance to check movement of said sector 38, and consequently of the corresponding sector 29, at a point determined by the particular pin P^1 to P^9 which has
55 been depressed in a corresponding row thereof in the disk d^1 . Upon rotation of the shaft S^8 , one or more sectors having been released and being free to move under action of the springs f^4 , will advance until
60 stopped by the engagement of the detent 39 with the particular tooth t' on the spiral sector 38 which corresponds with the row of pins in the disk d^1 in which a pin has been depressed. It will be remembered that
65 during this movement of the sectors the

figure wheels and pinions have been raised to an inoperative position, and when each of the sectors has reached its individual limit of movement, and said pinions dropped into engagement with the teeth thereof, said sectors are then positively returned to their original positions, as described, thereby effecting rotation of each corresponding figure wheel through a predetermined arc.

75 The inventive idea embodied in the mechanisms just described and their functions is one of the most important of those which together form my complete invention. The detent-bars b^3 , positions of which determine the various distances of movement of corresponding sectors, are independent of the bars b^2 the instant the pawls 42 engage the proper teeth in the series of ratchets 43, whereupon the bars b^2 which have been moved may be immediately returned without waiting for the sectors to complete, or even commence, their reciprocations. Such return of bars b^2 and consequent return of
80 plates 18 to their normal positions (shown in Fig. 2) is effected by the spring pressure which, as before explained, holds the end of pitman 26 against its cam C^1 , moving said pitman to the left, Fig. 1, rocking the arms
85 A^1 , and causing bar m^1 carried thereby to engage pins m^2 (Fig. 1) of all bars b^2 that have been moved and thus return said bars to their normal positions.

My machine is provided with nine digit keys k^1 to k^9 , of the common or usual pattern, identified in the usual manner by the proper symbols, and each comprising a longitudinally reciprocating stem 44 projecting through the casing and capped by a suitable striking head or button conveniently located for operation. These keys are spring-pressed to a normally raised position, the stem of each having a pivotal connection (shown in dotted lines Fig. 2) with a corresponding horizontal lever L^3 .
100 Levers L^3 are each provided at one end with a hammer 46, and at their other ends are fulcrumed upon a shaft S^{12} suitably fixed in the frame of the machine. These levers L^3 are shaped and adjusted, as shown in Fig. 5, to bring the series or row of hammers 46 into operative juxtaposition with one of the rows of pins P^1 to P^9 in the disk
105 d^1 . The disk d^1 being stationary for operation, the depression of any one of the digit keys k^1 to k^9 will cause its corresponding hammer 46 to strike and depress a corresponding pin in that particular row thereof which is for the time being under said hammers. As hereinbefore described, each pin is temporarily retained in its depressed position, and it is desired to advance the row in which it is located one step to bring the next succeeding row under the hammers, and ready for the depression in a similar man-
110 115 120 125 130

ner of any one of the pins in said last-mentioned row. Advancement of the disk d^1 one step upon the release of a digit key is accomplished, through the escapement mechanism hereinbefore described, by providing for the depression of the bar b^1 simultaneously with the depression of any one of said digit keys. For this purpose, I have shown a pair of rock arms A^8 , pivoted upon the shaft S^{13} , and connected at their extremities by a rod 47 against which all of said digit-key levers L^3 impinge. The arms A^8 and rod 47 are normally spring-pressed in any suitable manner as by spring a^8 Fig. 5—to their raised positions. A rock arm A^9 is mounted on a shaft S^{14} , journaled in bearings in a pair of supports or brackets 48, said arm and shaft being provided with counteracting shoulders (see Fig. 27)—a common and well-known construction—whereby said arm may be rocked by said shaft or independently thereof. The arm A^9 is provided with a forked extremity, engaging a pin 49 near the lower end of said bar b^1 . Carried by the rod 47 is the lever L^4 , of substantially S-shape (part of which is shown in dotted lines in Fig. 2) to avoid intermediate parts and to provide for the application of power at proper points. This lever L^4 is provided with a slot 50 (the function of which will be hereinafter made clear) the upper end of which engages a pin 51 upon the rock arm A^9 to effect downward movement of said arm with the downward movement of said lever. Upon depression of any one of the digit keys, therefore, the lever L^3 operated thereby will depress the rod 47 therewith and operate the lever L^4 , depressing the arm A^9 and therewith the bar b^1 , operating the escapement mechanism hereinbefore described and permitting of the advancement or rotation of the disk d^1 through one step. This operation may be repeated until for a number, of say five figures, said disk has been advanced five steps, each row of pins operated upon having one pin thereof in a depressed position adapted to be engaged by its corresponding plate 18 when the latter is advanced by rotation of the cam shaft S^8 .

The cam shaft S^8 is operated from the shaft S^2 by means of a chain of gears g^6 , g^7 , g^8 and g^9 . It will be remembered that the shaft S^2 is subject at all times to a force tending to rotate the same, and does so rotate and therewith the shaft S^8 except when said shaft S^8 is held or checked against rotation. Projecting from a collar 52 fixed upon the shaft S^8 is the stop-arm 53 normally impinging against the extremity of the rod 54 pivoted to drop into the path thereof. This rod 54 is preferably pivoted to the buffer 55 of a dash-pot 56, of common and usual construction and function. When it is desired to rotate the shaft S^8 ,

it is only necessary to momentarily raise the end of the pivoted rod 54 clear of the path of the stop 53 on said shaft, whereupon said shaft will rotate under the described application of power until again checked by reengagement between said stop and rod. To effect this release, I have shown a pivoted lever L^6 the free extremity of which impinges against the lower face or edge of the rod 54. This lever is adapted to be raised by depression of a lever L^7 , the power being preferably transmitted through counteracting shoulders b^6 , b^7 , Fig. 4, whereby depression of the lever L^7 will operate to raise the lever L^6 , while the lever L^7 may be raised without effecting movement of the lever L^6 or the rod 54. A lever L^8 is suitably pivoted in the frame of the machine and adjusted to effect a slight engagement between its extremity and the extremity of the lever L^7 , slightly depressing said lever L^7 and passing below the same—the latter being preferably spring-pressed to its normal position. The lever L^8 is held in its normal or raised position by means of the pivoted detent 57 which engages the arm A^{10} secured to said lever.

A bar b^4 is mounted in slide bearings in suitable supports and is capable of a limited longitudinal movement therethrough. One extremity thereof is pivoted to the arm A^{11} of the bell-crank lever operated by the register bar 58, the other arm A^{12} of which lever being one of a pair of supporting arms which carry said register bar 58, normally spring-pressed to a raised position. Longitudinal movement of the bar b^4 is thus effected by depression of the register bar. This bar b^4 is provided with a pin 59, between which and the arm A^{10} is distended a tension spring f^6 , adapted upon forward movement of said bar to exert a yielding force against said arm A^{10} , which, as described, is checked by the detent 57. A pin 60 is suitably located upon said bar b^4 , and adapted at the proper time to engage the arm A^{13} secured to and controlling movement of the detent 57, raise said detent and free the arm A^{10} . The spring f^6 having been previously distended, said arm will move suddenly forward upon release, causing the lever L^8 to strike a sudden and forcible blow against the end of the lever L^7 , which is depressed to raise the end of the rod 54 and instantly returned when the end of said lever L^8 has passed beneath. A pin 61 on the bar b^4 is located to engage the arm A^{10} upon the return of said bar and effect reengagement between said arm and the detent 57. The lever L^7 being free to rise without affecting the lever L^8 , the lever L^8 in returning will freely raise and pass the lever L^7 , which drops at once to its normal position. This adjustment is provided to insure quick action, whereby, upon being raised to

release the stop-arm 53 on the shaft the rod 54 will, under ordinary conditions, be returned in time to be again engaged by said stop-arm 53 to limit movement of said shaft to one rotation only.

A certain number is set up by successively depressing the proper digit keys, operating through the hammers to depress a corresponding pin in the row thereof successively brought under said hammers and carried forward one step after each operation. The proper digit keys having been successively depressed to completely set up the desired number, the register bar is depressed, operating, as described, to raise the stop-rod and permit of one rotation of the cam shaft. This rotation of the cam shaft operates to withdraw the bars b^2 , corresponding to the plates 18 which have been released, to the proper distances from the spiral sectors. Immediately thereafter, the cam C^2 operates to exert yielding forces upon the entire series of sector arms (the figure wheels and pinions having been just previously raised, as described) moving those sectors which have been released through the predetermined distances or arcs, and (the figure wheels and pinions having been returned) positively returning said sectors to their normal positions and thereby rotating the proper figure wheels through the desired arcs to indicate thereon the figures represented by the digit keys depressed and in the order of depression. If a number is already represented on the figure wheels, the employment of suitable "carrying" mechanism, such as will be hereinafter described, will effect the addition of the two numbers and indicate their sum.

I provide a single-cipher key k^{10} , adapted upon depression to operate the escapement mechanism to advance the disk d^1 one step without depressing any of the pins P^1 to P^5 , whereby the pin P^{10} in that row is not raised but continues to hold a corresponding plate 18 against movement. This key k^{10} is one of a series of preferably five keys k^{10} , k^{11} , k^{12} , k^{13} and k^{14} , adapted, respectively, to advance the disk d^1 through one, two, three, four or five steps, at one operation, and which may be operated independently or, if desired, simultaneously with the depression of one of the digit keys. The function of the key k^{10} being to advance the disk d^1 through one step without depressing a pin, and thereby prevent any impulse being sent to the particular figure wheel corresponding in position to the position of the cipher in the number being set up (except as provided by the "carrying of 1" from the wheel to the right thereof), I provide upon the stem 62 of the key k^{10} —which is spring-pressed to its raised position by spring 620, similar springs being provided for the other cipher keys—a tapered or beveled shoulder i^1 , im-

pinging against the rod 63 carried between the extremities of the pair of rock arms A^{23} fixed upon the shaft S^{14} . It will be remembered that the arm A^9 is mounted upon the shaft S^{14} to rock therewith and independently thereof, in consequence of which depression of the key k^{10} will operate through the arms A^{23} to rock said shaft S^{14} , depress the arm A^9 and therewith the bar b^1 to release the escapement, as described. The slot 50 in the lever L^1 provides for the movement of the pin 51 therethrough, whereby operation of the escapement may be effected by said key k^{10} without moving the lever L^1 . The remaining four cipher keys k^{11} , k^{12} , k^{13} and k^{14} are designed to provide, when operated independently, for an escapement through two, three, four and five steps, respectively, at one operation. Each of these cipher keys has a similar vertical stem 62, mounted in slide bearings for a limited, vertical reciprocating movement and spring-pressed to its normal or raised position.

Mounted in slide-bearings in the pair of supports 63 63 are two horizontally-disposed, longitudinally-slidable, contiguous bars or rods b^5 and b^6 , normally locked together for joint movement by means of the spring-pressed detent 64, pivoted on the bar b^5 and engaging a pin 65 on the bar b^6 . The lower of these two bars, b^5 , is provided with a pin 66 engaged by a fork 67 at the extremity of a rock arm A^{13} at one end of a shaft L^{80} , another rock-arm b^8 on said shaft being provided with a similar fork 68 operating in an annular groove 69 at the end of the sleeve 9, to raise and lower the disk d^5 , which, as hereinbefore described, is adapted upon depression to successively engage and withdraw the pins p^1 , p^2 , p^3 , p^4 and p^5 from the groove 6 in the disk d^4 . It has been seen that the depression of said disk through a certain distance will withdraw the shortest of said pins; through a slightly greater distance, the next pin, and so on. Depression of said disk is thus controlled by means of the sliding bars b^5 and b^6 , operating, under ordinary conditions, as stated, in unison.

I have shown each of the vertical stems of the keys k^{10} , k^{11} , k^{12} , k^{13} and k^{14} provided with tapered or beveled shoulders i^1 , i^2 , i^3 , i^4 and i^5 , respectively, providing inclined planes of successively increasing pitch or angle. Mounted upon the lower bar b^6 and each located and adjusted to be immediately engaged by its corresponding beveled shoulder or inclined plane upon depression of any one of said keys, is a series of pins 70, adapted to move said bars horizontally through a distance which varies as the pitch or angle of the inclined plane upon the particular stem depressed. Depression of the single cipher-key under ordinary conditions does not bring its shoulder i^1 into action

against its pin 70 and hence does not move bars b^5 and b^6 . Depression of the two-cipher key k^{11} , will however under normal conditions move the bars b^5 and b^6 through the proper distance to withdraw the shortest p^1 of the pins from the groove 6 of the disk d^4 and permit an escapement of one additional step, or two steps in all. Similarly, depression of the key k^{12} will withdraw the two pins p^1 and p^2 from the groove, permitting of an escapement of three steps, depression of key k^{13} will effect an escapement of four steps and of key k^{14} five steps.

I have referred to the simultaneous depression of both a digit key and a cipher key. This is to facilitate the setting up of such a number as "5000", which, while first striking the digit key k^5 and subsequently the three-cipher key k^{12} will properly set up this number, still time may be saved by making it possible to produce the same result by simultaneously depressing both keys. In order to provide for the additional escapement of one step—the addition of the digit making this step necessary—I have shown the lever L^4 provided at its lower extremity with a shoe 71, adapted, upon depression of said lever as hereinbefore described, to engage the operating lever 72 of the detent 64 and release said detent from engagement with the pin 65, to permit of the longitudinal movement of the bars b^5 and b^6 independently of each other within the limits provided by the pin 73 in the notch 74. I have also shown a longitudinally reciprocating bar b^7 , pivotally mounted upon the pair of rock arms A^{14} , and provided with a series of notches 75, (Fig. 3) normally clear of the path of each of a corresponding series of pins 76 (Fig. 2) on the cipher-key stem 62. This bar b^7 is normally adapted to engage any one of the pins 76 to stop downward movement of the key stems 62, and when moved longitudinally to a point where the notches 75 register with the pins 76, it is obvious that each of the stems 62 will be capable of a slightly increased downward movement—or through an additional distance equal to the depth of the notch. To provide for this longitudinal movement through the proper distance of the bar b^7 , I have shown a tapered or beveled shoulder 77, providing an inclined plane upon the upper extremity of one of the rock arms A^{14} , adapted to be impinged by the end of the lever L^4 in its downward movement, these parts being adjusted to provide for proper distance of movement of the bar b^7 when the lever L^4 is depressed by operation of any one of the digit keys. Each cipher-key stem is thus capable of an additional downward movement, when depressed simultaneously with the depression of a digit key, and the bars b^5 and b^6 being now movable independently of each other,

the bar b^6 will be moved one additional step to withdraw from the groove 6 in the disk d^4 one more of the pins p^1 to p^5 than would be so withdrawn by the depression of the cipher key alone. Thus, depression of a digit-key and cipher-key k^{10} will result in such downward movement of the stem of said cipher-key as to bring its beveled-shoulder i into action against its corresponding pin 70, moving bar b^6 to the right a distance sufficient to actuate rock-arm A^{13} , shaft L^8 and rock-arm b^8 , lowering disk d^5 to withdraw pin p^1 from the groove 6 in disk d^4 , and thereby permitting an escapement of two steps. In like manner, depression of a digit-key and the five-cipher key k^{14} will lower disk d^5 a distance sufficient to withdraw all of the pins p^1 to p^5 inclusive from groove 6, permitting an escapement of six steps, the movement of disk d^4 under influence of spring f^1 being in such case arrested by extremity 71 of groove 6 making contact with pin 12 on disk d^3 .

I prefer to equip my machine with a series of preliminary indicating wheels in order that the work of setting up the numbers may be verified prior to the transmission of each to the figure wheels. This "verifying" means is provided for by the disk d^7 fixed upon the shaft S^5 near the upper extremity thereof. This disk is provided with a series of approximately radially disposed plates 770, corresponding to the radial rows of pins in the disk d^4 . These plates are provided with teeth t^8 meshing with the teeth of the pinion 78 secured to the single figure wheel 79 rotatably mounted in suitable supports on the disk d^7 . A spiral spring f^7 , one end of which is secured to the rim of said figure wheel and the other to one of the supports therefor, provides a force constantly tending to rotate said wheel, which rotation is checked except as the plate 77 is free to move. Teeth t^9 are provided on the lower edge of this plate 770, adapted to be engaged by a spring-pressed pawl 80, said pawl being provided with a short operating lever 81.

