No. 897,877. PATENTED SEPT. 8, 1908.

A. E. COLE.

ADDING MACHINE.

APPLICATION FILED NOV. 26, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

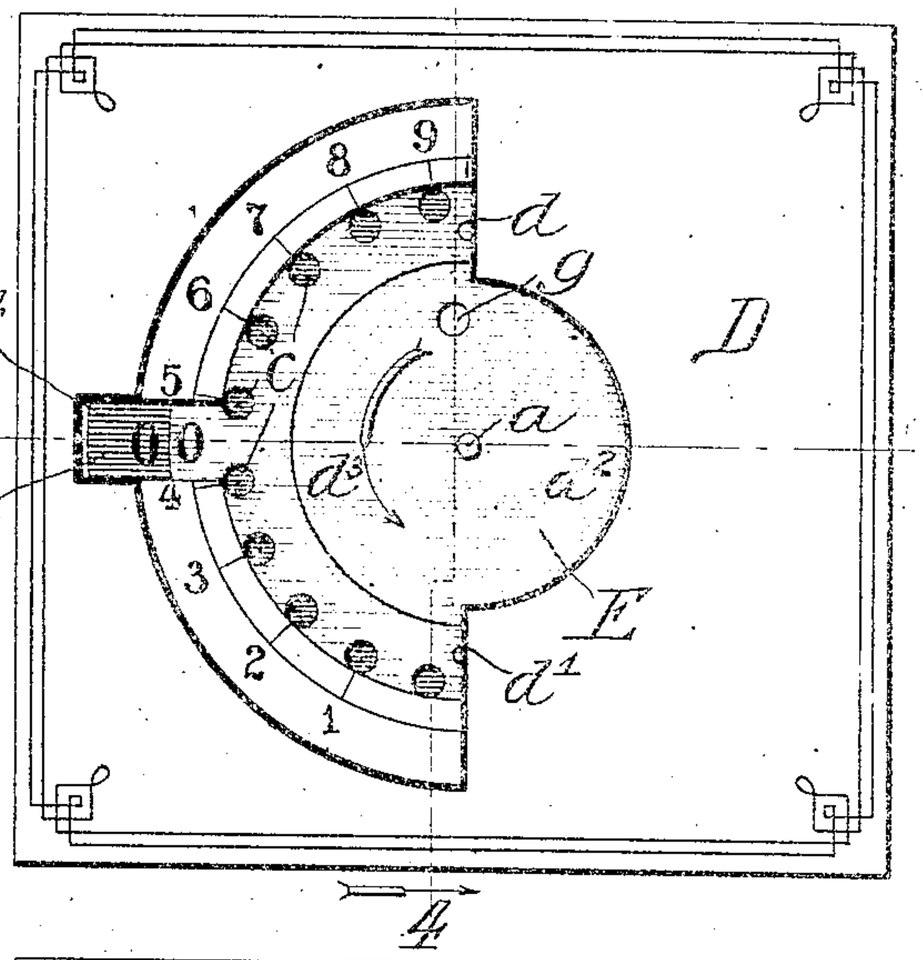


Fig. 2.