A lever L^8 , fulcrumed at 82 in a support suitably carried by the frame of the machine, is operated by means of a pin 83 at the extremity of the arm A^{15} fixed upon the rod 47, which, as has been described, is depressed upon each depression of a digit key; pin 83 operates in the slot 84—providing for a slight time element—in the extremity of said lever L^8 . This lever L^8 is provided with a laterally-projecting forked extremity 85, adjusted with reference to the disk d^7 so that under normal conditions each of the pawl-operating levers 81 will pass freely between the branches of the fork 85, each step in the movement of said disks d^4 and d^7 successively bringing one of the levers 81 into position to be engaged by said fork when

moved in a vertical direction. It will be
 apparent that upon striking a digit key, in
 addition to depressing its corresponding pin
 in the disk d^1 , the lever L^8 will be operated
 5 to raise a corresponding pawl-releasing lever
 81 and permit of the longitudinal movement
 of said plate 770 in an outward direction,
 or away from the center of the disk. I
 have shown a pin 86 projecting from the
 10 lower edge of said plate 770, said pin being
 bent to provide a laterally-projecting portion
 87. (See Fig. 28.) This pin 86, in addition
 to providing a permanent stop to engage
 15 the end of the slot in the disk d^1 to limit
 the movement of said plate toward the center
 of the disk, also provides a stop—through
 the bent portion 87 thereof—adapted under
 normal conditions to pass freely under the upper
 20 arms of the branched extremities of a series
 of pivoted rods 88, the lower arms of which
 rest upon the hammers 46. Each of said rods
 88 (Figs. 22 and 23) is adapted to drop by
 gravity as its corresponding hammer is depressed
 25 under the action of a digit key. To provide
 positive stops for the downward movement of
 these rods 88, and at the same time provide
 auxiliary lateral guides and supports, I have
 shown a plate 89 (Figs. 24 and 25)
 30 provided with a series of elongated notches
 90 through which said rods 88 extend, the
 plate 89 comprising a laterally bent portion
 of the arm 91 suitably secured, as shown, to
 the frame of the machine. It will be apparent
 35 that when a certain digit key is struck,
 resulting in the depression of a corresponding
 pin in a row on the disk d^1 one extremity
 of the lever L^8 will be depressed, raising
 the fork 85 and operating the lever
 40 81 to release the pawl controlled thereby,
 to permit of rotation of the figure wheel 79
 under action of the spiral spring f^1 . Depression
 of the hammer operated by the particular
 digit key struck, permits a corresponding
 45 rod 88 to fall in its notch in the plate 89,
 bringing the arm 92 thereof into the path
 of the arm 87 of the pin 86, to stop movement
 of the plate 770, and consequently of the
 wheel 79, at a point determinable by the
 50 striking of the desired digit key. It will be
 apparent that the relationship of these parts
 may be, and is herein illustrated, so adjusted
 that movement of the plate 770 will be
 stopped at that point where the figure
 55 wheel 79 (which is provided with the ten
 digital characters) will indicate a value
 corresponding to that of the key depressed
 and the pin in the disk d^1 which has been
 depressed. I prefer to provide the casing of
 60 my machine with a glass plate 93 (Fig. 2)
 so that these figure wheels 79 may be constantly
 in view and the work verified as it progresses.
 Naturally, these preliminary figure wheels
 must be returned to zero after
 65 the number has been sent forward to the

registering mechanism. To accomplish this,
 I have shown a peripherally grooved disk d^8
 fixed upon the lower end of a sleeve 94 slid-
 able upon the shaft S^5 . Through apertures
 in this disk, and corresponding apertures in
 the disk d^1 , are vertically disposed the rods
 95 provided with heads 96 to limit their up-
 ward movement. Attached to the upper ends
 of these rods are strings or cords—preferably
 of gut—the other extremity of each of which
 is attached to the end of a plate 770, passing
 70 through suitable apertures in the disk d^7 and
 the flange 97. The rods 95 are normally in
 their lower positions, as indicated in Fig. 2,
 the plates 770 being in their normal or retracted
 75 positions. It will be apparent that longitudinal
 movement of any one of these plates 770 will
 operate through the corresponding cord to raise
 a corresponding rod 95 through a distance
 80 equal to the distance of movement of said
 plate. Operating within the peripheral groove
 98 of the disk d^8 is the fork 99 at the
 extremity of the lever L^8 pivoted at 100 and
 operated by means of the short arm A^{16} . A
 85 connecting rod or plate 101 is pivoted to said
 arm and provided with a pin 102 projecting
 into a double slot 103 in the arm A^{11} of the
 bell-crank lever directly operated by the
 90 register bar 58. This pin 102 is normally
 within the upper portion of the double slot
 103, where it is engaged upon movement of
 said arm A^{12} to rock the arm A^{16} and
 depress the lever L^8 . When a number is
 transferred to the calculating or registering
 95 mechanism by the depression of the bar 58,
 the lever L^8 will be operated to depress
 such of the rods 95 as have been raised and
 draw said plates 770—or such thereof as
 have been moved upon release by the action of
 100 their operating springs—to normal positions,
 thereby returning the figure wheels 79 to
 zero. Simultaneous with the above-described
 operation, should be the release of the
 depressed pins in the disk d^1 , which have
 105 served their purpose in providing for the
 forwarding of the proper number to the
 registering mechanisms. This is provided
 for by the U-shaped lever L^{10} , normally
 elevated by a spring l^{10} , depending from the
 110 casing Fig. 2, and pivoted for vertical
 reciprocation, the semi-circular portion of
 which registers with the series of pins P^{10}
 in substantially one-half the rows on the
 disk d^1 . This U-shaped lever is provided
 115 with a short projecting arm A^{17} , pivoted to
 which is the connecting rod 104, of the
 peculiar configuration shown to provide for
 the application of power at the proper
 points and to avoid intermediate mechanisms.
 120 The other end of the rod 104 is provided
 with a pin 105, normally within a notch
 106 (Fig. 1) in the vertically reciprocating
 shoe 107 at the extremity of the lever
 125 L^{11} , pivoted at 108 and reciprocated by

means of the lever L^{12} operated by the cam C^6 on the shaft S^8 . Engagement between said cam and lever is so timed by the configuration of the former and its adjustment upon the shaft as to depress the lever L^{11} and therewith the rod 104 immediately after the plates 18 have been returned to their normal or retracted positions in the manner hereinbefore described. The pins P^{10} which have been released by the depression of pins P^1 to P^9 in the same rows will therefore be simultaneously and positively depressed by means of said lever L^{10} , releasing and returning to normally raised and inoperative positions, as will be remembered, any pin P^1 to P^9 which have been depressed.

The machine illustrated in the drawings is provided with a series of eleven figure wheels 35, each with the usual, equi-distantly disposed, peripheral characters indicating the digits from 1 to 0, the first wheel of the series, to the right, representing units, the next tens, the next hundreds, the next thousands, and so on; or the first cents, the next dimes, the next dollars, and so on; or the series may signify any abstract or concrete values in multiples of ten from the initial wheel. I have hereinbefore described mechanism including ten bars b^2 , ten plates 18, and ten rock-arms A^2 , whereby each of ten of these wheels is rotated through an arc which will bring the desired digit or numeral thereon into alinement with others at a convenient point in the line of vision of the operator. I have furthermore described how successive depressions of a predetermined arrangement or combination of digit keys will set up a number which is transmitted to the figure wheels by depression of the register bar. The eleventh figure wheel 35, the lowermost in Fig. 4, has no corresponding plate 18 and bar b^2 , and is provided to increase the capacity of the machine by registering tens carried thereto from the tenth wheel. To avoid special parts, this eleventh wheel, like the other wheels, has its corresponding rock-arm A^2 and sector 29, spring connection f^4 , sector A^7 and detent 39, which latter may be fixed in the position shown in Fig. 1, no means (such as bar b^2 , etc.) being provided to move this particular detent. The presence of these parts is essential to the carrying of tens to the eleventh figure wheel, as will later appear. It remains to be described how these wheels "carry," from one to the other, in performing processes of addition. It is obviously necessary that one complete revolution of the "units" wheel, from 0 to 0, shall effect movement of the "tens" wheel through one step, or one-tenth of a revolution, to add "1" to the numeral already appearing thereon. Similarly, each complete revolution of the "tens" wheel should carry

"1" to the "hundreds" wheel, and so on through the series.

There are many well-known ways of effecting movement of one step of a wheel by the complete revolution of a wheel contiguous thereto, but for many reasons I prefer the one herein shown and described. I have shown a series of levers L^{13} , fulcrumed at 109 (Fig. 1) upon a shaft suitably carried by the frame of the machine, one end of each thereof being provided with a detent 110 normally spring-pressed to a position to engage a pin 111 upon a contiguous sector 29. The other extremity of this lever is provided with a shoe 112 adapted to be impinged by a pin 113 upon the face of the figure wheel contiguous to said lever upon the opposite side thereof. It will be apparent that as each figure wheel is revolved (counter-clockwise in direction—referring to Fig. 1) a point is reached where the pin 113 will contact with and depress the shoe 112, operating through said lever L^{13} to withdraw the detent 110 from engagement with the pin 111 to permit of movement of said sector 29 through one additional step, limited by the permanent stop-bar 114, suitably mounted upon the base-board of the machine, against which all of said spiral-sector arms A^7 are adapted to impinge. To provide the force for moving the sectors 29 this additional step or distance—required at different times for each sector, and the rod 32, acting simultaneously against all thereof, not being available for this purpose—I have shown (in dotted lines Fig. 1) a series of individual levers L^{14} , pivoted upon a shaft S^{15} and each under constant pressure of a spring f^8 in tension between the arm A^{17} of each of said levers and a rod 115 supported between a pair of arms A^{18} on the branches 31 of the levers L^1 . Each of said levers L^{14} impinges against a pin 116 on a corresponding sector arm A^2 . Under this constant but yielding pressure each sector 29 will move the additional step when the detent 110 is withdrawn in the manner described. As said figure wheels are not affected when said sectors are moved in the reverse direction, the latter are re-set for the next operation without regard to this additional step or distance through which one or more of them may have been moved in carrying. From the previous description, it will be understood that the rock-arm A^2 and its sector 29, of the eleventh figure-wheel 35, have no movement to the left from the position in which similar parts are shown in Fig. 1, but can move only through the additional step, limited by the permanent stop 114, to register tens carried to said wheel. For example, when the tenth wheel 35 moves from nine to zero, the pin 113 thereof actuates its correspond-

ing lever L^{13} to withdraw detent 110 from the path of pin 111 on the sector 29 of the eleventh wheel 35, permitting the lever L^{14} corresponding to said wheel to move rack 29 the additional step limited by stop 114, thus advancing said eleventh wheel one step to carry ten thereto from the tenth wheel. To return the levers L^{13} to their normal positions, I have shown each thereof provided with an arm A^{19} projecting upwardly from the extremity of each lever, adapted to be engaged by one of a corresponding series of preferably elastic pins or spring bars 117, mounted upon the rock-shaft S^{60} carried by the pair of rock arms A^{20} . A pitman or connecting-rod 118 is pivoted to one thereof to reciprocate said arms, being provided with a roller at the extremity thereof against which operates the cam C^7 upon the shaft S^8 . I prefer to employ yielding means to return said levers L^{13} for a purpose which will be hereinafter explained. The cam C^7 is properly adjusted upon the shaft S^8 to time reciprocation of the rod 118 and effect return to normal positions of the levers L^{13} when the sectors 29 have been advanced under yielding force.

A third row of four keys is shown, one of which, k^{17} , bears the symbol or character "x" and is what I will term the multiplying key. As carried out by my machine, the process of multiplication consists, of course, in a series of repetitions of the process of addition, but not, however, involving the necessity of successively setting up and registering the multiplicand. It will be remembered that when a certain number has been set up, one rotation of the power shaft S^8 transfers and registers said number upon the proper figure wheels. It will be furthermore remembered that release of the depressed register bar, controlling the transferring and computing mechanisms, under normal conditions automatically returns the pins P^1 to P^9 which have been depressed in the disk d^1 to their raised positions, ready for the setting up of the next succeeding number, which is in the same manner transferred to the figure wheels to indicate their sum. It will be apparent that if the depressed pins in the disk d^1 are not released, nor said disk rotated or advanced one step, and the shaft S^8 is again rotated, the number which has been previously set up and transmitted will have been multiplied by two. Each rotation of said shaft, under these conditions, will effect one of the series of additions, the total number of which rotations represents the multiplier.

It has been described how the shafts S^8 is normally stopped upon the completion of one rotation. To carry out a simple process in multiplication, in which the multi-

plier consists in a single figure, of units only, it is only necessary to set up and transfer the multiplicand in the usual manner, providing, however, instead of one rotation, for as many rotations of the shaft S^8 , continuously, as there are units in the multiplier. The proper product will appear upon the figure wheels. When the multiplier consists in a number containing two figures, or both units and tens, my machine will carry out the process of multiplication with equal facility. The multiplicand is first set up in the usual manner and the shaft S^8 rotated as many times as there are units in the figure in the multiplier in units position. The disk d^1 is then automatically advanced one step without releasing the depressed pins, which effects the removal of each of the figures of the multiplicand, which are represented by the depressed pins, one space each to the left, which will result—if said shaft S^8 is rotated once—in the transfer and addition to the number already appearing upon the figure wheels of the product of the original multiplicand and ten. Obviously, if said shaft is continuously rotated a predetermined number of times, instead of once, the process of multiplying one number by another containing two figures may be rapidly and successfully performed. It will be apparent, furthermore, that this process may be carried on indefinitely, to the maximum capacity of the series of wheels. These results are obtained through the employment of the following auxiliary mechanisms, best illustrated in Figs. 2 and 5, wherein I have shown a vertical shaft S^{150} having secured to its upper extremity a laterally-projecting arm A^{20} , disposed to be engaged, when said shaft is rotated, by any one of the series of pins 119 projecting downwardly from the pivoted rods or bars 88, each of which, as will be remembered, is adapted to fall a certain distance as its corresponding hammer 46 is depressed. A sleeve 120 is slidable upon said shaft, and provided at each extremity with a clutch, 121 and 122, adapted to engage, respectively,—according to whether said sleeve is in its lowered or raised position—a similar clutch member 123 fixed upon the base-board of the machine, or a clutch 124 upon said shaft. Sleeve 120 carries a gear g^{10} , adapted to be rotated through a suitable chain of gears g^{11} and g^{12} (Fig. 5) by the ratchet wheel 125. Gear g^{11} has wide teeth to prevent disengagement of the teeth of gear g^{10} when sleeve 120 is shifted vertically, as hereafter explained. This ratchet wheel 125 is rotated, when said shaft is free to rotate, by a bar b^8 , actuated in one direction by a spring b^{80} , Fig. 1, and provided with a suitable tooth-engaging pawl 126, said bar

being capable of a limited reciprocating motion, corresponding to the distance between the teeth on said ratchet, and provided at its other extremity with a roller 5 against which operates a cam C^8 on the shaft S^8 . Rotation of said shaft S^8 thus moves said bar b^8 to its operative position with spring b^{80} under tension and with the pawl in engagement with a tooth on 10 the ratchet 125, to be returned, when the parts are released by disengagement of the clutch members 121 and 123, by spring b^{80} to rotate said ratchet wheel through one step. A lever L^{15} (Fig. 2) is pivoted at 15 128 and is adapted through its forked extremity 129, operating in the groove 130 in said sleeve 120, to raise and lower said sleeve into and out of engagement with the clutch 124 upon said shaft. When in its 20 lower position, engagement between the clutches 121 on the sleeve and 123 on the base-board of the machine, holds said sleeve against rotation.

The lever L^{15} is operated by the simultaneous depression of a digit key and the multiplying key, by means of the bar b^9 pivoted to the rod 47 which is depressed by operation of each and any digit key. This bar b^9 is provided with a notch 131, 30 normally free of but adapted to engage the pin 132 at the extremity of the lever L^{15} . The multiplying key k^{17} effects this engagement, this key stem being provided with a tapered or beveled shoulder 133 35 operating against the stud 134 at the extremity of the bar b^{11} , effecting when said key is depressed, not only longitudinal displacement of said bar b^{11} but forcing the bar b^9 into a position where engagement 40 is effected between the pin 132 and the notch 131. Therefore, when a digit key is depressed simultaneously with the depression of the multiplying key, the lever L^{15} will be operated to raise the sleeve 120, freeing the same of the lower clutch 123 and 45 engaging the upper clutch members 122 and 124 to effect rotation of the shaft S^{150} . It has been heretofore explained that the depression of a digit key, and the resulting depression of a corresponding hammer 46, 50 permits a corresponding pivoted bar 88 to drop and therewith the pin 119, projecting from its lower face or edge. When one of said pivoted bars 88 is in its lowered position, its pin 119 is in the path of the arm 55 A^{20} upon the shaft S^{150} and stops movement thereof and, consequently, rotation of said shaft, the distance of rotation, or the number of successive steps thereof, depending upon the position of the depressed 60 bar 88.

I have shown the spring-pressed bar b^8 provided with a pin 135, adapted, upon movement of said bar toward the shaft S^8 , 65 to engage the extremity of the lever L^{15} and

raise the pivoted arm 54, which, as hereinbefore described, normally engages the stop 53 upon the shaft S^8 to limit movement thereof to one rotation. It will be apparent, 70 therefore, that upon reciprocation of the bar b^8 the arm 54 will be successively raised clear of the path of the revolving stop 53 to permit of as many rotations of the shaft S^8 as the number of times said bar is reciprocated. It will be remembered that this 75 bar b^8 is free to move under the force of the spring b^{80} only as said ratchet wheel 125 is free to rotate, which, in turn, depends upon the freedom of said sleeve 120 and shaft S^{15} to rotate. Consequently, when said 80 sleeve 120 is raised, in the manner I have described, by the simultaneous depression of a digit key and the multiplying key, a two-fold function is accomplished. First, said shaft and sleeve are released, whereby the 85 bar b^8 is free to move longitudinally under the pressure of the spring to raise the stop-arm 54 which would otherwise check rotation of the shaft S^8 after one rotation, said bar b^8 being returned to its normal position 90 and engaging the next succeeding tooth in the ratchet wheel 125 by means of the cam C^8 on the shaft S^8 , as described. Rotation of the shaft S^{150} will thus be effected through the chain of gears in a step-by-step 95 movement. Secondly, the depression of the digit key—which should correspond in value, obviously, to the figure in the multiplier which is to be employed—releasing its corresponding bar 88 and the pin 119 thereon, 100 provides a stop in the path of the laterally-projecting arm A^{20} to positively check movement of the same after a certain number of steps—one for each reciprocation of the bar b^8 and corresponding in number to 105 the digital value or position of the particular digit key depressed. When so stopped, obviously, movement of the bar b^8 by its spring b^{80} in a direction to raise said stop-arm 54 will be prevented, and said arm remains in its lowered position to check rotation of the shaft S^8 . It will be apparent, 110 therefore, that I have provided, when the multiplying key is depressed simultaneously with the depression of a digit key, for as many rotations of the shaft S^8 as the numerical value of the digit key employed. Release of the multiplication key will effect lowering of sleeve 120 and consequent disengagement of clutch members 124 and 122, 120 freeing shaft S^{150} and permitting spring a^{20} , fixed at one end by a screw (Figs. 2 and 5) to a part of the machine frame and at its other end bearing against arm A^{20} , to return said arm (at the same time rotating shaft S^{150} in a reverse direction) to its normal position against a stop-pin a^{21} (Fig. 2) depending from said part of the framework. In effecting a series of repeated additions, however, I must prevent what I 130

have termed "erasure" of the number originally set up, or, in other words, prevent release of the pins P^1 to P^9 depressed in the disk d^1 , automatically accomplished under normal conditions. This erasure is prevented by means of the longitudinal displacement of the bar b^{11} , previously referred to, effected by operation of the beveled shoulder 133 against the stud 134 at the extremity of said bar b^{11} upon depression of the multiplying key. The other extremity of the bar b^{11} is pivotally connected to the lower end of the connecting rod 104 controlling, through the pin 105 and the notch 106, the depression of the U-shaped lever L^{10} . This longitudinal displacement of the bar b^{11} withdraws the pin 105 from the notch 106 in the shoe 107 at the extremity of the lever L^{11} , and prevents automatic depression of said lever L^{10} and, consequently, depression of the pins P^{10} to release the pins P^1 to P^9 which may have been depressed. In preventing return of the depressed pins P^1 to P^9 , I desire, at the same time, to prevent erasure of the figures appearing upon the verifying figure wheels 79. This is accomplished by means of the bar b^{12} , pivoted between the plate or rod 101 and the rock arm A^{21} secured to and rocked by the arm A^{22} pivoted to and operated by the stud 134. Thus, upon depression of the multiplying key, the bar b^{12} will be depressed carrying therewith the pivoted end of the plate or rod 101 and bringing the pin 102 thereon into the lower portion of the double slot 103 where it is not affected by depression of the register bar and the figure wheels 79, therefore, not returned to zero.