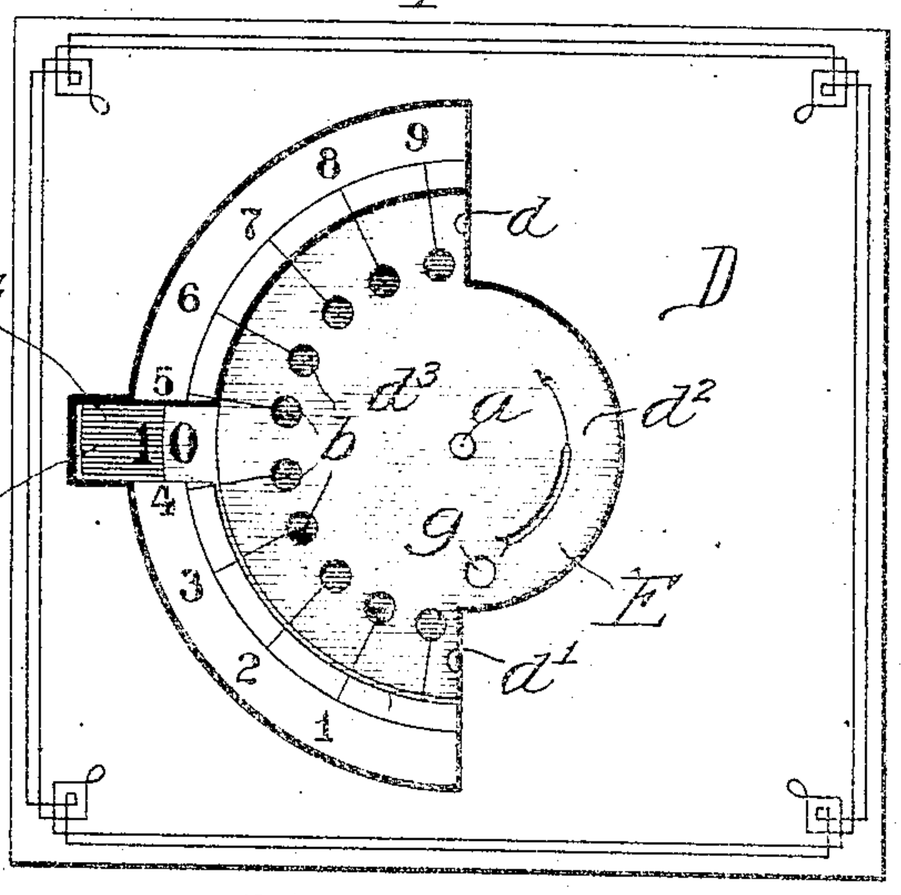
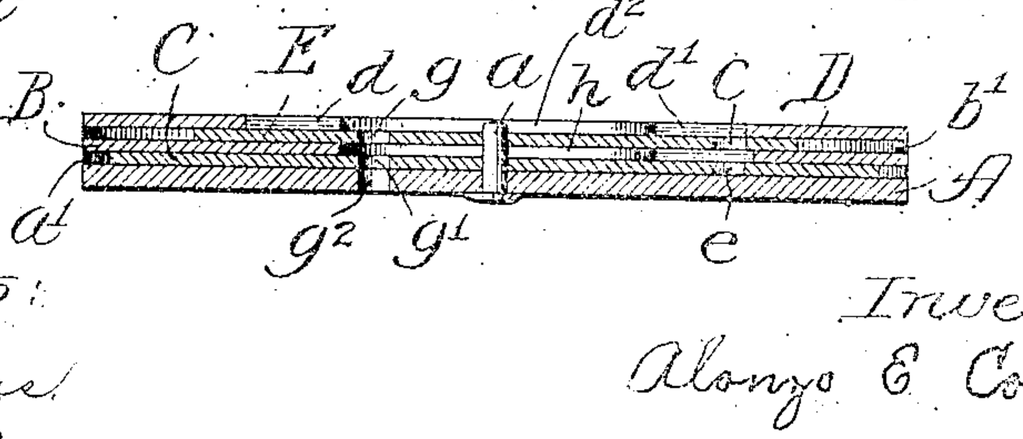


Fig. 3.

Fig. 4.



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2 SHEETS—SHEET 2.

Fig. 5.