It will be remembered that when one of the pins P^1 to P^9 is depressed by operation of a digit key, it is temporarily checked in its depressed position. In solving a problem in multiplication, involving the simultaneous depression of the multiplying key and a digit key of the proper numerical value to provide for the desired number of rotations of the shaft S^8 , it will be seen that the depression of one of the pins P^1 to P^9 , a necessary consequence, in this operation effects no useful purpose. I do not attempt to prevent depression of the pin, but I do provide a lever L^{17} , fulcrumed at 136, one end of which is operated upon by beveled shoulder 138 upon the multiplying key stem, (see Figs. 29, 30 and 31) whereby, upon depression of said multiplying key the other end of the lever L^{17} is moved horizontally to a point immediately above the release pin P^{10} in that row of pins which is at that time in operative relation to the hammers 46. This end of the lever L^{17} is provided with a downwardly-projecting beveled shoulder 139 adapted to engage the head of the raised pin P^{10} —which, as will be remembered, has been released by the de-

pression of the digit key simultaneously with depression of the multiplying key. As the disk d^1 moves forward under operation of the escapement mechanism, as the keys are released, engagement between the pin P^{10} and the shoulder 139 effects the re-depression of the raised pin P^{10} , releasing, in the manner heretofore explained, the pin in the same row on the disk d^1 which has been depressed by the hammer.

Problems in addition and multiplication, as carried out by my machine, require comparatively little mental effort beyond mastering the details of key-board operation, just described. Problems in subtraction and division, however, while facilitated to a large extent by the employment of my machine by one who has become skilled in the operation thereof, require more or less preliminary or simultaneous mental coöperation. It is a well-known fact that the remainder obtained by subtracting one number from another comprises identically the same arrangements of figures as the sum obtained by adding to the subtrahend the complement of the minuend—with the exception of the fact that in such addition the digit "1" is carried into or added to the figure already occupying the space or column to the left of the first figure in the complement of the minuend. If this figure—which is always the digit "1" if a cipher formerly occupied this space or column—is not taken into consideration, the result obtained by the process of adding to a larger number the complement of a smaller number is the same as the result obtained by subtracting the smaller from the larger. This fact is taken advantage of by me in carrying out with my machine the process of subtraction. To avoid the necessity of first mentally determining the complement of the subtrahend, I have shown the faces of the nine digit keys, and also the face of the single-cipher key, divided, and provided upon the larger spaces thereon with characters indicating the real numerical value of each key, and on the smaller spaces with its complementary value,—providing, however, that there will be in each case "1 to carry" from the right. Therefore, it will be necessary for the operator to remember that in striking the last figure of the numeral which represents the subtrahend, considering the characters in the lower and smaller spaces on the digit keys, to decrease by "1" the value of the last key. For instance, should the subtrahend be the number 6817, if the characters on the lower spaces of the digit keys were followed strictly, the real value of the number set up and transferred will be 3182. The complement of 6817, however, is 3183, in consequence of which, in striking the number 6817—using the keys according to their complementary values—the last figure in

said number, which in this case is "7", is decreased in value one unit, and the numeral "6" employed, which transfers the real value "3," the one desired. To perform an ordinary problem in subtraction, therefore, considering for the time being that both the minuend and the subtrahend contain the same number of figures, I first set up the minuend in the usual manner and transfer the same to the figure wheels. I then proceed to set up the subtrahend, employing the digit keys according to the numerical value represented by the lower row of identifying numerals, the last one of which employed I remember to decrease one unit in value. I then have the complement of the subtrahend set up, which I transfer to the figure wheels, thereby adding the number thus transferred to the minuend which is already represented thereon. Where the minuend and subtrahend contain the same number of figures, the numeral "1" will, as explained, always be carried to and appear on the next succeeding wheel to the left. If I disregard this "1," the proper remainder will be shown upon the wheels. Should the subtrahend consist of a less number of figures than the minuend, or should it be desired to show the exact remainder upon the figure wheels without superfluous figures appearing, it will be necessary to precede the setting up of the complement of the subtrahend with a plurality of the numerals "9," whereby the "1" which is carried to the left upon the adding of the two numbers, is carried through the series of wheels, operating through the carrying mechanism to change all of said 9's to 0's, and carrying the "1" far enough to the left so as not to be confused with the remainder which will appear. In fact, to provide for this condition, and particularly to prevent the printing of superfluous figures by the printing mechanism, I provide what I call the subtraction key k^{18} , (Fig. 5) the stem of which is provided with a beveled shoulder 140, (see Fig. 32) adapted upon depression of said key to impinge against one arm of the lever L^{19} , the other arm of which (Fig. 4) is provided with a stop or shoe 141 which is by operation of said lever moved under the end of the last one of the series of sectors 38, which is the sector of the eleventh figure-wheel 35, heretofore referred to, to prevent movement of said wheel and hence the carrying of ten thereto. Now, if I disregard the last or eleventh wheel, movement of which I can prevent by depressing the subtraction key k^{18} , and instead of proceeding at once to set up the complement of the subtrahend strike the digit key representing the figure "9" as many times as there would be unused wheels in the series (disregarding the eleventh), and then follow with the complement of the subtrahend, when this number has been

transferred and added to the minuend, which already appears on the figure wheels, the result will be that the "1" will be carried through the wheels upon which "9" appears, changing the 9's to 0's, the "1" which would under ordinary conditions be carried to the eleventh wheel being prevented from appearing by the depression of the subtraction key which prevents rotation of said wheel. The figure wheels will therefore indicate the exact remainder resulting from the subtraction of the two numbers, and this exact remainder will be printed in the manner hereinafter described without superfluous figures. To illustrate, let it be supposed that it is desired to subtract the number 68471 from the number 2243728. The latter number is set up and transferred to the figure wheels. Remembering that there are ten figure wheels to take into consideration, with five figures in the number to be subtracted, I strike the digit key representing "9" five times, immediately following with the figures 6, 8, 4, 7 and 0, employing the lower row of identifying numerals on the digit keys and remembering to decrease the value of the last numeral one unit. What is actually done by the machine, therefore, is indicated in the following:

00002243728

09999931529

00002175257

As has been explained, the carrying of 1 to the eleventh wheel has been prevented by the depression of subtraction key k^{20} , and the number now shown by the figure wheel and printed is the correct remainder resulting from the subtraction of 68471 from 2243728. From the preceding explanation it will be understood that if said eleventh figure wheel were omitted from the machine, the function of the subtraction key k^{18} and the lever L^{19} actuated thereby would be eliminated, and said parts could be omitted.

I have explained how the process of multiplication, as carried out by my machine, amounts to a series of repeated additions. Similarly, the process of division consists in a series of repeated subtractions, which, while somewhat more complicated than the other processes my machine is capable of performing, may nevertheless be effected with exceeding rapidity and accuracy by one reasonably skilled in the operation thereof. The operator may choose between two ways of carrying out a process of division. The mathematician of sufficient skill to quickly and accurately determine the number of times a divisor will be contained in each partial dividend, may make use of the multiplying key, as hereinafter explained, and effect a great saving in time. In carrying out a process of division by

auxiliary employment of the multiplying key, somewhat greater mental activity is necessary, the operator being required to keep constantly in mind, or in view for ready reference, the number of figures in the divisor and the relative value thereof as compared with each partial dividend. The process may possibly be best explained by illustrating a problem in division as it would be performed by my machine. Let it be supposed that it is desired to divide the number 1728687 by 492. The former number is first set up and transferred to the figure wheels in the usual manner, and will appear on the seven wheels to the right of the series. I then set up on the rows of pins $p^1 p^2$, etc., the divisor, following, as in the process of subtraction, the lower row of identifying numerals on the digit keys, remembering to decrease the value of the last figure by one unit, and, as before, preceding this complement of the divisor by at least one 9, two 9's being set up in the example given below. The number actually set up, therefore, (not considering the 9's) will be 508, consisting of three figures as against seven figures in my dividend. I note that my first partial dividend is 1728, and strike the single-cipher or release key k^{10} three times, which advances disk d^2 and thereby transfers the number 508 three spaces to the left, or into proper position to be added to the partial dividend. I now have shown upon the figure wheels the following:

00001728687

and set up on the rows of pins $p^1 p^2$, etc., for addition thereto the following:

99508000

I have noted that my divisor 492 is contained in my first partial dividend 3 times. I therefore simultaneously depress the multiplying key k^{17} and the digit key k^3 , whereupon the machine upon depression of the register bar 58 carries out the following operation, continuously, in the manner hereinbefore described:

00001728687

99508
99508
99508

00300252687

My remainder, 252, thus appearing upon the figure wheels, being less than my divisor, 492, I strike the reverse spacing key k^{15} , hereinafter described, transferring the figures 508, still set up, one space each to the right. Or in the absence of such reverse spacing key k^{15} , said figures 508 may be brought to the position indicated by the use of the cipher-keys k^{10} , k^{11} , etc. I note that my divisor 492 is contained in my second

partial dividend, 2526, 5 times. I therefore simultaneously depress the multiplying key k^{17} and the digit key k^5 the following operation resulting:

00300252687

99508
99508
99508
99508
99508

00350006687

I now similarly transfer the number 508 one space to the right, noting that my divisor is contained in my third partial dividend 1 time. The simple process of addition is then performed, as follows:

00350006687

99508

00351001767

I again transfer or shift the complement of the divisor one space to the right, noting that my divisor is contained in my last partial dividend 3 times. Similarly, then, this last process may be performed by the machine:

00351001767

99508
99508
99508

00351300291

from which I note that 492 is contained in 1728687, 3513 times with a remainder of 291.

While a problem in division may be accurately and expeditiously solved through the employment of the multiplying key, in the manner I have just described, I prefer to equip my machine with a key k^{16} , which I term the division key, the function of which is merely to prevent erasure of the divisor when set up by the depression of the proper pins P^1 to P^3 in the disk d^1 . This may be accomplished by providing the stem of the division key with a tapered or beveled shoulder similar to the beveled shoulder 133 upon the multiplying key k^{17} , and similarly adapted to engage the stud 134 to withdraw the pin 105 from the notch 106 by means of the longitudinal displacement of the bar b^{11} . To carry out the process of division through the employment of the division key k^{16} , I first set up the dividend and transfer the same to the figure wheels in the manner described. I then set up my divisor, employing the identifying characters on the digit keys representing the complementary values of said keys, remembering to decrease the value of the last key struck by one unit, and, as before, preceding the complement of the divisor with one or

more 9's. Through the employment of the single-cipher or release key k^{10} , I now bring the complement of the divisor into proper position under my first partial dividend. It will be apparent, remembering that depression of the key k^{16} prevents erasure of the number set up, that each rotation of the shaft S^8 will effect the subtraction of my divisor from said first partial dividend. I therefore depress the division key k^{16} and then successively depress the register bar 58, which repeatedly releases the shaft S^8 for a complete rotation, each rotation effecting the subtraction referred to. The result of each subtraction is indicated immediately thereafter upon the figure wheels, and I am enabled to note thereon when my first partial dividend is exhausted or is less than my divisor. When I note that it is less than my divisor, I strike or depress the reverse-spacing key k^{15} , (or to the same end, may use the cipher-keys, as heretofore explained), which, in a manner hereafter described, effects the rotation of the disk d^1 through one step in a reverse direction. This operation, or one or more repetitions thereof, will bring the complement of my divisor, still set up on the disk d^1 , under my second partial dividend, whereupon I again hold down or depress the division key while successively striking the register bar until, similarly, my second partial dividend is exhausted or an amount remains which is less than my divisor. These operations are repeated until I have a remainder from my last partial dividend, when the figure wheels will show, in a manner precisely similar to the previously described process of division, my quotient and final remainder.

The back-spacing or reverse-spacing key k^{15} , to which I have referred, is provided with a stem 142 (Fig. 5) upon which is mounted the tapered or beveled shoulder 143, adapted to engage, when said key is depressed, the arm A^{25} controlling the movement of the pivoted lever L^{20} . To the extremity of this lever L^{20} is pivoted the spring-pressed pawl 144, adapted to engage, when said lever is operated, a tooth t^4 on the disk d^4 and rotate said disk one step in a reverse direction. This spring-pressed pawl 144 is normally free of the path of said teeth, so as not to interfere with the normal operation of the escapement mechanism, being preferably held in a relatively operative position by means of the pin 145, whereby, upon depression of the key k^{15} a tooth t^4 is engaged by said pawl and back-spacing of the disk d^1 through one step effected. I also provide a key k^{20} , which I term the "unison" key, the function of which is to provide independent means for returning all of the figure wheels to zero. This key is shown with a stem 146 (Fig. 1) provided with a pivoted stop 147, spring-pressed to its normal position,

and operating, upon depression of said key, to impinge against the arm of the bell-crank lever L^{21} to move the shaft S^{17} , suitably carried between a pair of rock arms of which the arm of said lever is one. This shaft or rod S^{17} is adapted to simultaneously contact with the pins 41 upon the sliding bars b^3 to withdraw all of said bars to their maximum distance of movement from the sectors 38.

Journalled in suitable bearings mounted on the base-board of the machine, is the rock-shaft S^{18} , operated by the crank or rock arm A^{24} pivoted to and adapted to be depressed by downward movement of the unison key stem 146. A similar arm A^{25} , fixed to the other extremity of said shaft, is provided with a forked extremity slidable within the annular groove 148 in the sleeve 149, see Figs. 4 and 14, feathered upon the cam-shaft S^8 to rotate therewith yet have a limited longitudinal sliding movement thereon. Upon this sleeve is mounted the cam C^3 , which, as will be remembered, reciprocates the rod or pitman 36 to raise and lower the entire series of figure wheels and pinions. This sleeve also carries a similar cam C^3 , oppositely disposed, and operating, when said unison key is depressed to slide said sleeve to a position where the cam C^3 instead of the cam C^3 will impinge the roller at the extremity of said pitman 36, to inversely operate the reciprocation of said series of figure wheels 35 and pinions 34, retaining said series in its lowered and operative position during primary movement of the sectors 29 and raising said series during return movement of said sectors. It will thus be apparent that depression of the unison key will first withdraw the series of detents 39 to release all of the sectors 38 and permit of their maximum distance of reciprocation. At the same time the sleeve 149 is shifted to reverse the raising and lowering of the figure wheels, whereupon the register bar being struck, the figure wheels will be rotated in a reverse direction during primary movement of the sectors 29. The pin 113 upon the face of each of said figure wheels is located to engage the shoulder or stop provided by the shoe 112 upon said lever L^{13} at that point in the rotation of each wheel where the "0" thereon is at the predetermined point in the line or plane of vision. Said sectors 29 being advanced under yielding pressure, each of the wheels 35, irrespective of its relative position of rotation, will be rotated in a reverse direction until the zero is reached, the entire series of figure wheels being raised to disengage the pinions 34 from the teeth of the sectors 29 during return of the sectors to their normally retracted positions. This operation of returning the figure-wheels to unison will actuate the printing mechanism, explained

hereafter, to print the amount or total accumulated upon the figure-wheels.

I have shown the lever L^{13} , after having been operated to "carry 1," returned to normal position by yielding pressure springs 117, on account of the fact that just as it is desired to return all of the figure wheels to zero one of said wheels may just have effected the "carrying of 1" to the next succeeding wheel to the left, and the pin 113 thereon just have released its corresponding shoe 112. Now, should it happen that this wheel should begin to rotate in a reverse direction, under operation of the unison key, before operation of the rock shaft S^{15} to return the levers L^{13} to normal positions, operation of said shaft S^{15} might commence while said pin 113 was in position to prevent upward movement of said shoe 112. The employment of yielding pressure, however, to return said levers L^{13} , will obviate ill-effects which might arise from such a condition.

A stop 151, (Fig. 1) suitably mounted upon the frame of the machine, is adapted to engage the bent extremity of the lever L^{22} controlling the pivoted stop 147 on the unison-key stem, and release the lever L^{21} just prior to complete depression of said key, whereupon said lever L^{21} is immediately returned under spring pressure to its normal position, the pawl 42 retaining each detent-bar b^3 in its retracted position, to be subsequently returned in a manner which has been described.

Should an error or mistake be made in setting up a number, as the preliminary figure wheels 79 will indicate, it will be necessary, of course, to provide for erasure of the number or release of the depressed pins P^1 to P^9 in the disk d^1 independent of the automatic erasing means. For this purpose I provide a key k^{19} , the stem of which is provided with a tapered or beveled shoulder, similar in location and function to the tapered shoulder 133 on the stem of the key k^{17} , impinging against a stud, similar to the stud 134, carried by a rock-arm, similar to the rock-arm A^{22} . Bar b^{14} is connected to said stud and adapted to be moved longitudinally by depression of said key k^{19} . The other extremity of this bar b^{14} is pivoted to an arm of the bell-crank lever L^{28} , the other arm of which is provided with a pin 166 adapted to impinge against the lever L^{11} , when said bar b^{14} is moved longitudinally, and depress the shoe 107 at the extremity of said lever, operating, in the manner hereinbefore described, to depress all pins P^{10} which may have been raised and release the pins P^1 to P^9 in corresponding rows.

The printing and listing mechanism shown comprises a platen or paper roller 152, provided with any form of automatic line-spacing mechanism, which, as it forms no

part of the present invention, is not illustrated in the drawings. The paper is preferably fed under this roller from the usual roll of paper ribbon. A series of sectors 153, one for each figure wheel, is provided, each with ten raised types thereon indicating the digits from "1" to "0" and adapted to be impressed against the platen. Each of these sectors 153 is mounted, as shown, upon a bent arm A^{26} , pivoted on the shaft S^{19} , and rocked by means of a lever L^{23} the extremity of which is pivoted to the connecting rod 155 pivoted to the supporting arm A^2 of a corresponding sector 29. Each type sector 153 is pivoted at a^{27} to its arm A^{26} and has a shoulder a^{28} which normally bears by gravity against said arm, leaving the sector free to swing upward on its pivot a^{27} in making a printing stroke. It will thus be apparent that movement of any one of said sectors 29 will effect a corresponding movement of a type-sector 153 and bring a particular type character thereon opposite the proper point for an impression thereof on the platen.

A series of spring-pressed hammers 156 is located each in operative proximity to the extremity of one of the type sectors 153, and a ratchet wheel 157 is rotatably mounted upon an elongated sleeve 158 slidable upon the shaft S^{20} but keyed against rotation independently thereof. The teeth t^9 upon said ratchet are adapted upon rotation thereof to engage the operating lever L^{24} (with which each of said hammers is provided) of a particular hammer, depending upon the position of said sleeve and ratchet upon the shaft, forcing said hammer against the action of its spring until the apex of the particular tooth in action is reached, at which point said hammer will be suddenly released to strike the proper type sector and press the desired type thereon against the platen. Each of the hammer levers L^{24} is provided with a wing 159, (Fig. 1) projecting to the left over the next adjacent hammer lever upon one side thereof, whereby, upon operation of any one of the intermediate hammers, all of the remaining hammers to the right thereof will be similarly operated, while those to the left thereof are not affected.

To determine the longitudinal position of the operating ratchet wheel 157 upon the shaft S^{20} , I have shown (Fig. 4) a rod 160 projecting from a short arm 161 on said sleeve 158, located and adjusted to pass freely under the ends of the type sectors 153 which have not been moved by the sectors 29 until stopped by contact with any one of said sectors 153 which has been moved or depressed. The ratchet wheel 157 is so located and adjusted on said sleeve as to be in operative relation to the particular hammer lever L^{24} corresponding to the first type sector 153

to the left which has been depressed, operation of which hammer, as will be remembered, effects the simultaneous operation of all the other hammers to the right thereof.

5 I have shown a lever L^{25} , (Figs. 1 and 2) pivoted at 167 and provided at its extremity with a pin adapted to slide in a guide-groove 162 suitably disposed in a sleeve 163 (not shown in Fig. 14) secured to the shaft S^8 .
 10 This groove 162 is of a configuration to oscillate said lever L^{25} and properly time each oscillation. The other extremity of this lever L^{25} is connected to the sleeve 158 by means of the tension spring f^9 , whereby, just
 15 prior to the printing operation, a pull is exerted upon said sleeve to move the same under yielding pressure to the right until stopped by contact between the end of the rod 160 and the first to the left of the type
 20 sectors depressed. The ratchet wheel 157 will then be in position to operate the first type hammer, and therewith all other hammers to the right thereof. To operate this ratchet wheel, I have shown a reciprocally
 25 sliding bar b^{13} provided at one extremity with a roller 164 (Fig. 4) and spring-pressed against the cam C^9 upon the shaft S^8 , the other end thereof being provided with a spring-pressed pawl 165 adapted to engage
 30 corresponding teeth t^{10} to rotate a ratchet wheel 168 through one step upon each rotation of the cam shaft S^8 , the cam C^9 being of a configuration and so disposed to effect this operation at the proper time.

35 Many modifications of the details of my improved calculating machine will doubtless readily suggest themselves to those skilled in the art to which it appertains, and I therefore do not desire to limit my invention
 40 to the specific construction herein shown and described.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

45 1. In a calculating machine, the combination of a series of figure-wheels; independent mechanism for each wheel including wheel-rotating means and stop-engaging means; a series of rows of normally inoperative stops which rows are adapted to be
 50 repeatedly positioned to the paths of movement of said stop-engaging means through movement in one direction only, said stops when operative being adapted to arrest and
 55 determine the extent of movement of the stop-engaging means cooperating therewith; and means for rendering operative any one stop in one or more of said rows.

60 2. In a calculating machine, the combination of a series of figure-wheels; independent mechanism for each wheel including wheel-rotating means and stop-engaging means; a movably supported series of rows of normally inoperative stops, said stops
 65 when operative being adapted to arrest and

determine the extent of movement of the stop-engaging means cooperating therewith; means for rendering operative any one stop in one or more rows; and means for advancing said rows of stops by movement in one direction only to repeatedly
 70 present each row in the same position relative to the paths of movement of said stop-engaging means.

3. In a calculating machine, the combination of a series of figure-wheels; independent mechanism for each wheel including wheel-rotating means and stop-engaging means; a movably supported continuous series of rows of normally-inoperative stops, said stops when operative being adapted to
 80 arrest and determine the extent of movement of the stop-engaging means cooperating therewith; means for successively rendering operative one stop in each of a predetermined number of rows; and means for bringing said operative stops into the paths
 85 of movement of said stop-engaging means.

4. In a calculating machine, the combination of a series of figure-wheels; independent normally-checked mechanism for each wheel including wheel-rotating means and stop-engaging means; a series of rows of normally-inoperative stops adapted to be repeatedly positioned to the paths of movement of said stop-engaging means through
 90 movement in one direction only; and means for rendering operative any one stop in one or more of said rows and for releasing the mechanisms to which said operative stops
 95 are positioned.

5. In a calculating machine, the combination of a series of figure-wheels; independent normally-checked mechanism for each wheel including wheel-rotating means and
 100 stop-engaging means; a movably supported series of rows of normally-inoperative stops; means for rendering operative any one stop in one or more rows; means for repeatedly positioning said rows to the paths of movement of said stop-engaging means through
 105 movement in one direction only, and means for releasing those of said mechanisms to which operative stops are positioned.

6. In a calculating machine, the combination of a series of figure-wheels; independent normally-checked mechanism for each wheel including wheel-rotating means and stop-engaging means; of a movably supported continuous series of rows of normally-inoperative stops; means operable
 110 successively with relation to a predetermined number of rows to render operative one stop in each of said rows; and means for bringing said operative stops into the paths
 115 of movement of said stop-engaging means and for releasing said mechanisms.

7. In a calculating machine, the combination of a series of figure-wheels; a corresponding series of independent normally-
 120 130

checked mechanisms, each mechanism including wheel-rotating means and stop-engaging means; a movably-supported series of rows of normally-inoperative stops; means for rendering operative one stop in a row in an initial position; means for bringing said stop into the path of movement of the stop-engaging means of any one of said mechanisms through movement in one direction only; and means for releasing the mechanism to which the stop is thus positioned.

8. In a calculating machine, the combination of a series of figure-wheels; a corresponding series of independent normally-checked mechanisms, each mechanism including wheel-rotating means and stop-engaging means; a movably-supported continuous series of rows of normally-inoperative stops; and means for successively rendering operative one stop in each of a predetermined number of rows and thereby automatically bringing each stop so rendered operative into the path of the rotating means of a mechanism and releasing said mechanism.

9. In a calculating machine, the combination of a series of figure-wheels; independent mechanism for each wheel including wheel-rotating means and stop-engaging means; a movably supported series of rows of normally-inoperative stops, said stops when operative being adapted to arrest and determine the extent of movement of the stop-engaging means cooperating therewith; means for rendering operative any one stop in one or more rows; means for repeatedly positioning said rows to the paths of movement of said stop-engaging means through movement in one direction only; and means for automatically returning said stops to normal positions after each operation of said mechanisms.

10. In a calculating machine, the combination of a series of figure-wheels; independent normally-checked mechanism for each wheel including wheel-rotating means and stop-engaging means; a series of rows of normally-inoperative stops adapted to be repeatedly positioned to the paths of movement of said stop-engaging means through movement in one direction only; means for rendering operative any one stop in one or more rows and releasing the mechanism to which said operative stop is positioned; and means for returning said stops to normal position after each operation of said mechanisms.

11. In a calculating machine, the combination of a series of figure-wheels; independent normally-checked mechanism for each wheel including wheel-rotating means and stop-engaging means; a movably-supported series of rows of normally-inoperative stops; means for rendering operative

any one stop in one or more rows; means for repeatedly positioning said rows to the paths of movement of the stop-engaging means of each of said mechanisms by movement in one direction only and releasing said mechanisms; and means for returning said stops to normal position after each operation of said mechanisms.

12. In a calculating machine, the combination of a series of figure-wheels; a corresponding series of independent normally-checked mechanisms each mechanism including wheel-rotating means and stop-engaging means; a movably supported series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows and thereby automatically bringing each stop so rendered operative into the path of the stop-engaging means of a corresponding mechanism and releasing said mechanism; and means for automatically returning all stops to normally-inoperative positions after each operation of said mechanisms, said rows of stops having movement in one direction only.

13. In a calculating machine, the combination of a series of figure-wheels; independent mechanism for each wheel including wheel-rotating means and stop-engaging means; a movably supported series of rows of normally inoperative stops, said rows of stops having movement in one direction only; means for rendering operative any one stop in one or more rows; means for positioning said rows to the paths of movement of said stop-engaging means; and means for returning said stops to normally-inoperative positions automatically upon each operation of said mechanism and independently thereof at will.

14. In a calculating machine, the combination of a series of figure-wheels; independent mechanism for each wheel including wheel-rotating means and stop-engaging means, a movably-supported series of rows of normally-inoperative stops, said rows having movement in one direction only, and said stops when operative being adapted to arrest and determine the extent of movement of the stop-engaging means cooperating therewith; means for rendering operative any one stop in a row in an initial position and advancing said row into position relative to the path of movement of the stop-engaging means of a mechanism; and means for automatically returning said stops to normally inoperative positions after each operation of said mechanisms.

15. In a calculating machine, the combination of a series of figure-wheels; independent normally-checked mechanism for each wheel including wheel-rotating means and stop-engaging means; a movably-supported continuous series of rows of nor-

mally-inoperative stops, means for rendering operative any one stop in a row in an initial position and advancing said row into position relative to the path of movement of the stop-engaging means of a mechanism; means for releasing said mechanisms; and means for automatically returning said stops to normally-inoperative positions after each operation of said mechanisms.

16. In a calculating machine, the combination of a series of figure-wheels; a corresponding series of independent normally-checked mechanisms each mechanism including wheel-rotating means and stop-engaging means; a movably-supported endless series of rows of normally-inoperative stops; means for rendering operative any one stop in a row in an initial position and advancing said row one step into position relative to the path of movement of the stop-engaging means of a mechanism; means for releasing said mechanisms; and means for returning said stops to normally-inoperative positions automatically upon each operation of said mechanisms and independently thereof at will.

17. In a calculating machine, the combination of a series of figure-wheels; means for effecting and controlling rotation of said wheels, said means for each wheel including a reciprocating member; means for reciprocating said members; a movably-supported series of rows of normally-inoperative stops; and means for successively rendering operative one stop in each of a predetermined number of rows and automatically bringing said operative stops into the paths of movement of reciprocating members, said rows of stops having movement in one direction only.

18. In a calculating machine, the combination of a series of figure-wheels; means for effecting and controlling rotation of said wheels, said means for each wheel including a normally-checked reciprocating member; a movably supported series of rows or normally-inoperative stops, said rows of stops having movement in one direction only; means for successively rendering operative any one stop in each of a predetermined number of rows and automatically bringing said operative stops into the paths of movement of reciprocating members; and means for releasing said members.

19. In a calculating machine, the combination of a series of figure-wheels; means for effecting and controlling rotation of said wheels, said means for each wheel including a normally-checked reciprocating member; yielding means for moving said members in one direction; a movably-supported series of rows of normally-inoperative stops; and means for successively rendering operative any one stop in each of a predetermined number of rows; and for

automatically bringing said operative stops into the paths of movement of reciprocating members and releasing said members.

20. In a calculating machine, the combination of a series of figure-wheels; means for effecting and controlling rotation of said wheels, said means for each wheel including a normally-checked reciprocating member; yielding means for moving said members in one direction; a movably-supported continuous series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative stops into the paths of movement of reciprocating members and releasing said members; and means for rendering said members inoperative to movement under application of the yielding forces.

21. In a calculating machine, the combination of a series of figure-wheels; mechanism for each wheel including means in engagement with the wheel to rotate the same, and a normally-checked reciprocating member; yielding means for actuating said wheel rotating means in one direction; a movably-supported continuous series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative stops into the paths of movement of reciprocating members and releasing said wheels and their rotating means prior to and holding them disengaged during movement of the latter under application of the yielding forces; and means for reversing the operation of said disengaging means.

22. In a calculating machine, the combination of a series of figure-wheels; means for effecting and controlling rotation of said wheels, said means for each wheel including a normally-checked reciprocating member; means for simultaneously exerting yielding forces against all of said members; a movably-supported continuous series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative stops into the paths of movement of reciprocating members and releasing said members; and positive means for returning the members which have been moved.

23. In a calculating machine, the combination of a series of figure-wheels; means for effecting and controlling rotation of said wheels, said means for each wheel including a normally-checked reciprocating member; means simultaneously exerting yielding forces upon said wheel rotating means to move the same in one direction; a

movably-supported continuous series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative stops into the path of movement of reciprocating members and releasing said members; positive means for returning the wheel rotating means which have been moved; and means for rendering said wheel rotating means inoperative during movement under application of the yielding forces.

24. In a calculating machine, the combination of a series of figure-wheels, mechanism for each wheel including means in engagement with the wheel to rotate the same, and a normally-checked reciprocating member; means simultaneously exerting yielding forces against wheel rotating means; a movably-supported continuous series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative stops into the paths of movement of reciprocating members and releasing said members; positive means for returning the wheel rotating means which have been moved; means for disengaging said wheels and their rotating means prior to and holding them disengaged during movement of said rotating means under application of the yielding forces, and means for reversing the operation of said disengaging means.

25. In a calculating machine, the combination of a series of independently-rotatable figure-wheels; means for effecting and controlling rotation of said wheels, said means including a series of normally-checked independently reciprocating members corresponding to said wheels; yielding means simultaneously tending to move said wheel-rotating means in one direction; a movably-supported continuous series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative stops into the paths of movement of reciprocating members and releasing said members; positive means for returning said members; means for rendering said wheel-rotating means inoperative during movement under application of the yielding forces; and means for checking independent movement of said wheels while free of said wheel-rotating means.

26. In a calculating machine, the combination of a series of figure-wheels, of means for effecting and controlling rotation of said wheels, said means including a series of independently-reciprocating normally-checked members corresponding to said

wheels; means simultaneously imparting yielding forces against all of said wheel rotating means; a movably-supported continuous series of rows of normally inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative stops into the paths of movement of reciprocating members and releasing said members; positive means for returning the members which have been moved; and means for automatically disengaging the entire series of wheels from said wheel-rotating means prior to and holding them disengaged during movement of said means under application of the yielding forces; means for reversing the operation of said disengaging means; and means for checking independent movement of said wheels while free of said rotating means.

27. In a calculating machine, the combination, with a series of independently-rotatable figure wheels and a series of independently-movable members to rotate said wheels, of a series of intermediate stops each checking movement of a corresponding member and adapted upon release to determine the distance of movement of said member; means checking movement of said intermediate stops; a movably-supported series of rows of normally-inoperative primary stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative primary stops into the paths of movement of said intermediate stops and releasing said intermediate stops; and means for operating said members and said intermediate stops.

28. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of independently movable members to rotate said wheels, of a series of intermediate stops each checking movement of a corresponding member and adapted upon release to determine the distance of movement of said member; means for checking movement of said intermediate stops; a movably-supported series of rows of normally-inoperative primary stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative primary stops into the paths of movement of said intermediate stops and releasing said intermediate stops; means for operating said members and said intermediate stops; and means for returning the operative primary stops to their normal positions after each operation of said members.

29. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of independently-mov-

able members to rotate said wheels, of a series of intermediate stops each checking movement of a corresponding member and adapted upon release to determine the distance of movement of said member; means for checking movement of said intermediate stops; a movably-supported series of rows of normally-inoperative primary stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative stops into the paths of movement of said intermediate stops and releasing said intermediate stops; means for operating said members and said intermediate stops; and means for returning the operative primary stops to normally inoperative positions automatically upon each operation of said members, and independently thereof at will.

30. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of independently-movable members to rotate said wheels, of a series of intermediate stops each checking movement of a corresponding member and adapted upon release to determine the distance of movement of said member; means for checking movement of said intermediate stops; a movably-supported series of rows of normally-inoperative primary stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative stops into the paths of movement of and releasing intermediate stops; means for operating said members and said intermediate stops; means independent of said primary stops to check said intermediate stops in the positions to which they are withdrawn; and means for automatically returning the operative primary stops to normally inoperative positions.

31. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of independently-movable members to rotate said wheels, of a series of intermediate stops each normally checking movement of a corresponding member and adapted upon release to determine the distance of movement of said member; means for checking movement of said intermediate stops; a movably-supported series of rows of normally-inoperative primary stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative stops into the paths of movement of and releasing intermediate stops; means for operating said members and said intermediate stops; means independent of said primary stops to automatically check said intermediate stops in their retracted positions; means for auto-

matically returning the operative primary stops to normal positions; and means for automatically releasing said retracted intermediate stops after each operation of said members.

32. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of independently-movable members to rotate said wheels, of a series of intermediate stops normally checking movement of said members and each adapted upon release to determine the distance of movement of a corresponding member; means for checking movement of said intermediate stops; a movably-supported continuous series of rows of normally-inoperative primary stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative stops into the paths of movement of and releasing intermediate stops; and means for operating said members and said intermediate stops.

33. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of independently-movable members to rotate said wheels, of a series of intermediate stops normally checking movement of said members and each adapted upon release to determine the distance of movement of a corresponding member; means for checking movement of said intermediate stops; a movably-supported continuous series of rows of normally-inoperative primary stops; means successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative stops into the paths of movement of and releasing intermediate stops; means for operating said members and said intermediate stops; and means for automatically returning said operative primary stops to normal positions after each operation.

34. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of independently-movable members to rotate said wheels, of a series of intermediate stops normally checking movement of said members and each adapted upon release to determine the distance of movement of a corresponding member; means for checking movement of said intermediate stops; a movably-supported continuous series of rows of normally-inoperative primary stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative stops into the paths of movement of and releasing intermediate stops; means for operating said members and said intermediate stops; and means for returning said

operative primary stops to normal positions automatically after each operation and independently thereof at will.