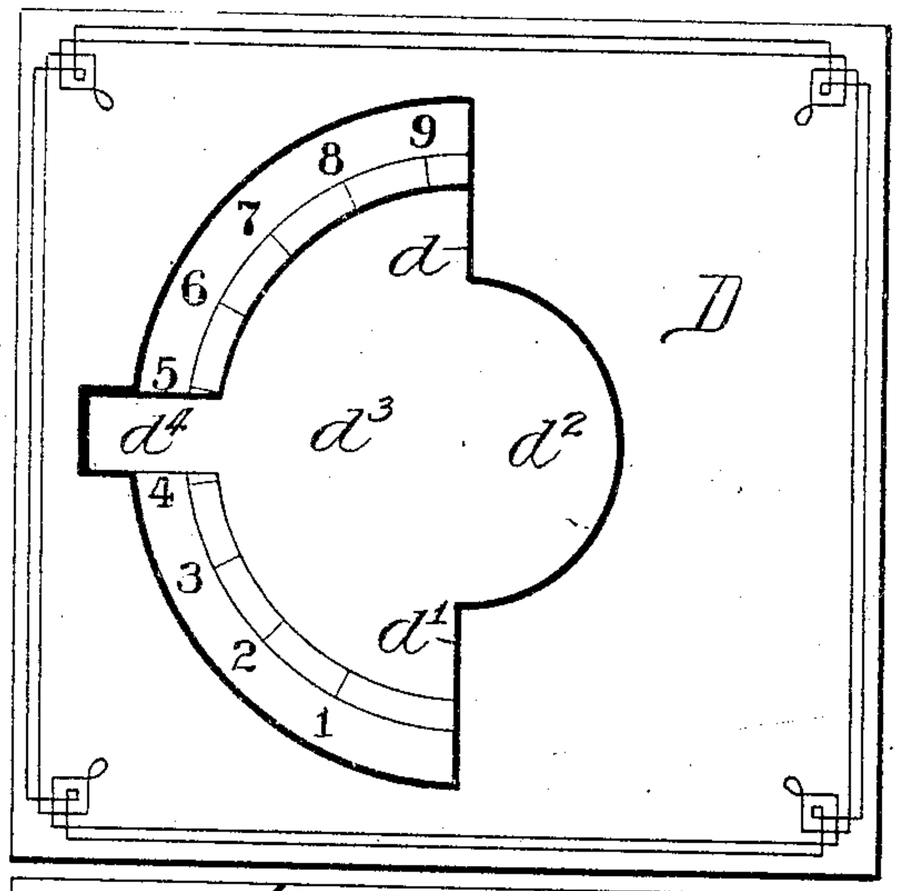


Fig. 6.

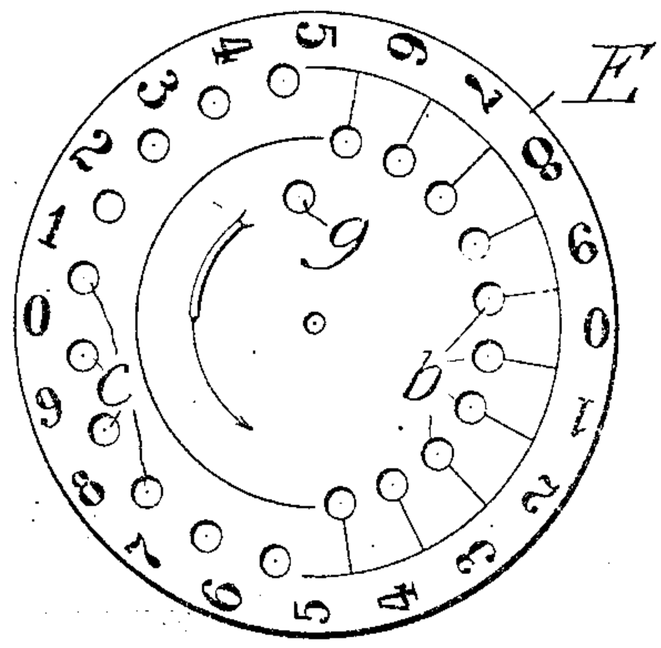


Fig. 7.

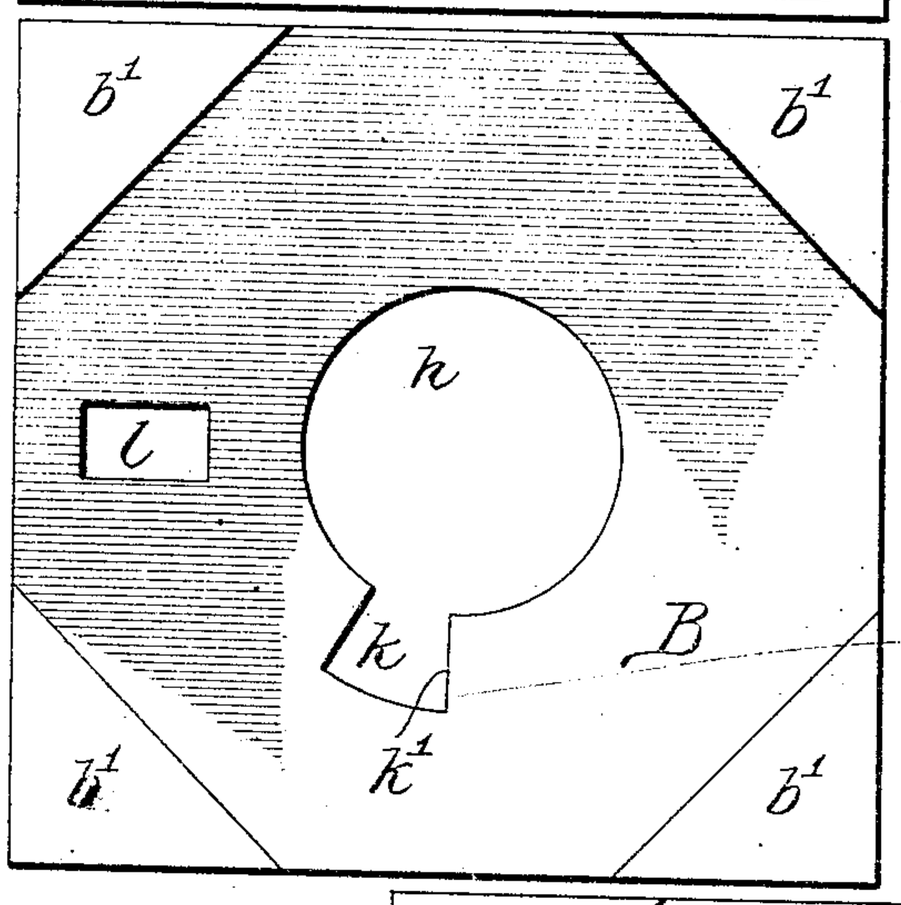


Fig. 8.

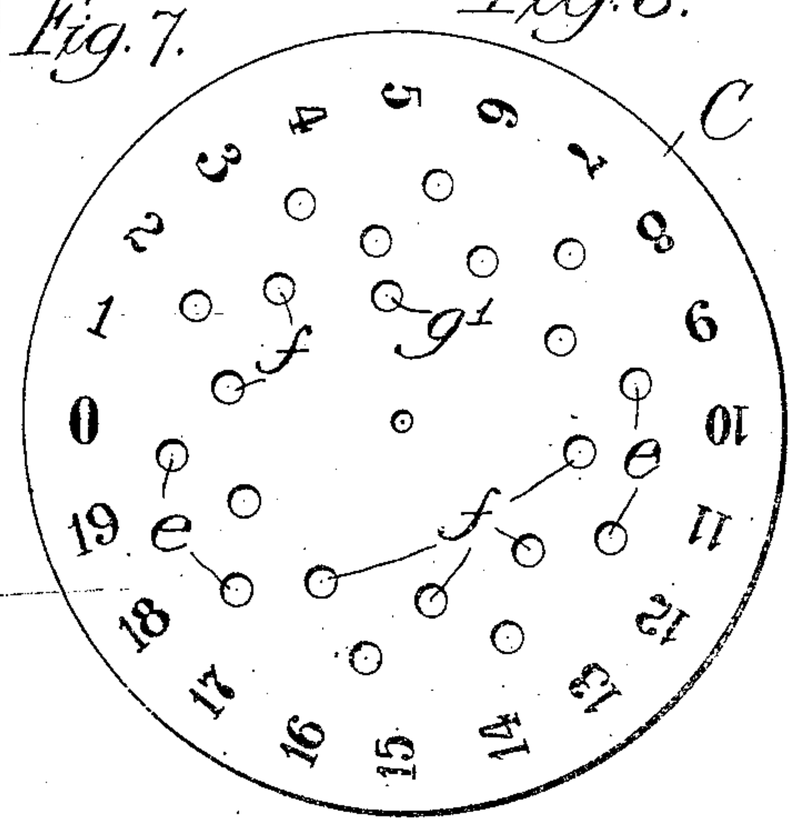
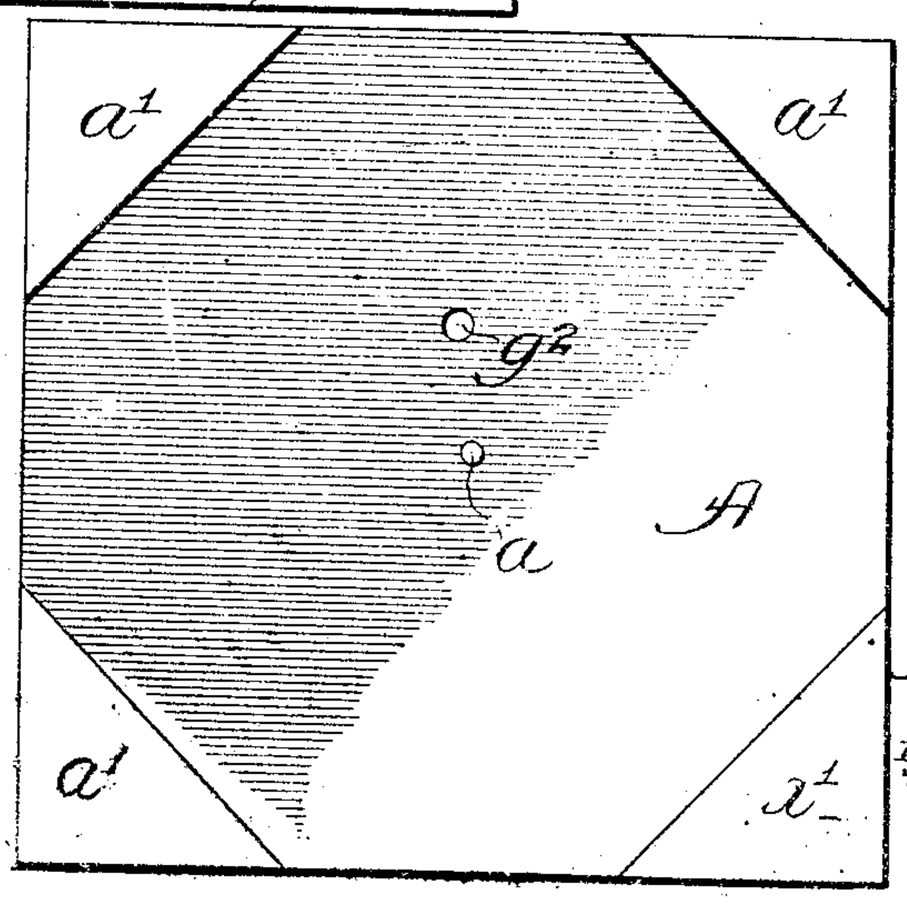