35. In a calculating machine, the combination, with a series of figure wheels and means for rotating the same, said means including a series of independently-movable members corresponding to said wheels; of a movably-supported endless series of rows of normally-inoperative stops; means for advancing the rows of stops; stop setting means for successively rendering operative any one stop in each of a predetermined number of rows and for automatically controlling said advancing means to advance said rows of stops one step at each operation of said stop setting means; and means other than said stop setting means for controlling the stop advancing means to advance said rows of stops one or more steps at one operation of said other means.

36. In a calculating machine, the combination, with a series of figure wheels and means for rotating said wheels, said means including a series of normally-checked independently-reciprocating members corresponding to said wheels, of a movably supported endless series of rows of normally-inoperative stops; means for advancing the rows of stops; stop-setting means for successively rendering operative any one stop in each of a predetermined number of rows and for controlling said advancing means to automatically advance said rows of stops one step upon each operation of said stop-setting means; means for automatically releasing reciprocating members corresponding to rows in which a stop has been rendered operative; and means other than said stop setting means for controlling the stop advancing means to advance said rows of stops one or more steps at one operation of said other means.

37. In a calculating machine, the combination, with a series of figure wheels and means for rotating said wheels, said means including a series of independently-reciprocating members corresponding to said wheels, of a movably-supported continuous series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows and automatically advancing said rows of stops one step upon each operation of said means for rendering stops operative; means for reciprocating said members; means for automatically returning said operative stops to normal positions after each reciprocation; and means for preventing automatic return of said stops for a predetermined number of reciprocations.

38. In a calculating machine, the combination with a series of figure wheels and

means for rotating said wheels, said means including a series of normally-checked independently-reciprocating members corresponding to said wheels, of a movably-supported continuous series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows and automatically advancing said rows of stops one step upon each operation of said means for rendering stops operative; means for releasing the reciprocating members corresponding to rows in which a stop has been rendered operative; means for reciprocating the members thus released; means for automatically returning said operative stops to normal positions after each reciprocation; and means for preventing automatic return of said stops for a predetermined number of reciprocations.

39. In a calculating machine, the combination, with a series of figure wheels and means for rotating said wheels, said means including a series of independently-reciprocating members corresponding to said wheels, of a continuous series of rows of normally-inoperative stops; a movable carrier on which said rows of stops are mounted; means for advancing said carrier; stop-setting means for successively rendering operative any one stop in each of a predetermined number of rows and for automatically controlling said carrier advancing means to advance said carrier one step upon each operation of said stop-setting means; other independent means for controlling said carrier advancing means to advance said carrier one or more steps at one operation thereof; means for moving said carrier step-by-step in a reverse direction; and means for reciprocating said members.

40. In a calculating machine, the combination, with a series of figure wheels and means for rotating said wheels, said means including a series of normally-checked reciprocating members corresponding to said wheels, of a continuous series of rows of normally-inoperative stops; a movable carrier on which said rows of stops are mounted; means for advancing said carrier; stop-setting means for successively rendering operative any one stop in each of a predetermined number of rows and for automatically controlling said carrier advancing means to advance said carrier one step upon each operation of said stop-setting means; other independent means for controlling said carrier advancing means to advance said carrier one or more steps at one operation thereof; means for moving said carrier step-by-step in a reverse direction; and means for releasing said reciprocating members.

41. In a calculating machine, the combination

nation of a series of figure wheels, means for effecting and controlling rotation of said wheels, said means including a series of normally-checked independently-reciprocating members corresponding to said wheels, of a movably-supported series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative stops into the paths of movement of and releasing corresponding reciprocating members; means for returning said operative stops to normal positions automatically upon each reciprocation and independently thereof at will; and means for preventing automatic return of said stops for a predetermined number of reciprocations.

42. In a calculating machine, the combination, with a series of figure wheels and means for rotating the same, said means including a corresponding series of independently-movable members in engagement therewith to rotate said wheels, of a movably-supported continuous series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows and automatically advancing said rows of stops one step upon each operation of said stop operating means; means for disengaging said wheels and members prior to movement in one direction; and means for reversing the operation of said disengaging means.

43. In a calculating machine, the combination of a series of figure wheels, mechanism for effecting and controlling rotation of said wheels including a corresponding series of independently-movable members in engagement with said wheels, and stop-engaging means associated with said movable members, of a movably-supported series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative stops into the paths of movement of the stop engaging means; means for automatically disengaging said wheels and members during movement in one direction; and means for reversing the operation of said disengaging means.

44. In a calculating machine, the combination, with a series of figure wheels; means for effecting and controlling rotation of the same, said means including a series of independently-reciprocating members corresponding to said wheels; and means normally checking movement of said members; of a movably-supported series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows and for automatically advancing said operative stops into the paths of movement of

and releasing corresponding reciprocating members; means for automatically returning the operative stops to normal positions upon each reciprocation; means for automatically rechecking said members after one reciprocation; and means for preventing operation of both said returning means and said rechecking means whereby a plurality of identical reciprocations is effected.

45. In a calculating machine, the combination, with a series of figure wheels; means for effecting and controlling rotation of the same, said means including a series of independently-reciprocating members corresponding to said wheels; and means normally checking movement of said members; of a movably supported series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows and for automatically advancing said operative stops into the paths of movement of and releasing reciprocating members; means for automatically returning the operative stops to normal positions upon each reciprocation; means for automatically rechecking said members after one reciprocation; means for preventing operation of both said returning means and said rechecking means whereby a plurality of identical reciprocations is effected; and means for positively controlling the number of reciprocations.

46. In a calculating machine, the combination, with a series of independently-rotatable figure wheels and a series of independently-movable members to rotate said wheels, of a series of intermediate stops each checking movement of a corresponding member and adapted upon release to determine the distance of movement of said member; a movably-supported series of rows of normally-inoperative primary stops; means for successively rendering operative one stop in each of a predetermined number of rows, and for automatically bringing said operative primary stops into the paths of movement of and releasing corresponding intermediate stops; means for operating said reciprocating members and said intermediate stops; means for automatically returning the operative primary stops to normal positions after each reciprocation; and means for preventing operation of said automatic returning means.

47. In a calculating machine, the combination, with a series of independently-rotatable figure wheels and a series of independently-movable members to rotate said wheels, of a series of intermediate stops each checking movement of a corresponding member and adapted upon release to determine the distance of movement thereof; means normally checking movement of said intermediate stops; a movably-supported

series of rows of normally-inoperative primary stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative primary stops into the paths of movement of and releasing corresponding intermediate stops; means for operating said members and said intermediate stops; means for rechecking said intermediate stops after one operation; means for automatically returning said operative primary stops to normal positions upon each operation; and means for preventing said action of said rechecking means and said returning means.

48. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of independently-movable members to rotate said wheels, of a series of intermediate stops each checking movement of a corresponding member and adapted upon release to determine the distance of movement thereof; means normally checking movement of said intermediate stops; a movably-supported series of rows of normally-inoperative primary stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative stops into the paths of movement of and releasing corresponding intermediate stops; means for operating said movable members and said intermediate stops; means independent of said primary stops to check the intermediate stops in the positions to which they are withdrawn; means for automatically returning the operative primary stops to normally inoperative positions; means for again automatically releasing said intermediate stops; and means for preventing automatic return of said operative primary stops.

49. In a calculating machine, the combination, with a series of figure wheels, means for effecting and controlling rotation of said wheels, and a series of normally-checked independently-reciprocating members; means simultaneously imparting yielding forces tending to move all of said members in one direction; and positive means for returning said members; of a movably-supported series of rows of normally-inoperative stops; and means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically bringing said operative stops into the paths of movement of and releasing corresponding reciprocating members.

50. In a calculating machine, the combination, with a series of figure wheels; means for effecting and controlling rotation of said wheels, and a corresponding series of normally-checked independently-reciprocating members; means for imparting yielding forces simultaneously tending to move

all of said members in one direction; and positive means for returning said members; of a movably-supported series of rows of normally-inoperative stops; means for advancing said rows of stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically controlling said advancing means to advance said operative stops into the paths of movement of and releasing corresponding reciprocating members; and other means for controlling said advancing means to advance said rows of stops.

51. In a calculating machine, the combination, with a series of figure wheels; means for effecting and controlling rotation of said wheels, and a corresponding series of normally-checked independently-reciprocating members; means for imparting yielding forces simultaneously tending to move all of said members in one direction; and positive means for returning said members; of a movably-supported series of rows of normally-inoperative stops; means for advancing said rows of stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically controlling said advancing means to advance said operative stops into the paths of movement of and releasing corresponding reciprocating members; other means for controlling said advancing means; and means for moving said rows of stops step-by-step in a reverse direction.

52. In a calculating machine, the combination, with a series of figure wheels; mechanism for effecting and controlling rotation of the wheels, said mechanism including means normally in engagement with said wheels for rotating the same, and a series of independently-reciprocating members corresponding to said wheels; means imparting yielding forces simultaneously tending to move all of said members in one direction; and positive means for returning said members; of a movably-supported series of rows of normally-inoperative stops; means for advancing said rows of stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically controlling said advancing means to advance said stops one step at each operation and said rows into the paths of movement of and releasing corresponding reciprocating members, and other means for controlling said advancing means to advance said rows of stops step-by-step.

53. In a calculating machine, the combination, with a series of figure wheels, mechanism for effecting and controlling rotation of said wheels, said mechanism including a series of normally-checked independently-

movable members normally in engagement with the wheels and stop-engaging means associated with said members; means imparting yielding forces simultaneously tending to move all of said members in one direction; and positive means for returning said members; of a movably-supported series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative stops into the paths of movement of stop-engaging means and releasing corresponding members; and means for disengaging said wheels and members prior to movement of the latter under application of the yielding forces.

54. In a calculating machine, the combination, with a series of figure wheels; mechanism for effecting and controlling rotation of said wheels, said mechanism including a corresponding series of normally-checked independently-movable members normally in engagement with the wheels and stop-engaging means associated with said members; means imparting yielding forces simultaneously tending to move all of said members in one direction; and positive means for returning said members; of a movably-supported series of rows of normally-inoperative stops; means successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative stops into the paths of movement of stop-engaging means and releasing corresponding members; means for disengaging said wheels and members prior to and during movement under application of the yielding forces; and means for reversing the operation of said disengaging means.

55. In a calculating machine, the combination, with a series of figure wheels; mechanism for effecting and controlling rotation of said wheels, said mechanism including a series of normally-checked independently-reciprocating members corresponding to said wheels and stop-engaging means associated with said members; means simultaneously imparting yielding forces tending to move all of said members in one direction; and positive means for returning said members; of a movably-supported series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative stops into the paths of movement of stop-engaging means and releasing said members; and means for returning said stops to normally inoperative positions after each reciprocation.

56. In a calculating machine, the combination, with a series of figure wheels; mechanism for effecting and controlling rotation

of said wheels, said mechanism including a series of normally-checked independently-reciprocating members corresponding to said wheels and stop-engaging means associated with said members; means simultaneously imparting yielding forces to said members tending to rotate all of said wheels; and positive means for returning said members; of a movably-supported series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative stops into the paths of movement of stop-engaging means and releasing members; and means for returning said stops to normal positions automatically upon reciprocation of said members and independently thereof at will.

57. In a calculating machine, the combination, with a series of figure wheels; mechanism for effecting and controlling rotation of said wheels, said mechanism including a series of normally-checked and independently-reciprocating members corresponding to said wheels and stop-engaging means associated with said members; means for simultaneously imparting yielding forces tending to move all of said members in one direction; and positive means for returning said members; of a movably-supported series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative stops into the paths of movement of stop-engaging means and releasing members; means for rechecking said members after reciprocation; means for automatically returning said operative stops to normally-inoperative positions; and means for preventing automatic operation of said rechecking means and said returning means, whereby a plurality of identical reciprocations is effected.

58. In a calculating machine, the combination, with a series of figure wheels; mechanism for effecting and controlling rotation of said wheels, said mechanism including a series of normally-checked independently-reciprocating members corresponding to said wheels and stop-engaging means associated with said members; means for simultaneously imparting yielding forces tending to move all of said members in one direction; and positive means for returning said members; of a movably-supported series of rows of normally-inoperative stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative stops into the paths of movement of stop-engaging means and releasing members; means for rechecking said members after reciprocation; means for automatically

returning said operative stops to normal positions; means for preventing operation of said rechecking means and said returning means for a predetermined number of reciprocations, and means for positively controlling the number of reciprocations.

59. In a calculating machine, the combination, with a series of figure wheels; a corresponding series of normally-checked independently-movable members to rotate said wheels; means for simultaneously imparting yielding forces tending to move all of said members in one direction; and positive means for returning said members; of a series of intermediate stops each normally checking movement of a corresponding member and adapted upon release to determine the distance of movement of said member; means normally checking movement of said intermediate stops; a movably-supported series of rows of normally inoperative primary stops; and means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative primary stops into the paths of movement of and releasing corresponding intermediate stops.

60. In a calculating machine, the combination, with a series of figure wheels; a corresponding series of normally-checked independently-movable members to rotate said wheels; means for simultaneously imparting yielding forces tending to move all of said members in one direction; and positive means for returning said members; of a series of intermediate stops each normally checking movement of a corresponding member and adapted upon release to determine the distance of movement thereof; means normally checking movement of said intermediate stops; a movably-supported series of rows of normally-inoperative primary stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative primary stops into the paths of movement of and releasing intermediate stops; means independent of said primary stops to check said intermediate stops in the positions to which they are withdrawn; and means for returning the operative primary stops to normal positions.

61. In a calculating machine, the combination, with a series of figure wheels; a corresponding series of normally-checked independently-movable members to rotate said wheels; means for simultaneously imparting yielding forces tending to move all of said members in one direction; and means for positively returning said members; of a series of intermediate stops each normally checking movement of a corresponding member and adapted upon release to determine the distance of movement thereof;

a movably-supported series of rows of normally-inoperative primary stops; means for successively rendering operative any one stop in each of a predetermined number of rows, and for automatically advancing said operative stops into the paths of movement of and releasing intermediate stops; means independent of said primary stops to automatically check said intermediate stops in their retracted positions; means for automatically returning the operative primary stops to normal positions; and means for automatically releasing said retracted intermediate stops after each operation of said members.

62. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of means including stop-engaging parts to rotate said wheels; of a movably-supported continuous series of rows of normally-inoperative stops, said stops when operative being adapted to arrest and determine the extent of movement of the stop-engaging parts cooperating therewith; a single series of digit keys in operative relation to one row thereof and each adapted to render operative a corresponding stop in said row; and means for automatically advancing said rows of stops one step upon each operation of a digit key.

63. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of normally-checked independently-reciprocating members, of a movably-supported continuous series of rows of normally inoperative stops; a single series of digit keys in operative relation to one row thereof and each adapted to render operative a stop in said row; means for automatically advancing said rows of stops one step upon each operation of a digit key whereby said operative stop is brought into the path of movement of a reciprocating member; and means for releasing said member.

64. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of normally-checked independently-reciprocating members, of a movably-supported continuous series of rows of normally-inoperative stops; a single series of digit keys in operative relation to one row thereof and each adapted to render operative a stop in said row; means for automatically advancing said rows of stops one step upon each operation of a key and releasing a reciprocating member; and means for reciprocating said members.

65. In a calculating machine, the combination, with a series of figure wheels; a corresponding series of normally-checked independently-reciprocating members; of a movably-supported continuous series of rows of normally-inoperative stops; a single series of digit keys in operative relation to one row

thereof and each adapted to render operative a stop in said row; means for automatically advancing said row one step upon each operation of a key and for releasing a reciprocating member; means for reciprocating said members; and means for rendering said members inoperative prior to the primary movement of reciprocation.

66. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of normally-checked independently-reciprocating members, of a movably-supported continuous series of rows of normally-inoperative stops; a single series of digit keys in operative relation to one row of said stops and each adapted to render operative a stop thereof; means for advancing said rows of stops one step upon each operation of a key and for releasing a reciprocating member; means for reciprocating said members; and means for returning said operative stops to normal positions upon each reciprocation.

67. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of normally-checked independently-reciprocating members, of a movably-supported, continuous series of rows of normally-inoperative stops; a single series of digit keys in operative relation to one row thereof and each adapted to render operative a stop in said row; means for advancing said rows of stops one step upon each operation of a key and for releasing a reciprocating member; other independent means for controlling said stop advancing means to advance said rows of stops one or a predetermined number of steps at one operation; and means for reciprocating said members.

68. In a calculating machine, the combination, with a series of figure wheels and a corresponding series of normally-checked independently-reciprocating members, of a movably-supported continuous series of rows of normally-inoperative stops; a single series of digit keys in operative relation to one row thereof and each adapted to render operative a stop in said row; means for advancing said rows of stops one step upon each operation of a key and for releasing a reciprocating member; other independent means for controlling said stop advancing means to advance said rows of stops one or a predetermined number of steps at one operation; and means for moving said rows of stops step-by-step in a reverse direction.

69. In a calculating machine, the combination, with a series of figure wheels and a series of reciprocating members corresponding to said wheels, of a rotatable carrier provided with a series of equi-distant rows of normally-inoperative stops; and means for successively rendering operative one stop in each of a predetermined number of rows

and for automatically bringing said operative stops into the paths of movement of reciprocating members.

70. In a calculating machine, the combination, with a series of figure wheels and a series of reciprocating members corresponding to said wheels, of a rotatable carrier provided with a series of equi-distant rows of stops normally spring-pressed to a raised and inoperative position; and means for depressing one stop in each of a predetermined number of rows and for automatically bringing said depressed stops into the paths of movement of reciprocating members.

71. In a calculating machine, the combination, with a series of figure wheels and a series of normally-checked independently-reciprocating members corresponding to said wheels, of a rotatable carrier provided with a series of equi-distant rows of normally-inoperative stops; means for successively rendering operative one stop in each of a predetermined number of rows and for automatically bringing said operative stops into the paths of and releasing reciprocating members; and means for reciprocating said members.

72. In a calculating machine, the combination, with a series of figure wheels and a series of reciprocating members corresponding to said wheels, of a rotatable carrier provided with a series of equi-distant rows of normally-inoperative stops; a single series of digit keys in operative relation to one row thereof and each adapted to render operative one stop in said row, rotate said carrier one step and release a reciprocating member; and means for reciprocating said members.