Fig. 9.



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UNITED STATES PATENT OFFICE.

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ADDING-MACHINE.

No. 897,877. Specification of Letters Patent. Patented Sept. 8, 1908.

Application filed November 26, 1907. Serial No. 403,920.

To all whom it may concern:

Be it known that I, ALONZO E. COLE, 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 Adding-Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to adding machines, and its object is to construct an inexpensive, simple, compact and durable device of this character adapted to be conveniently and expeditiously operated by unskilled persons and not liable to get out of order or require repair.

In general the invention contemplates arranging upon a common axis, in a suitable case, a series of flat surface disks or circular bodies with a flat stop cover above each disk, in providing key holes and corresponding numbered marginal spaces on each disk, arranging governing openings and stop edges in each cover and numbered spaces on the top cover, in connection with an index aperture, in such relation that by inserting a key in an opening corresponding to a number on one of the numbered spaces on the top cover, drawing the key to the proper stop edge and repeating this operation with the same or a different numbered space until the addition is completed, a number will be brought into view in the index aperture which is the sum of the numbers on the spaces opposite the openings in which the key has been inserted when drawing it to the stop edge, the whole being arranged with key operated orifices for returning the disks to initial position. The stop covers or the openings and stop edges in them and in the disks govern and limit the engagement of the key so that the disks may be rotated automatically in relatively fixed mathematical relations to each other and to the index aperture.

The simplicity of the device, and the economy with which the disks and covers may be struck out of plain flat blanks are among the especial advantages of the invention. The disks, stop covers and the base are conveniently made from steel, hard rubber or other suitable material, the expansion and contraction of metals not seriously affecting the operation of the device.

The method of constructing the device for adding three or more columns of figures is the same in principle as that used in making a device for adding two columns.

In the accompanying drawings, I have shown an adding machine embodying my invention in its preferred form adapted to add and indicate sums not exceeding totals in two figures.

Figure 1 is a top view of the assembled device showing the position assumed by the parts when the disks are set at zero, the initial position. Fig. 2 is a similar view showing the parts after an addition giving the total ten has been made, an operation which required more than a half revolution of the top disk, and brought in operation the second disk below it to travel one disk space. Fig. 3 is a sectional view on line 3 of Fig. 1 in the direction of the arrow. Fig. 4 is a similar view on line 4 of Fig. 1. Fig. 5 is a top view of the face plate or top stop cover for the primary disk. Fig. 6 is a top view of the primary or units revolving disk. Fig. 7 is a top view of the secondary disk stop cover. Fig. 8 is a top view of the secondary or tens revolving disk. Fig. 9 is a top view of the base or back plate and its corner supporting blocks.