73. In a calculating machine, the combination, with a series of figure wheels and a series of normally-checked reciprocating members corresponding to said wheels, of a rotatable carrier provided with a series of equi-distant rows of normally-inoperative stops; a single series of digit keys in operative relation to one row thereof and each adapted to render operative one stop in said row; means for advancing said carrier one step upon each operation of a key and for releasing a reciprocating member; independent means for advancing said carrier one or a predetermined number of steps at one operation; and means for reciprocating said members.

74. In a calculating machine, the combination, with a series of figure wheels and a series of normally-checked independently-reciprocating members, of a rotatable carrier provided with a series of equi-distant rows of stops normally spring-pressed to a raised and inoperative position; a single series of digit keys in operative relation to one row thereof and each adapted upon oper-

ation to depress one stop in said row; means for advancing said carrier one step upon each operation of a key and for releasing a reciprocating member; means for checking each operative stop in its depressed position; and means for releasing said stops upon each reciprocation of said members.

75. In a calculating machine, the combination, with a series of figure wheels and means for rotating the same, of a rotatable carrier provided with a series of equidistant rows of normally-inoperative stops; a constant source of power tending to rotate said carrier; an escapement mechanism therefor; and means for rendering operative one stop and simultaneously operating said escapement mechanism.

76. In a calculating machine, the combination with a series of figure wheels and means for rotating the same, of a rotatable carrier provided with a series of equidistant rows of normally-inoperative stops; a constant source of power tending to rotate said carrier; a step-by-step escapement mechanism therefor; means for rendering operative one stop and automatically operating said escapement mechanism; and independent means for operating said escapement mechanism.

77. In a calculating machine, the combination, with a series of figure wheels and means for rotating the same, of a rotatable carrier provided with a series of equidistant rows of normally-inoperative stops; a constant source of power tending to rotate said carrier; means for rendering operative one stop and releasing said carrier for a movement of one step; and independent means for releasing said carrier for a movement of one or a predetermined number of steps.

78. In a calculating machine, the combination, with a series of figure wheels and means for rotating the same, said means including a series of normally-checked independently-reciprocating members, of a rotatable carrier provided with a series of equidistant rows of normally-inoperative stops; an auxiliary stop in each row normally checking movement of a reciprocating member; a constant source of power tending to rotate said carrier; means for rendering operative one step in a row and thereby simultaneously releasing said auxiliary stop in said row; means for automatically releasing said carrier for a movement of one step as each stop is rendered operative; and means for reciprocating said members.

79. In a calculating machine, the combination, with a series of figure wheels and means for rotating the same, said means including a series of independently-reciprocating members, of a rotatable carrier provided with a series of equidistant rows of

stops each normally spring-pressed to an inoperative position; an auxiliary stop in each row normally checking movement of a corresponding reciprocating member; a constant source of power tending to rotate said carrier; means for setting one stop in a row in operative position and thereby automatically releasing the auxiliary stop in said row; means for automatically releasing said carrier for a movement of one step upon operation of each stop; and independent means for releasing said carrier for movement of one or a predetermined number of steps.

80. In a calculating machine, the combination with a series of figure wheels and means for rotating the same, said means including a series of independently-reciprocating members, of a rotatable carrier provided with a series of equidistant rows of normally-inoperative stops; an auxiliary stop in each row normally checking movement of a corresponding reciprocating member; a constant source of power tending to rotate said carrier; a single series of digit keys each adapted upon operation to render operative one stop in a row thereof and release said carrier for a movement of one step; and means for reciprocating said members.

81. In a calculating machine, the combination, with a series of figure wheels and means for rotating the same, said means including a corresponding series of independently-reciprocating members, of a rotatable carrier provided with a series of equidistant rows of stops each normally spring-pressed to an inoperative position; an auxiliary stop in each row normally checking movement of a reciprocating member; a constant source of power tending to rotate said carrier; a single series of digit keys in operative relation to one of said rows and each adapted to operate one stop in said row and release said carrier for a movement of one step; independent means for releasing said carrier for a movement of one or a predetermined number of steps at one operation; and means for reciprocating said members.

82. In a calculating machine, the combination, with the registering means and movable members to operate said registering means, of a constant source of power; a shaft adapted to be rotated thereby; means upon said shaft to move said members; means for automatically checking movement of said shaft after each complete rotation; and means for preventing operation of said checking means for a predetermined number of rotations.

83. The combination, in a calculating machine having a series of keys and recording devices and intermediate devices for operating the recording devices after the

setting of the keys, of a driving shaft; means for controlling it to operate said intermediate devices and for automatically and positively arresting the operation after the recording of each amount and always at the same point; and means for preventing operation of said arresting means for a predetermined number of operations of said intermediate devices.

84. The combination, in a calculating machine having a series of keys and recording devices and intermediate devices for operating the recording devices to record separate amounts and also totals after the setting of the keys, of a driving shaft; means for controlling it to operate said devices and for automatically and positively arresting the operation after the recording of each amount and at a predetermined point; and means for preventing operation of said arresting means for a predetermined number of operations upon said devices.

85. The combination, in a calculating machine, of keys; recording means; intermediate devices for actuating said means to record both separate amounts and totals; a continuously-operating driving shaft; appliances for communicating motion from the driving shaft to said means; means for positively and mechanically arresting the operation of said appliances after recording each amount and as they reach a predetermined position; and means for preventing operation of said arresting means for a predetermined number of operations upon said intermediate devices.

86. In a calculating machine, the combination of adding mechanism; keys; devices controlled by the keys for actuating the adding mechanism; a continuously rotating driving shaft; means independent of all of the keys for controlling the driving shaft to operate the actuating devices and for arresting the action automatically at a fixed point on each completed movement of the said devices; and means for preventing operation of said arresting means for a predetermined number of completed movements of the said devices.

87. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; and means for releasing said checking means and permit the same to again act to limit movement of said shaft to one rotation only; of a series of reciprocating elements; a reciprocating member common to and adapted to contact with all thereof; individual yielding connections between said member and each element; and means upon said shaft to reciprocate said member once for each rotation thereof.

88. In a calculating machine, the combination, with a shaft; means imparting a

constant force tending to rotate said shaft; means normally checking rotation thereof; and means for releasing said checking means; of a series of normally-checked reciprocating elements; a reciprocating member common to and adapted to contact with all of said elements; means upon said shaft for reciprocating said member once for each rotation thereof; individual yielding connections between said member and each of said elements; and means for releasing one or more of said elements.

89. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; and means for releasing said checking means and permit the same to again act to limit movement of said shaft to one rotation only; of a series of normally checked reciprocating elements; a reciprocating member common to and adapted to contact with all of said elements; means upon said shaft for reciprocating said member once for each rotation thereof; individual yielding connections between said member and each of said elements; and means for releasing one or more of said elements.

90. In a calculating machine, the combination of a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; means for releasing said checking means to again automatically check movement of said shaft after one rotation; and means for rendering said checking means inoperative for a predetermined number of rotations.

91. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; and means for releasing said checking means to automatically limit movement of said shaft to a predetermined plurality of rotations; of a series of reciprocating elements; suitable value-indicating means operated thereby; and connecting means between said shaft and elements to reciprocate the latter once for each rotation of said shaft.

92. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; means for releasing said checking means to automatically limit movement of said shaft to a predetermined number of rotations; of a series of reciprocating elements; a reciprocating member common to and adapted to contact with all of said elements; means upon said shaft to reciprocate said member; and yielding connections between said member and each of said elements.

93. In a calculating machine, the combination, with a shaft; means imparting a

constant force tending to rotate said shaft; means normally checking rotation thereof; and means for releasing said checking means to automatically limit movement of said shaft to a predetermined number of rotations; of a series of reciprocating elements; a reciprocating member common to and adapted to contact with all said elements; means upon said shaft to reciprocate said member once upon each rotation thereof; and individual yielding connections between said member and each of said elements.

94. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; and means for releasing said checking means to automatically limit movement of said shaft to a predetermined number of rotations; of a series of normally-checked reciprocating elements; a reciprocating member common to and adapted to contact with all of said elements; means upon said shaft for reciprocating said member; individual yielding connections between said member and each of said elements; and means for releasing any one or more of said elements.

95. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; means for releasing said checking means to again automatically check movement of said shaft after one rotation; and means for rendering said checking means inoperative for a predetermined number of rotations; of a series of reciprocating elements; and connecting means between said shaft and elements to reciprocate said elements.

96. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; means for releasing said checking means to again automatically check movement of said shaft after one rotation; and means for rendering said checking means inoperative for a predetermined number of rotations; of a series of reciprocating elements; a reciprocating member common to and adapted to contact with all of said elements; means upon said shaft for reciprocating said member; and individual yielding connections between said member and each of said elements.

97. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; means for releasing said checking means to again automatically check movement of said shaft after one rotation; and means for rendering said checking means inoperative for a predetermined number of rotations; of a series of normally-checked reciprocating

elements; a reciprocating member common to and adapted to contact with all of said elements; means upon said shaft for reciprocating said member; yielding connections between said member and each of said elements; and means for releasing any one or more of said elements.

98. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; and means for releasing said checking means to automatically limit movement of said shaft to one continuous and complete rotation only; of a series of normally-checked independently-reciprocating elements; a reciprocating member common to and adapted to contact with all of said elements; means upon said shaft for reciprocating said member; individual yielding connections between said member and each of said elements; and means for releasing one or more of said elements and simultaneously limiting the distance of reciprocation.

99. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; means for releasing said checking means to again automatically check movement of said shaft after one rotation; and means for rendering said checking means inoperative for a predetermined number of rotations; of a series of normally-checked independently-reciprocating elements; means interposed between said shaft and elements to reciprocate said elements; and means for releasing one or more of said elements and simultaneously limiting the distance of reciprocation.

100. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; means for releasing said checking means to again automatically check movement of said shaft after one rotation; and means for rendering said checking means inoperative for a predetermined number of rotations; of a series of normally-checked independently-reciprocating elements; a reciprocating member common to and adapted to contact with all of said elements; means upon said shaft for reciprocating said member; individual yielding connections between said member and each of said elements; and means for releasing one or more of said elements and simultaneously limiting the distance of reciprocation.

101. In a calculating machine, the combination, with a shaft and means for rotating said shaft; of a series of independently-rotatable figure wheels; a corresponding series of independently-reciprocating elements normally in operative engagement therewith

- to rotate said wheels; a reciprocating member common to and adapted to contact with all of said elements; means upon said shaft for reciprocating said member; individual yielding connections between said member and each of said elements; and means for automatically disengaging said wheels and elements prior to movement of the latter in one direction.
102. In a calculating machine, the combination, with a shaft and means for rotating said shaft intermittently in one direction; of a series of independently-rotatable figure wheels; a corresponding series of independently-reciprocating elements normally in operative engagement therewith to rotate said wheels; a reciprocating member common to all of said elements; means upon said shaft for reciprocating said member; individual yielding connections between said member and each of said elements; means for automatically disengaging said wheels and elements prior to movement of the latter in one direction; and means for reversing operation of said disengaging means.
103. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; and means for releasing said checking means to automatically limit movement of said shaft to one rotation only; of a series of independently-rotatable figure wheels; a corresponding series of independently-reciprocating elements normally in operative engagement therewith to rotate said wheels; a reciprocating member common to all of said elements; means upon said shaft to reciprocate said member once for each complete rotation of said shaft; individual yielding connections between said member and each of said elements; means for automatically disengaging said wheels and elements prior to movement of the latter in one direction; and means for reversing operation of said disengaging means.
104. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; means for releasing said checking means to automatically limit movement of said shaft to one rotation only; and means for rendering said checking means inoperative for a predetermined number of rotations; of a series of figure wheels; a corresponding series of reciprocating elements in operative engagement therewith to rotate said wheels; means interposed between said shaft and elements to reciprocate the latter; means for automatically disengaging said wheels and elements prior to movement of the latter in one direction; and means for reversing operation of said disengaging means.
105. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; means for releasing said checking means to automatically limit movement of said shaft to one rotation only; and means for rendering said checking means inoperative for a predetermined number of rotations; of a series of figure wheels; a corresponding series of reciprocating elements in operative engagement therewith to rotate said wheels; a reciprocating member common to and adapted to reciprocate all of said elements; means upon said shaft for reciprocating said member; means for automatically disengaging said wheels and elements prior to movement of the latter in one direction; and means for reversing operation of said disengaging means.
106. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; means for releasing said checking means to automatically limit movement of said shaft to one rotation only; and means for rendering said checking means inoperative for a predetermined number of rotations; of a series of independently-rotatable figure wheels; a corresponding series of independently-reciprocating elements normally in operative engagement therewith to rotate said wheels; a reciprocating member common to and adapted to contact with all of said elements; individual yielding connections between said member and each of said elements; means for automatically disengaging said wheels and elements prior to movement of the latter in one direction; and independent means for reversing operation of said disengaging means.
107. In a calculating machine, the combination, with a shaft and means for rotating said shaft intermittently in one direction; of a series of independently-rotatable figure wheels; a corresponding series of normally-checked independently-reciprocating elements normally in operative engagement therewith to rotate said wheels; a reciprocating member common to all of said elements; means upon said shaft for reciprocating said member; individual yielding connections between said member and each of said elements; means for releasing one or more of said elements; means for automatically disengaging each wheel and its corresponding element prior to movement of the latter in the direction of the yielding force; and means for reversing operation of said disengaging means.
108. In a calculating machine, the combination, with a shaft; means for rotating said shaft in one direction only; and means limiting movement thereof to one rotation; of a series of independently-rotatable figure wheels; a corresponding series of normally-checked independently-reciprocating elements normally in operative engagement therewith to rotate said wheels; a reciprocating member common to and adapted to reciprocate all of said elements; means upon said shaft for reciprocating said member; means for automatically disengaging said wheels and elements prior to movement of the latter in one direction; and means for reversing operation of said disengaging means.

ure wheels; a corresponding series of normally-checked independently-reciprocating elements normally in operative engagement therewith to rotate said wheels; a reciprocating member common to all of said elements; means interposed between said shaft and member to reciprocate said member; individual yielding connections between said member and each of said elements; means for releasing one or more of said elements; means for automatically disengaging said wheels and elements prior to movement of the latter in the direction of the yielding force; and means for reversing operation of said disengaging means.

109. In a calculating machine, the combination, with a shaft, means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; and means for releasing said checking means to automatically limit movement of said shaft to one continuous rotation only; of a series of independently-rotatable figure wheels; a corresponding series of normally-checked independently-reciprocating elements normally in operative engagement therewith to rotate said wheels; a reciprocating member common to all of said elements; means upon said shaft to reciprocate said member; individual yielding connections between said member and each of said elements; means for releasing one or more of said elements; means for automatically disengaging each wheel and its corresponding element prior to movement of the latter in the direction of the yielding force; and means for reversing operation of said disengaging means.

110. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; means for releasing said checking means to automatically limit movement of said shaft to one rotation only; and means for rendering said checking means inoperative for a predetermined number of rotations; of a series of independently-rotatable figure wheels; a corresponding series of normally-checked independently-reciprocating elements normally in operative engagement therewith to rotate said wheels; means interposed between said shaft and elements to reciprocate the latter; means for releasing any one or more of said elements; means for automatically disengaging said wheels and elements prior to movement in one direction; and means for reversing operation of said disengaging means.

111. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; means for releasing said checking means to automatically limit movement of said shaft

to one rotation only; and means for rendering said checking means inoperative for a predetermined number of rotations; of a series of independently-rotatable figure wheels; a corresponding series of normally-checked independently-reciprocating elements normally in operative engagement therewith to rotate said wheels; a reciprocating member common to and adapted to reciprocate all of said elements; means upon said shaft to reciprocate said member; means for releasing one or more of said elements; means for automatically disengaging said wheels and elements prior to movement of the latter in one direction; and means for reversing operation of said disengaging means.

112. In a calculating machine, the combination, with a shaft; means imparting a constant force tending to rotate said shaft; means normally checking rotation thereof; means for releasing said checking means to automatically limit movement of said shaft to one rotation only; and means for rendering said checking means inoperative for a predetermined number of rotations; of a series of independently-rotatable figure wheels; a corresponding series of normally-checked independently-reciprocating elements normally in operative engagement therewith to rotate said wheels; a reciprocating member common to and adapted to contact with all of said elements; individual yielding connections between said member and each of said elements; means for releasing any one or more of said elements; means for automatically disengaging said wheels and elements prior to movement of the latter in the direction of the yielding force; and means for reversing operation of said disengaging means.

113. In a calculating machine, the combination, with the registering means and reciprocating members to operate said registering means; of movable stops normally checking movement of said members and each adapted upon withdrawal to determine the distance of reciprocation of its corresponding member.

114. In a calculating machine, the combination, with the registering means and reciprocating members to operate said registering means; of movable stops normally checking movement of said members and each adapted to be withdrawn and to determine the distance of reciprocation of its corresponding member by the distance of withdrawal.

115. In a calculating machine, the combination, with the registering means, of pivoted reciprocating members to operate said registering means, each of said members being provided with a spirally segmental portion having a series of stop-engaging means; movable stops normally checking movement

of said members and adapted to be withdrawn to release said members and arrest movement thereof through engagement with any one of said stop-engaging means.

116. In a calculating machine, the combination of a plurality of keys; devices adapted to be set by said keys; mechanism which includes means adapted to cooperate with said devices to determine the operation of said mechanism; a power-driven shaft; connections for transmitting power from said shaft while rotating to said devices to move the latter; and means under control of an operator for controlling said action of the connections.

117. In a calculating machine, the combination of a plurality of keys; devices adapted to be set by said keys; mechanism which includes means adapted to cooperate with said devices to determine the operation of said mechanism; a power-driven shaft for actuating said mechanism; connections for transmitting power from said shaft while rotating to said devices to move the latter; and means under control of an operator for controlling said action of the connections.

118. In a calculating machine, the combination of a plurality of key-stops; keys for setting said stops; a power-driven shaft; connections for transmitting power from said shaft while running to said stops to move the latter; means under control of an operator for controlling said action of the connections; and mechanism which includes means adapted to cooperate with said stops to determine the operation of said mechanism.

119. In a calculating machine, the combination with a plurality of key-stops; keys for setting said stops; mechanism which includes means adapted to cooperate with said stops to determine the operation of said mechanism; a power driven shaft for actuating said mechanism; connections for transmitting power from said shaft while rotating to said key-stops to move the latter; and means under control of an operator for controlling said action of the connections.

120. The combination of a plurality of keys; a plurality of rows of key-stops; a power-driven shaft; connections for transmitting power from said shaft while rotating to said rows of stops to move the same successively into operative relation to said keys; means under control of an operator for controlling said action of the connections in moving the rows of stops; and mechanism which includes means adapted to cooperate with said stops to determine the operation of said mechanism.

121. The combination of a plurality of keys; devices adapted to be set by said keys and when set to arrest and determine the extent of movement of means cooperating

therewith; mechanism which includes means adapted to cooperate with said devices to determine the operation of said mechanism; and means for advancing said devices each repeatedly into operative relation with the keys by movement in one direction.

122. The combination of a plurality of keys; devices adapted to be set by said keys and when set to arrest and determine the extent of movement of means cooperating therewith; mechanism which includes means adapted to cooperate with said devices to determine the operation of said mechanism; and means for moving said devices over a continuous path to repeatedly present the same *seriatim* into operative relation with said keys by movement along said path in one direction.

123. The combination of a plurality of keys; devices adapted to be set by said keys; mechanism which includes means adapted to cooperate with said devices to determine the operation of said mechanism; power-driven means for moving said devices over a continuous path to repeatedly present the same *seriatim* into operative relation with said keys by movement along said path in one direction; and means under control of an operator for controlling movement of said devices by said power-driven means.

124. The combination of a plurality of keys; devices adapted to be set by said keys; mechanism which includes means adapted to cooperate with said devices to determine the operation of said mechanism; power-driven means for moving said rows of stops over a continuous path to repeatedly present the same *seriatim* into operative relation with said keys by movement along said path in one direction; and means under control of an operator for controlling movement of the rows of stops by said power-driven means.

125. In a calculating machine, the combination of a rotatable carrier; a plurality of keys; devices mounted on said carrier and adapted to be set by actuation of the keys; mechanism which includes means adapted to cooperate with said devices to determine the operation of said mechanism; and means for rotating said carrier to bring succeeding devices into operative relation with said keys.

126. In a calculating machine, the combination of a rotatable carrier; a plurality of keys; devices mounted on said carrier and adapted to be set by actuation of the keys; mechanism which includes means adapted to cooperate with said devices to determine the operation of said mechanism; and power-driven means under control of an operator to rotate said carrier to bring succeeding devices into operative relation with said keys.

127. In a calculating machine, the combination of a rotatable carrier; a plurality of keys; a plurality of rows of key-stops mounted on said carrier and adapted to be set by actuation of the keys; mechanism which includes means adapted to cooperate with said stops to thereby determine the operation of said mechanism; and means for rotating said carrier to bring said rows of stops *seriatim* into operative relation with said keys.

128. In a calculating machine, the combination of a rotatable carrier; a plurality of keys; a plurality of rows of key-stops mounted on said carrier and disposed around its axis of rotation to form an endless succession of equi-distant rows, said stops being adapted to be set by actuation of the keys; mechanism which includes means adapted to cooperate with said stops to thereby determine the operation of said mechanism; and means for rotating said carrier to bring said rows of stops *seriatim* into operative relation to said keys.

129. In a calculating machine, the combination of a rotatable carrier; a plurality of keys; a plurality of rows of key-stops mounted on said carrier and disposed around its axis of rotation to form an endless succession of equi-distant rows, said stops being adapted to be set by actuation of the keys; mechanism which includes means adapted to cooperate with said stops to thereby determine the operation of said mechanism; and power-driven means under control of an operator to rotate said carrier to bring said rows of stops *seriatim* into operative relation with said keys.

130. In a calculating machine, the combination of a rotatable carrier; a plurality of keys; a plurality of rows of key-stops mounted on said carrier and disposed around its axis of rotation to form an endless succession of equi-distant rows, said stops being adapted to be set by actuation of the keys; mechanism which includes means adapted to cooperate with said stops to thereby determine the operation of said mechanism; and power-driven means controlled by actuation of the keys to intermittently rotate the carrier to bring succeeding rows of stops into operative relation with said keys.

131. In a calculating machine, the combination of a rotatable carrier; a plurality of rows of key-stops mounted on said carrier and disposed around its axis of rotation to form an endless succession of equi-distant rows; a plurality of keys for setting said stops; mechanism including means adapted to cooperate with said stops to determine the operation of said mechanism according to the setting of the stops; power-driven means for intermittently rotating said carrier and for actuating said mechanism; and

means under control, of an operator for controlling said action of the power-driven means.

132. In a calculating machine, the combination with a rotatable carrier and devices thereon; a plurality of keys for setting said devices; mechanism including means adapted to cooperate with said devices to determine the operation of said mechanism; means for rotating said carrier to bring the different devices into operative relation with said keys; and an escapement controlling said rotation of the carrier and adapted to be actuated by an operator.

133. The combination of a rotatable carrier and devices thereon adapted to be set to determine the operation of mechanism adapted to cooperate therewith; means for rotating said carrier; an escapement controlling the rotation of the carrier by said rotating means; and a plurality of keys the operation of which actuates said escapement.

134. The combination of a rotatable carrier and devices thereon adapted to be set to determine the operation of mechanism adapted to cooperate therewith; means for rotating said carrier; an escapement controlling the rotation of the carrier by said rotating means; one or more keys each operation of which actuates said escapement to effect rotation of the carrier one step; and one or more keys each operation of which actuates said escapement to effect rotation of the carrier a plurality of steps.

135. The combination of a rotatable carrier and devices thereon adapted to be set to determine the operation of mechanism adapted to cooperate therewith; means for rotating said carrier; an escapement controlling the rotation of the carrier by said rotating means; a plurality of keys for setting the devices on the carrier and each operation of which keys actuates said escapement to effect rotation of the carrier one step; and a plurality of keys adapted when operated to respectively actuate said escapement to effect rotation of said carrier different numbers of steps.

136. The combination of a rotatable carrier; a plurality of rows of key-stops mounted on said carrier; means for rotating said carrier; an escapement controlling the rotation of the carrier by said rotating means; and a plurality of keys for setting said key-stops and thereby determining the operation of mechanism adapted to cooperate therewith, the operation of said keys also actuating said escapement to effect step-by-step rotation of the carrier to bring said rows of key-stops *seriatim* into operative relation with said keys.

137. The combination of a rotatable carrier; a plurality of rows of key-stops mounted on said carrier; means for rotating

said carrier; an escapement controlling the rotation of the carrier by said rotating means; a plurality of keys for setting said key-stops and thereby determining the operation of mechanism adapted to cooperate therewith, the operation of said keys also actuating said escapement to effect step-by-step rotation of the carrier to bring said rows of key-stops *seriatim* into operative relation with said keys; and a plurality of other keys adapted when operated to actuate the escapement to effect rotation of the carrier one, two or more steps corresponding to the different keys.

138. The combination of a rotatable carrier and devices thereon adapted to be set to determine the operation of mechanism adapted to cooperate therewith; power-driven means for rotating said carrier; an escapement controlling the rotation of the carrier by said power-driven rotating means; and a plurality of keys the operation of which actuates said escapement.

139. The combination of a rotatable carrier and devices thereon adapted to be set to determine the operation of mechanism adapted to cooperate therewith; power-driven means for rotating said carrier; an escapement controlling the rotation of the carrier by said power-driven rotating means; a plurality of keys for setting the devices on the carrier and each operation of which keys actuates said escapement to effect rotation of the carrier one step; and one or more keys each operation of which actuates said escapement to effect rotation of the carrier a plurality of steps.

140. The combination of a rotatable carrier; a plurality of rows of key-stops mounted on said carrier; power-driven means for rotating said carrier; an escapement controlling the rotation of the carrier by said power-driven rotating means; and a plurality of keys for setting said key-stops and thereby determining the operation of mechanism adapted to cooperate therewith, the actuation of said keys also operating said escapement to effect step-by-step rotation of the carrier to bring said rows of stops *seriatim* into operative relation with said keys.

141. The combination of a rotatable carrier; a plurality of rows of key-stops on said carrier; power-driven means for rotating said carrier; an escapement controlling the rotation of the carrier by said power-driven rotating means; a plurality of keys for setting said key-stops and thereby determining the operation of mechanism adapted to cooperate therewith, the operation of said keys also actuating said escapement to effect step-by-step rotation of the carrier to bring said rows of stops *seriatim* into operative relation with said keys; and a plurality of other keys adapted when operated to actuate the escapement to effect rotation

of the carrier; and a plurality of keys the responding to the different keys.

142. The combination of a movable carrier having thereon devices adapted to be set to determine the operation of mechanism adapted to cooperate therewith; means for imparting movement to said carrier; a rotary escapement controlling said movement of the carrier; and a plurality of keys the operation of which actuates said escapement to effect intermittent movement of the carrier by its said moving means.

143. The combination of a rotary carrier; a plurality of rows of key-stops mounted on said carrier and adapted to be set to determine the operation of mechanism adapted to cooperate therewith; means for rotating said carrier; a rotary escapement controlling said rotation of the carrier by said means; and a plurality of keys for setting said stops and which keys when operated also actuate said escapement to effect intermittent rotation of the carrier.

144. The combination of a rotary carrier; a plurality of rows of key-stops mounted on said carrier and adapted to be set to determine the operation of mechanism adapted to cooperate therewith; means for rotating said carrier; a rotary escapement controlling said rotation of the carrier by said means; a plurality of keys for setting said stops and which keys when operated also actuate said escapement to effect intermittent rotation of the carrier.

145. The combination of a movable carrier, and devices mounted thereon and adapted to be set to determine the operation of mechanism adapted to cooperate therewith; means for moving said carrier; a rotary escapement controlling said movement of the carrier, said escapement comprising a plurality of stops disposed when in action to limit movement of the carrier to different numbers of steps; and keys adapted when actuated to respectively render correspondingly positioned stops of the escapement active.

146. The combination of a rotatable carrier; a series of rows of key-stops mounted thereon and adapted to be set to determine the operation of mechanism adapted to cooperate therewith; means for rotating said carrier; a rotary escapement controlling said movement of the carrier, said escapement comprising a plurality of stops disposed when in action to limit rotation of the carrier to different numbers of steps; and keys adapted when actuated to respectively render correspondingly positioned stops of the escapement active.

147. The combination of a rotatable carrier; a series of rows of key-stops mounted thereon and adapted to be set to determine the operation of mechanism adapted to cooperate therewith; means for rotating said

carrier; a rotary escapement controlling said movement of the carrier, said escapement comprising a plurality of stops disposed when in action to limit rotation of the carrier to different numbers of steps; a plurality of keys each adapted when actuated to set a corresponding key-stop in a row of said key-stops, and to actuate said escapement to render active one of said stops thereof which limits the rotation of the carrier to one step to bring the next succeeding row of key-stops into operative relation with said keys; and other keys adapted to actuate said escapement to render active stops thereof which limit the rotation of the carrier to one, two or more steps corresponding to the different keys.

148. The combination of a rotatable carrier; a series of rows of key-stops mounted thereon and adapted to be set to determine the operation of mechanism adapted to cooperate therewith; means for rotating said carrier; a rotary escapement controlling said rotation of the carrier, said escapement comprising a plurality of stops disposed when in action to limit rotation of the carrier to different numbers of steps; a plurality of "numeral-keys" each adapted when actuated to set a corresponding key-stop in a row of said key-stops, and to actuate said escapement to render active one of said stops thereof which limits the rotation of the carrier to one step to bring the next succeeding row of key-stops into operative relation with said numeral-key; other "cipher-keys" adapted to actuate said escapement to render active said stops thereof which limit the rotation of the carrier to one, two or more steps corresponding to the different cipher-keys; and means adapted to be operated, by the simultaneous actuation of a numeral-key and a cipher-key, to actuate said escapement to render active an appropriate stop thereof to effect rotation of the carrier through one or more steps corresponding to the particular cipher-key, and an additional stop for the numeral-key.

149. The combination of a series of keys; devices adapted to be set by operation of and in accordance with the numerical value of the keys; mechanism including elements adapted to cooperate with said devices to transfer to said mechanism the number set up on said devices; and means for relatively moving said mechanism and devices to bring them into cooperative engagement a predetermined number of times—one or more—then automatically locking said mechanism and devices against further relative movement, thereby transferring the number set up on the devices to said mechanism a corresponding number of times.

150. The combination of a plurality of devices adapted to be set to represent a desired number; mechanism including ele-

ments adapted to cooperate with said devices to transfer to said mechanism the number set up on said devices; a plurality of numeral keys of different values; and means for operating and controlling said mechanism and devices as set to bring them into cooperating engagement a number of times predetermined by actuation of said numeral keys and corresponding to the numerical value thereof, and to then automatically arrest said operation.

151. The combination of a single series of keys; devices adapted to be set by operation of said keys to represent a desired number; mechanism including elements adapted to cooperate with said devices to transfer to said mechanism the number set up on said devices; and means for operating and controlling said mechanism and devices as set to bring them into cooperative engagement a number of times predetermined by actuation of said numeral keys and corresponding to the numerical value thereof, and to then automatically arrest said operation.

152. The combination of a rotary carrier; a series of rows of stops mounted on said carrier; a series of keys and cooperating means for setting said stops to represent a desired number and for automatically rotating said carrier step-by-step to bring successive rows of stops into position to be operated upon by said keys; mechanism including elements adapted to cooperate with said stops to transfer to said mechanism the number set up on the stops; and means for operating and controlling said mechanism and the stops as set to bring them into cooperating engagement a number of times predetermined by further actuation of said keys and corresponding to the numerical value thereof, and to then automatically arrest said operation.

153. The combination of a movable carrier; a series of devices mounted on said carrier; a series of keys and cooperating means for setting said devices to represent a desired number and for automatically advancing said carrier step-by-step to bring successive devices into position to be operated upon by said keys; mechanism including elements adapted to cooperate with said devices to transfer to said mechanism the number set up on said devices; driving means operable to bring said mechanism and devices as set into cooperating engagement to effect said transfer; and stops one corresponding to each of said keys and adapted to be set to active position by its key to arrest the operation when the devices and elements have been brought into cooperating engagement a number of times corresponding to the numerical value of the key.

154. The combination of a rotatable carrier; a series of rows of stops mounted on said carrier; a series of keys and cooperat-

ing means for setting said stops to represent a desired number and for automatically advancing said carrier step-by-step to bring successive rows of stops into operative position with relation to said keys; mechanism including elements adapted to cooperate with said stops to transfer to said mechanism the number set up on said stops; driving means operable to bring said mechanism and stops as set into cooperating engagement; and other stops one corresponding to each of said keys and adapted to be set to active position by its key to arrest the operation when the first-mentioned stops and said elements have been brought into engagement a number of times corresponding to the numerical value of the key.

155. The combination of a series of keys; devices adapted to be set by operation of and in accordance with the numerical values of the keys; mechanism including elements adapted to cooperate with said devices to transfer to said mechanism the number set up on said devices; power-driven means adapted to operate to bring said mechanism and devices into cooperative engagement; means under control of an operator to render said power-driven means active and to thereafter automatically render the same inactive after said mechanism and devices have been brought into cooperative engagement a number of times—one or more—predetermined by said means under the operator's control.

156. The combination of keys; a movable carrier having a series of rows of stops thereon adapted to be set by said keys to represent a desired number; mechanism including elements adapted to cooperate with said stops to transfer to said mechanism the number set up on the stops; power-driven means adapted to operate to bring said mechanism and stops into cooperative engagement; and means adapted to be brought into action by operation of said keys to determine, in accordance with the numerical values of the keys, the number of times said mechanism and stops are brought into cooperative engagement by said power-driven means.

157. The combination of a movable carrier having a series of rows of stops thereon; power-driven means for moving said carrier; keys for setting said stops to represent a desired number and controlling the action of said power-driven means to move the carrier step-by-step to bring the rows of stops successively into position to be operated upon by said keys; mechanism including elements adapted to cooperate with said stops to transfer to said mechanism the number set up on the stops; power-driven means adapted to operate to bring said mechanism and stops into cooperative engagement; and means adapted to be

brought into action by operation of said keys to determine, in accordance with the numerical values of the keys; the number of times said mechanism and stops are brought into cooperative engagement by said power-driven means.

158. The combination of a rotary carrier having a series of rows of stops thereon; keys for setting said stops to represent a desired number; mechanism including elements adapted to cooperate with said stops to transfer to said mechanism the number set up on the stops; power-driven means adapted to operate to bring said mechanism and stops into cooperative engagement; and means adapted to be brought into action by operation of said keys to determine, in accordance with the numerical values of the keys, the number of times said mechanism and stops are brought into cooperative engagement by said power-driven means.

159. The combination of a rotary carrier having a series of rows of stops thereon; power-driven means for rotating said carrier; keys for setting said stops to represent a desired number and controlling the action of said power-driven means to rotate the carrier step-by-step to bring the rows of stops successively into position to be operated upon by said keys; mechanism including elements adapted to cooperate with said stops to transfer to said mechanism the number set up on the stops; power-driven means adapted to operate to bring said mechanism and stops into cooperative engagement; and means adapted to be brought into action by operation of said keys to determine, in accordance with the numerical values of the keys, the number of times said mechanism and stops are brought into cooperative engagement by said power-driven means.

160. The combination of a rotary carrier having a series of rows of stops thereon; power-driven means operable through an escapement to rotate said carrier; keys for setting said stops to represent a desired number and actuating said escapement to rotate the carrier step-by-step to bring the rows of stops successively into position to be operated upon by said keys; mechanism including elements adapted to cooperate with said stops to transfer to said mechanism the number set up on the stops; power-driven means operable through an escapement to bring said mechanism and stops into cooperative engagement; and means adapted to be brought into action by operation of the keys to control the operation of the escapement in accordance with the numerical values of the keys and thereby determine the number of times said mechanism and stops are brought into cooperative engagement by said power-driven means.