In the drawings, A indicates a case or bed plate, which serves as a base for the other parts, in the center of which is secured the upright shaft or axis *a* upon which the disks are pivoted. The stop covers are arranged one above each disk and are conveniently spaced to allow room for the rotatable disks and united to form an integral structure by corner blocks or projections and suitable fastenings. Stop cover B is so spaced and supported by blocks or projections *a'* fastened to it while A and D are similarly held by similar parts *b'*. The bedplate A and covers B and D are conveniently constructed of the same size and dimensions. The margins of the disks or circular bodies E and C are divided into radially equal disk spaces, that is, the radii which mark off adjacent spaces are drawn at regular intervals about the circumference of the disks, the dividing radii on C being extensions of and coincident with those on E. Disk E being of less diameter than C and concentric therewith the projection of its circumference upon C falls within its circumference and forms the inner edge of the disk spaces on C. Disk E being the primary or smaller units calculating wheel is provided with like series of numerals like

numbers being oppositely disposed, while perforations, adapted to receive a pencil point or other engaging key for turning the disk, are arranged, one for each space, on arcs of two circles in the circumferences of two circles of unequal diameters drawn with *a* as a center within the inner edge of the disk spaces, *b* indicating the perforations arranged on the circle of smaller diameter and *c* on the larger. In the drawings, two series are shown, but any even number of series may be arranged on arcs adjacent arcs lying in different circumferences. The sum of the perforations or spaces in each series on the different arcs equals in numeral value one space on the disk below, for example, if the result is to appear in pounds and ounces, I would construct sixteen spaces and corresponding perforations in each series in disk E and any number of spaces in disk C. Where, however, figures are to be added on the decimal system, I divide the disk into twenty radially equal disk spaces numbered in duplicate, as shown in the drawings, or I may arrange any number of pairs of series on arcs in two circumferences of different diameters.

On the index face or stop cover D is cut out an opening d^3 on an arc coincident when the parts rest in initial position with the arc in which the outer edges of the perforations in the series farthest from the disk center lie. In D on a circumference coincident with a circumference within the circles or arcs upon which the perforations are located is cut an opening d^2. This construction forms the upper and lower stop edges $d\ d'$ on diameters of the disks, but conceals the margin of the disk E upon which the numerals appear beneath the curved edge of d^3. To the left hand of the middle edge of the opening d^3 is cut out in the stop cover D an indicator opening d^4 radially equal to one disk space and adapted to reveal *seriatim* the numerals on the margins of disks E and C. The marginal edges of the index face adjacent to opening d^3 between the opening d^4 and vertical extensions of the edges $d\ d'$ are divided into radially equal index spaces corresponding to the divisions in the margin of the disk E and correspondingly consecutively numbered from bottom to top.

In the system of notation illustrated, the margin of disk C is divided into twenty radially equal parts or disk spaces numbered from zero to nineteen, the zero and ten numerals being at opposite ends of a diameter which is coincident with the diameter on disk E at the extremities of which the two zeros on that disk are located. On two circumferences within the disk C coinciding with the two circumferences on which the pairs of perforations *b* and *c* are arranged, are cut two series of perforations *e* and *f*. Succeeding perforations of the series *e* and *f* correspond alternately to adjacent disk spaces. By rotating the disks the perforations *b* and *c* may in turn be made to register with the perforations *f* and *e* respectively, since they are of the same size and located on coincident circumferences. When superposed with the zero of C and the left hand zero of E on coincident radii, the parts are in initial position. When the parts are in initial position the registering orifices g, g', g^2, adapted to receive a pencil point or other suitable key, are cut through the disks E and C into the bed plate A, respectively. The orifices g, g', g^2 are located on a diameter coincident with the edges d, d', their registering outer edges being coincident with the circumference on which the right hand edge of the opening d^2 lies so that this edge may form a guide for the pencil or key when the disks are turned backwards or clockwise. In the stop cover B is cut a circular opening *h* concentric with and of the same diameter as the circular opening d^2. The opening *h* is extended to form an opening *k* having an edge *k'* coincident with the edge *d'* extended to the circumference of a circle coincident with a circle having radii equal to the distance between *a* and the outer edges of the perforations *e* and *c*. Opening *k* is of sufficient size to expose only two adjacent openings *d* and *e* at one time. An opening *l* is cut in the stop cover B to register with opening d^4, the two being adapted to expose one at a time the numerals on the disk C.