161. The combination of a rotatable car-

rier having a series of rows of stops thereon; keys for setting said stops to represent a desired number; mechanism including elements adapted to cooperate with said stops to transfer to said mechanism the number set up on the stops; power-driven means operable through an escapement to bring said mechanism and stops into cooperative engagement; and means adapted to be brought into action by operation of the keys to control the operation of the escapement in accordance with the numerical values of the keys and thereby determine the number of times said mechanism and stops are brought into cooperative engagement by said power-driven means.

162. The combination of devices adapted to be set to represent a desired number; mechanism including elements adapted to be brought into cooperative engagement with said devices to transfer to said mechanism the number set up on said devices; a series of keys; and stops one corresponding to and adapted to be set by the operation of each key to limit and determine the number of cooperative engagements between said mechanism and devices in accordance with the different values represented by the keys.

163. The combination of devices adapted to be set to represent a desired number; mechanism including elements adapted to be brought into cooperative engagement with said devices to transfer to said mechanism the number set up on said devices; an element adapted to be advanced a predetermined distance each time said devices and mechanism are brought into cooperating engagement; a series of keys; and stops one corresponding to each key and adapted by the operation thereof to be set in the path of movement of said element to limit movement of the latter to a total distance corresponding to the value of the particular key operated.

164. The combination of a series of keys; stops adapted to be set by said keys to represent a desired number; mechanism including elements adapted to be brought into cooperative engagement with said stops to transfer to said mechanism the number set up on the stops; and other stops one corresponding to and adapted to be set by the operation of each key to limit and determine the number of cooperative engagements between said mechanism and devices in accordance with the different values represented by the keys.

165. The combination of devices adapted to be set to represent a desired number; mechanism including elements adapted to be brought into cooperative engagement with said devices to transfer to said mechanism the number set up on said devices; power-driven means operating to move said mechanism and devices into cooperating en-

gagement; a series of keys; stops one corresponding to and adapted to be set by the operation of each key to limit and determine the number of cooperating engagements between said mechanism and devices in accordance with the different values represented by the keys; and a "multiplication-key" or device the operation of which renders the action of said power-driven means, in bringing said devices and mechanism into cooperating engagement, subject to control by said stops.

166. The combination of devices adapted to be set to represent a desired number; a series of numeral keys for setting said devices; and a "multiplication-key" or device operable to effect the return to normal position of any of said devices set by subsequent operation of a numeral key.

167. The combination of devices adapted to be set to represent a desired number; a series of numeral keys for setting said devices; and a "multiplication-key" or device operable to nullify subsequent operation of the numeral keys with respect to said devices.

168. The combination of a rotatable carrier; a series of rows of stops on said carrier; numeral keys for setting said stops to represent a desired number; means for advancing the carrier step-by-step to bring successive rows of stops into position to be actuated by the keys; mechanism including elements adapted to be brought into cooperative engagement with the stops to transfer to said mechanism the number set up on the stops; and a "multiplication-key" or device operable to effect the return to normal position of any of said stops set by operation of a numeral key subsequent to operation of said multiplication-key and without affecting stops set by the keys previous to the operation of said multiplication key.

169. The combination of a movable carrier; stops mounted thereon; keys for setting said stops to represent a desired number; mechanism including elements adapted to be brought into cooperating engagement with said stops to transfer to said mechanism the number set up on the stops; and unitary means operable without further movement of the carrier to restore to normal position all stops, whether one or a plurality which have been set by operation of the keys.

170. The combination of a movable carrier; stops mounted thereon; keys for setting said stops to represent a desired number; mechanism including elements adapted to be brought into cooperating engagement with said stops to transfer to said mechanism the number set up on the stops; and means operating automatically after said mechanism and stops have been brought

into cooperating engagement, and without further movement of the carrier, to restore to normal position those stops which have been set by operation of the keys.

171. The combination of a rotatable carrier having thereon rows of stops adapted to be set to represent a desired number; keys for setting said stops; and unitary means operable without further movement of the carrier to restore to normal position those stops whether in one or a plurality of the rows which have been set by operation of the keys.

172. The combination of a rotatable carrier having thereon rows of stops adapted to be set to represent a desired number; keys for setting said stops; mechanism including elements adapted to be brought into cooperating engagement with said stops to transfer to said mechanism the number set up on the stops; and means operating automatically, after said mechanism and stops have been brought into cooperating engagement and without further movement of the carrier, to restore to normal position those stops which have been set by operation of the keys.

173. The combination with a movable carrier; stops mounted thereon; keys for setting said stops to represent a desired number; mechanism including elements adapted to be brought into cooperating engagement with said stops to transfer to said mechanism the number set up on the stops; means operating automatically, after said mechanism and stops have been brought into cooperating engagement, to restore to normal position those stops which have been set by operation of the keys; and means operable to throw said stop-restoring means out of operation.

174. The combination of a series of figure wheels; mechanism upon which numbers are adapted to be set up; means including a rack for rotating each figure wheel for transferring to said wheels numbers set up on said mechanism; means acting to impart an extra movement to the rack of any wheel to "carry ten" to said wheel from the wheel of next-lowest order; and means operable to prevent such extra carrying-ten movement of the rack of one wheel.

175. The combination of a series of figure wheels; mechanism upon which numbers are adapted to be set up; means including a rack for rotating each figure wheel for transferring to said wheels numbers set up on said mechanism; means including a spring-impelled lever acting to impart an extra movement to the rack of any wheel to "carry ten" to said wheel from the wheel of next-lowest order; and means operable to prevent such extra carrying-ten movement of the rack of one wheel.

176. The combination of a series of keys; a rotatable carrier having devices thereon adapted to be set by the keys to represent desired numbers; means controlled by operation of the keys to intermittently rotate the carrier in one direction; and a special key or device operable to rotate the carrier in the other direction.

177. The combination of a series of devices or stops adapted to be set to represent a desired number, and with which other parts of the mechanism are adapted to cooperate in transferring to said mechanism the said number; a movable carrier on which said devices or stops are mounted; a series of visibly disposed indicating devices movable with said carrier; and a series of keys operable to set said devices or stops to represent the desired number and at the same time to effect setting of corresponding of the indicating devices to visibly display said number.

178. The combination of a series of devices or stops adapted to be set to represent a desired number and with which other parts of the mechanism are adapted to cooperate in transferring to said mechanism the said number; a series of visibly disposed indicating devices; a series of keys operable to set said devices or stops to represent the desired number and at the same time to effect setting of corresponding of the indicating devices to visibly display said number; and means operating automatically, after transfer of the number from the devices or stops, to restore the stops and indicating devices to their normal positions.

179. The combination of a series of type bars; hammers one corresponding to each type bar, each hammer (with the exception of the one for the type-bar of highest order) having a lug thereon overlapping the hammer of the type-bar of next-highest order, whereby actuation of one hammer will simultaneously actuate all hammers of type-bars of lower order.

180. The combination of a series of keys; devices adapted to be set by and in accordance with the operation of said keys; mechanism including elements adapted to cooperate with said devices to operate said mechanism in accordance with the setting of the devices; means for relatively shifting said mechanism and devices as set to enable each device once set to cooperate with one of said elements in an original relationship and with another of said elements in a shifted relationship of said mechanism and devices; and means for relatively moving said mechanism and devices to bring them into cooperative engagement in each of said original and shifted relationships.

181. The combination of a series of keys; devices adapted to be set by and in accordance with the operation of said keys; mech-

anism including elements adapted to co-operate with said devices to operate said mechanism in accordance with the setting of the devices; means for relatively shifting said mechanism and devices as set to enable each device once set to coöperate with one of said elements in an original relationship and with another of said elements in a shifted relationship of said mechanism and devices; means for relatively moving said mechanism and devices to bring them into coöperative engagement one or a plurality of times in each of said original and shifted relationships; and means operable to limit said coöperative engagements to a predetermined number in each relationship.

182. The combination of a series of keys; devices adapted to be set by and in accordance with the operation of said keys; mechanism including elements adapted to co-operate with said devices to operate said mechanism in accordance with the setting of the devices; means for relatively shifting said mechanism and devices as set to enable each device once set to coöperate with one of said elements in an original relationship and with another of said elements in a shifted relationship of said mechanism and devices; means for relatively moving said mechanism and devices to bring them into coöperative engagement one or a plurality of times in each of said original and shifted relationships; and means operable to predetermine the number of coöperate engagements in each relationship and to automatically lock the parts against further movement when said number of engagements has been effected.

183. The combination of a series of keys; devices adapted to be set by and in accordance with the operation of said keys; mechanism including elements adapted to co-operate with said devices to operate said mechanism in accordance with the setting of the devices; means for relatively advancing said mechanism and devices as set to enable each device once set to coöperate with one of said elements in an original relationship and with a different one of said elements in each advanced relationship of said mechanism and devices; and means for relatively moving said mechanism and devices to bring them into coöperative engagement one or a plurality of times in each of said original and advanced relationships.

184. The combination of a series of keys; devices adapted to be set by and in accordance with the operation of said keys; mechanism including elements adapted to co-operate with said devices to operate said mechanism in accordance with the setting of the devices; means for relatively advancing said mechanism and devices as set to enable each device once set to coöperate with one of said elements in an original relationship and

with a different one of said elements in each advanced relationship of said mechanism and devices; means for relatively moving said mechanism and devices to bring them into coöperative engagement one or a plurality of times in each of said original and advanced relationships; and means also operable by said keys to predetermine and limit the number of coöperations in each of said relationships.

185. The combination of a series of keys; devices adapted to be set by and in accordance with the operation of said keys; mechanism including elements adapted to co-operate with said devices to operate said mechanism in accordance with the setting of the devices; means for automatically restoring the set devices to their normal inoperative positions after coöperative engagement of the devices and elements; means under control of an operator for throwing said automatic restoring means out of operation; means for relatively advancing said mechanism and devices as set to enable each device once set to coöperate with one of said elements in an original relationship and with a different one of said elements in each advanced relationship of said mechanism and devices; and means for relatively moving said mechanism and devices to bring them into coöperative engagement one or a plurality of times in each of said original and advanced relationships.

186. The combination of a series of keys; a movable carrier; stops or devices mounted on said carrier and adapted to be set by and in accordance with the operation of said keys; mechanism including elements adapted to coöperate with said stops to operate said mechanism in accordance with the setting of the stops; means for advancing said carrier, with its stops as set, relative to said elements to enable each stop once set to coöperate with one of said elements in an original relationship and with a different one of said elements in each advanced relationship of said mechanism and stops; and means for relatively moving said mechanism and stops to bring them into coöperative engagement one or a plurality of times in each of said original and advanced relationships.

187. The combination of a series of keys; a movable carrier; stops or devices mounted on said carrier and adapted to be set by and in accordance with the operation of said keys; mechanism including elements adapted to coöperate with said stops to operate said mechanism in accordance with the setting of the stops; means for advancing said carrier, with its stops as set, relative to said elements to enable each stop once set to coöperate with one of said elements in an original relationship and with a different one of said elements in each advanced relationship of said mechanism and stops; means for rela-

tively moving said mechanism and stops to bring them into coöperative engagement one or a plurality of times in each of said original and advanced relationships; and
5 means operable to predetermine and limit the number of coöperations in each of said relationships.

188. The combination of a series of keys; a movable carrier; stops or devices mounted on said carrier and adapted to be set by
10 and in accordance with the operation of said keys; mechanism including elements adapted to coöperate with said stops to operate said mechanism in accordance with
15 the setting of the stops; means for automatically restoring the set stops to their normal inoperative positions after coöperative engagement of the stops and elements; means under control of an operator for
20 throwing said automatic restoring means out of operation; means operable to advance the carrier step-by-step to change the relationship of the stops and elements; and means for relatively moving said mechanism and stops to bring them into coöperative
25 engagement one or a plurality of times in each of said original and advanced relationships.

189. The combination with a series of
30 keys; a carrier movable in a continuous endless path; stops or devices mounted on said carrier and adapted to be set in accordance with the operation of said keys; means operable to intermittently advance said carrier over its path; mechanism including
35 elements adapted to coöperate with the stops to operate said mechanism in accordance with the setting of the stops; means for automatically restoring set stops to their normal inactive position after coöperative engagement of the stops and elements; means for throwing said stop-restoring means out of operation; and means for relatively moving said stops and elements
40 into coöperative engagement in different positions of the movable carrier.

190. The combination with a series of
50 keys; a carrier movable in a continuous endless path; stops or devices mounted on said carrier and adapted to be set in accordance with the operation of said keys; means operable to intermittently advance said carrier over its path; mechanism including elements adapted to coöperate with the stops to operate said mechanism in accordance with the setting of the stops; means for automatically restoring set stops to their normal inactive position after coöperative engagement of the stops and elements; means for throwing said stop-restoring means out of operation; means for relatively moving said stops and elements into coöperative engagement in different positions of the movable carrier; and means
65 operable to predetermine and limit the num-

ber—one or more—of said coöperative engagements in each of said different positions.

191. The combination with a series of
70 keys; a carrier movable in a continuous endless path; stops or devices mounted on said carrier and adapted to be set in accordance with the operation of said keys; means operable to intermittently advance said carrier over its path; mechanism including elements adapted to coöperate with the stops to operate said mechanism in accordance with the setting of the stops; means for automatically restoring set stops to their normal inactive position after coöperative
80 engagement of the stops and elements; means for throwing said stop-restoring means out of operation; means for relatively moving said stops and elements into coöperative engagement in different positions
85 of the movable carrier; and means also operable by said keys to predetermine and limit the number—one or more—of said coöperative engagements, in each of said different positions, corresponding to different numerical values represented by the
90 keys.

192. The combination with a series of
95 keys; a rotatable carrier; stops or devices mounted on said carrier and adapted to be set in accordance with the operation of said keys; means operable to intermittently rotate said carrier; mechanism including elements adapted to coöperate with the stops to operate said mechanism in accordance with
100 the setting of the stops; means for automatically restoring set stops to their normal inactive position after coöperative engagement of the stops and elements; means for throwing said stop-restoring means out of operation; and means for relatively moving said stops and elements into coöperative engagement in different positions of the movable carrier.

193. The combination with a series of
110 keys; a rotatable carrier; stops or devices mounted on said carrier and adapted to be set in accordance with the operation of said keys; means operable to intermittently rotate said carrier; mechanism including
115 elements adapted to coöperate with the stops to operate said mechanism in accordance with the setting of the stops; means for automatically restoring set stops to their normal inactive position after coöperative engagement of the stops and elements; means for throwing said stop-restoring means out of operation; means for relatively moving said stops and elements into coöperative engagement in different positions
120 of the movable carrier; and means also operable by said keys to predetermine and limit the number—one or more—of said coöperative engagements, in each of said different positions, corresponding to differ-
130

ent numerical values represented by the keys.

194. The combination of a series of keys; devices adapted to be set by and in accordance with the operation of said keys; mechanism including elements adapted to cooperate with said devices to operate said mechanism in accordance with the setting of the devices; means for relatively shifting said mechanism and devices as set to enable each device once set to cooperate with one of said elements in an original relationship and with another of said elements in a shifted relationship of said mechanism and devices; power driven means; and means under control of an operator to render said power-driven means active to relatively move said mechanism and devices to bring them into cooperative engagement in each of said original and shifted relationships.

195. The combination of a series of keys; devices adapted to be set by and in accordance with the operation of said keys; mechanism including elements adapted to cooperate with said devices to operate said mechanism in accordance with the setting of the devices; means for relatively shifting said mechanism and devices as set to enable each device once set to cooperate with one of said elements in an original relationship and with another of said elements in a shifted relationship of said mechanism and devices; power driven means; means under control of an operator to render said power-driven means active to relatively move said mechanism and devices to bring them into cooperative engagement in each of said original and shifted relationships; and means also under control of an operator to predetermine the number—one or more—of said cooperative engagements in each relationship and automatically render the power-driven means inactive after said engagements have been effected.

196. The combination of a series of keys; devices adapted to be set by and in accordance with the operation of said keys; mechanism including elements adapted to cooperate with said devices to operate said mechanism in accordance with the setting of the devices; means for relatively shifting said mechanism and devices as set to enable each device once set to cooperate with one of said elements in an original relationship and with another of said elements in a shifted relationship of said mechanism and devices; power driven means; means under control of an operator to render said power-driven means active to relatively move said mechanism and devices to bring them into cooperative engagement in each of said orig-

inal and shifted relationships; and means also operable by said keys to predetermine the number—one or more, in accordance with the numerical values of the keys—of said cooperative engagements in each relationship and automatically render the power driven means inactive after said engagements have been effected.

197. The combination of a series of keys; a movable carrier; stops or devices mounted on said carrier and adapted to be set by and in accordance with the operation of said keys; mechanism including elements adapted to cooperate with said stops to operate said mechanism in accordance with the setting of the stops; means for advancing said carrier, with its stops as set, relative to said elements to enable each stop once set to cooperate with one of said elements in an original relationship and with a different one of said elements in each advanced relationship of said mechanism and stops; power driven means; and means under control of an operator to render said power driven means active to relatively move said mechanism and stops into cooperative engagement in each of said original and advanced relationships.

198. The combination of a series of keys; a movable carrier; stops or devices mounted on said carrier and adapted to be set by and in accordance with the operation of said keys; mechanism including elements adapted to cooperate with said stops to operate said mechanism in accordance with the setting of the stops; means for advancing said carrier, with its stops as set, relative to said elements to enable each stop once set to cooperate with one of said elements in an original relationship and with a different one of said elements in each advanced relationship of said mechanism and stops; power driven means; means under control of an operator to render said power driven means active to relatively move said mechanism and stops into cooperative engagement in each of said original and advanced relationships; and means also under control of an operator to predetermine the number—one or more—of said cooperative engagements in each relationship and automatically render the power driven means inactive after said engagements have been effected.

In testimony of the foregoing I have hereto set my hand in the presence of two witnesses.

ALFRED S. McCASKEY.

Witnesses:

GEORGE W. BURTON,
E. BERMAN.

It is hereby certified that in Letters Patent No. 1,018,510, granted February 27, 1912, upon the application of Alfred S. McCaskey, of Chicago, Illinois, for an improvement in "Calculating-Machines," an error appears in the printed specification requiring correction as follows: Page 38, line 66, strike out the words "of the carrier; and a plurality of keys the" and insert the words and syllable *of the carrier different number of steps cor-*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 17th day of September, A. D., 1912.

[SEAL.]

C. C. BILLINGS,

Acting Commissioner of Patents.