The operation of my device is as follows: The disks C and E are first turned to the initial position. If the problem be to add seven and two, the pencil point or key is inserted in the perforation in disk E corresponding to numeral 7 on the face plate D. The point penetrates through the disk E as far as the stop cover B which prevents it from moving the disk C. The pencil thus inserted is drawn in the direction of the arrow (shown in Fig. 1) rotating disk E until arrested by the stop edge *d'*. The relative arrangement of the disk spaces and the openings is such that the numeral 7 on disk E appears through the opening d^4, or, in other words, the distance traveled by the pencil fron the point 7 on D to the edge *d'* is equal to seven radial spaces on E. The pencil is next inserted in the perforation E corresponding to the numeral 2 on the index face D. The point of the pencil drops through E and rests on B. With the pencil turn the disk E in the direction of the arrow until stopped by the edge *d'*, the distance traveled is two radial spaces, which brings the numeral nine, the sum of seven and two, into view. The addition completed, the pencil is inserted in *g* and the disk E turned until the pencil drops through g' into g^2 when both disks again rest in initial position. If the problem be to add nine and three, the pencil, inserted in the perforation

opposite the numeral 9 on D, is brought around until arrested by the stop edge d', so that E is revolved nine radial spaces the pencil point moving on the top surface of stop cover B. The pencil is then inserted in the perforation opposite the numeral three on D and drawn towards the edge d'. The pencil point at first moves on the surface of B, but as soon as the right hand or second zero radial space on E passes the opening d^4 the pencil point drops through the opening K into one of the openings e in the disk C, causing the two disks E and C to travel together one radial space before the pencil is arrested by the stop edges d', k', thereby bringing the numeral 1 on disk C and numeral 2 on disk E into view through d^4, 12 being the sum of nine and three. With every half turn of E the disk C travels a distance equal to one radial space.

Having thus described my invention what I claim is:

1. In an adding machine, the combination of a stop cover having a circular opening with radially equal cover spaces on a semi-circular margin thereof, a disk beneath said stop cover concentric with said opening having radially equal disk spaces on the margin corresponding to said radial cover spaces, an index opening in said semi-circular margin adapted to reveal one at a time the disk spaces as the disk revolves and series of perforations in said disk, arranged in arcs on circumferences of different diameters between the disk center and the disk margins, one for each space on radii dividing adjacent spaces.

2. The combination of a disk having its outer margin divided by radial lines into equal disk spaces, a series of perforations arranged on said disk in arcs on circumferences of different diameters falling between said spaces and the center of said disk, a perforation on each of said dividing lines, a stop cover, a semi-circular opening concentric with said disk, having stop edges coincident with a disk diameter bisecting said arcs, the semi-circular margin about said opening being divided by radial lines coincident with the radial lines which divide the disk spaces into radially equal cover spaces, one of which is cut away to reveal one at a time the disk spaces as said disk rotates, substantially as and for the purposes described.

3. In an adding machine, a base, stop covers having coincident circular openings, disks concentric with said openings beneath each cover and orifices adapted to receive a key arranged one in each disk and in the base on coincident circumferences within the circumference of said circular openings, whereby said disks may be returned to initial position when turned therefrom by bringing said orifices into registration.

4. In an adding machine, concentric disks, stop covers above each disk provided with coincident circular openings concentric with said disks and orifices, adapted to receive a key, arranged in each disk on coincident circumferences within the circumference of said circular openings, whereby said disks may be alined to initial position by bringing said orifices into registration on insertion of a key in the orifice in the top disk and turning the same until the key drops into the orifices of the disks below.

5. In an adding machine, a rotatable disk having equal disk spaces on its outer margin divided by radii of the disk, each space bearing different numerals in duplicates, like numerals being oppositely disposed, series of apertures arranged in semi-circles concentric with the disk and between its center and the said spaces, there being in each series a number of apertures equal to the number of different numerals, and a stop cover above the disk having a semi-circular opening concentric with the disk, the semi-circular edge of this opening having as many equal cover spaces as there are different disk numerals, each space equal to and adapted to cover a disk space, one of said cover spaces being cut away to reveal one at a time the disk spaces below as said disk rotates, each cover space being indicated by different numerals corresponding to each of the different disk numerals, the straight edge of said opening constituting a stop for a disk operating key.

6. In an adding machine, a base, primary and secondary disks, concentrically arranged to rotate about a common axis each beneath a stop cover, stop covers, the top stop cover having radially equal index spaces arranged in a semi-circle concentric with the disks, the middle space being cut away above the disks to form an aperture for observing the disk spaces, twice as many radially equal disk spaces on the margin of each disk as there are index spaces, the disk spaces on the secondary disks extending beyond the corresponding spaces on the primary disks, stop edges on said covers, openings in said disks arranged to engage a disk operating key and the openings in said covers adapted to govern the fractional revolutions of the disks in a fixed ratio one to the other, substantially as and for the purposes described.

7. In an adding machine, stop covers having coincident circular openings, disks beneath each stop cover concentric with said openings, having numbered radially equal disk spaces, the numbers thereon on each succeeding disk traveling in a path beyond that in which the numbers on the disk above it travel, a semi-circular opening in the top disk of greater diameter than the circular opening thereon, stop edges between said openings, index spaces arranged on the curved margin of said semi-circular opening each radially equal to each other and to said

disk spaces, the middle space being cut away and extended from the center of said disks to reveal one disk space on each of the disks, perforations in said disks corresponding to each disk space arranged in circumferences having greater diameters than said circular openings, a key adapted to be inserted in said perforations, means carried by the lower stop covers for preventing said key from rotating the disks below them until the disk above has been turned a half revolution and means operated by said key for returning all of said disks to initial position when rotated therefrom.

8. The combination of concentric primary and secondary disks having numbered radially equal disk spaces thereon, the numbers of the secondary disk traveling in a path beyond that in which the numbers on the primary disk travel, stop covers above each disk having an aperture adapted to reveal one at a time one space on each disk, holes in said disks corresponding to each space, and openings, stop edges and numbered radially equal index spaces similar to said disk spaces in said covers, said stop covers being adapted to prevent a key inserted in a perforation from rotating said secondary disk when turning said primary disk less than a half revolution and to cause it to engage a hole in said secondary disk and turn the latter the distance of one space for each half revolution of said primary disk, whereby insertion of said key in a hole in the primary disk opposite a numbered index space and the turning of said disk until the key is arrested by said stop cover, causes a correspondingly numbered disk space to appear in said index aperture and repetitions of the operation cause numbered spaces equal in notation to the sum of the numbered index spaces from which the holes were rotated to appear in said index aperture.

9. In an adding machine, primary and secondary concentric disks having perforations arranged at regular intervals thereon, those on the primary disk being set in arcs, the radii of adjacent arcs being different, and those in the secondary disk arranged alternately in the circumferences of two circles coincident with said arcs, and a stop cover intermediate of the disks having an opening therein across said circumferences adapted to expose in pairs adjacent perforations one in each of circumferences.

10. In an adding machine, concentric circular bodies having radially equal marginal spaces, two series of perforations in each corresponding series arranged on the circumferences of coincident circles, and a stop cover having an opening adapted to limit the interlocking of a key inserted in a perforation to rotate the lower disk through an arc equal to one space for every half revolution of said upper disk, substantially as described.

11. In an adding machine, concentric disks having radially equal marginal disk spaces, the spaces on succeeding disks displaying series of numbers the sum of each series being equal to the unit of denomination of the series in the disk next below, series of perforations in each disk, each perforation corresponding to a different disk space, stop covers intermediate of said disks having openings across the circumferences, concentric with said disks, in which said perforations lie, said covers being adapted to expose only two adjacent perforations at a time, stop edges adapted to arrest rotation of said disks, the arrangement of said perforations and stop edges being such that rotation of a disk above through an arc equal to the sum of the disk spaces of one series rotates the disk below it through an arc equal to one disk space.

12. In an adding machine, concentric disks having radially equal disk spaces, series of perforations one for each disk space on said disks and means in the lower disk coöperating to interlock a key inserted in a perforation in the top disk to rotate said lower disk a fractional revolution equal to the arc included in one space for every turn of the top disk equal to the sum of the arcs included in the spaces of a single series, substantially as described.

13. The combination of concentric rotatable disks with means carried on said disks and means in the lower disk for engaging a key to rotate the lower disk one twentieth of a revolution for every half revolution of said upper disk.

14. The combination of concentric disks bearing numbered radially equal disk spaces, and stop covers above each disk, the top cover having equal numbered index spaces, of means corresponding to each disk space and carried by each disk and openings in said stop covers, for engaging a key to rotate alternately the top disks independently and both disks simultaneously, their simultaneous fractional revolutions bearing a constant relation one to the other and to said index spaces, substantially as described.

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

ALONZO E. COLE.

Witnesses:

ARTHUR GREENE,

CHARLES L. HINE.