L. I. DARBY & C. N. WALSH.

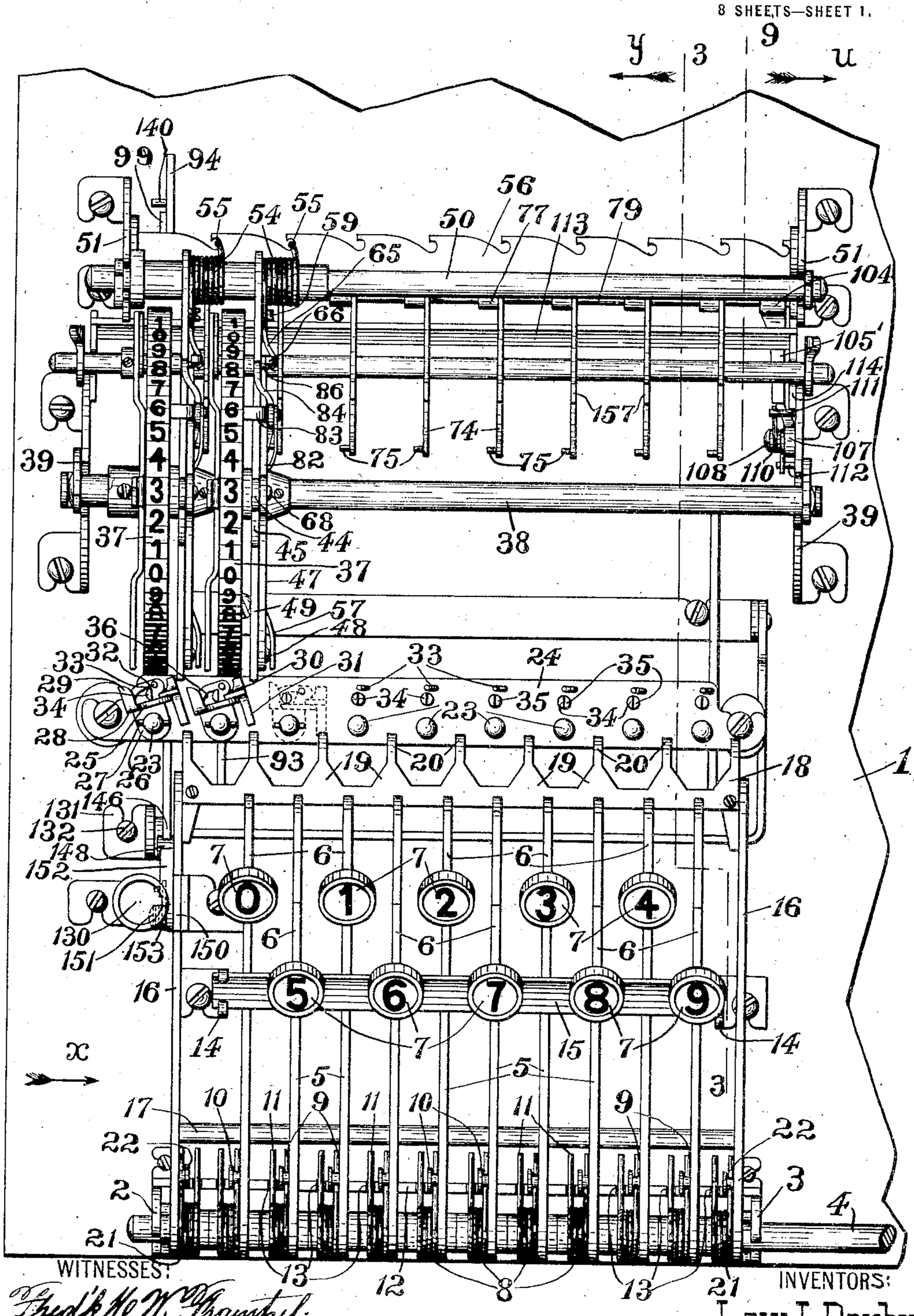
CALCULATING MACHINE.

APPLICATION FILED DEC. 4, 1912.

1,155,048.

Patented Sept. 28, 1915.

8 SHEETS—SHEET 1.



Fredk W. Fraentzel
Harry E. Pfeiffer

Fig. 1

Levi I. Darby,
and
Charles N. Walsh
by Fraentzel and Riolanda, ATTORNEYS

L. I. DARBY & C. N. WALSH.

CALCULATING MACHINE.

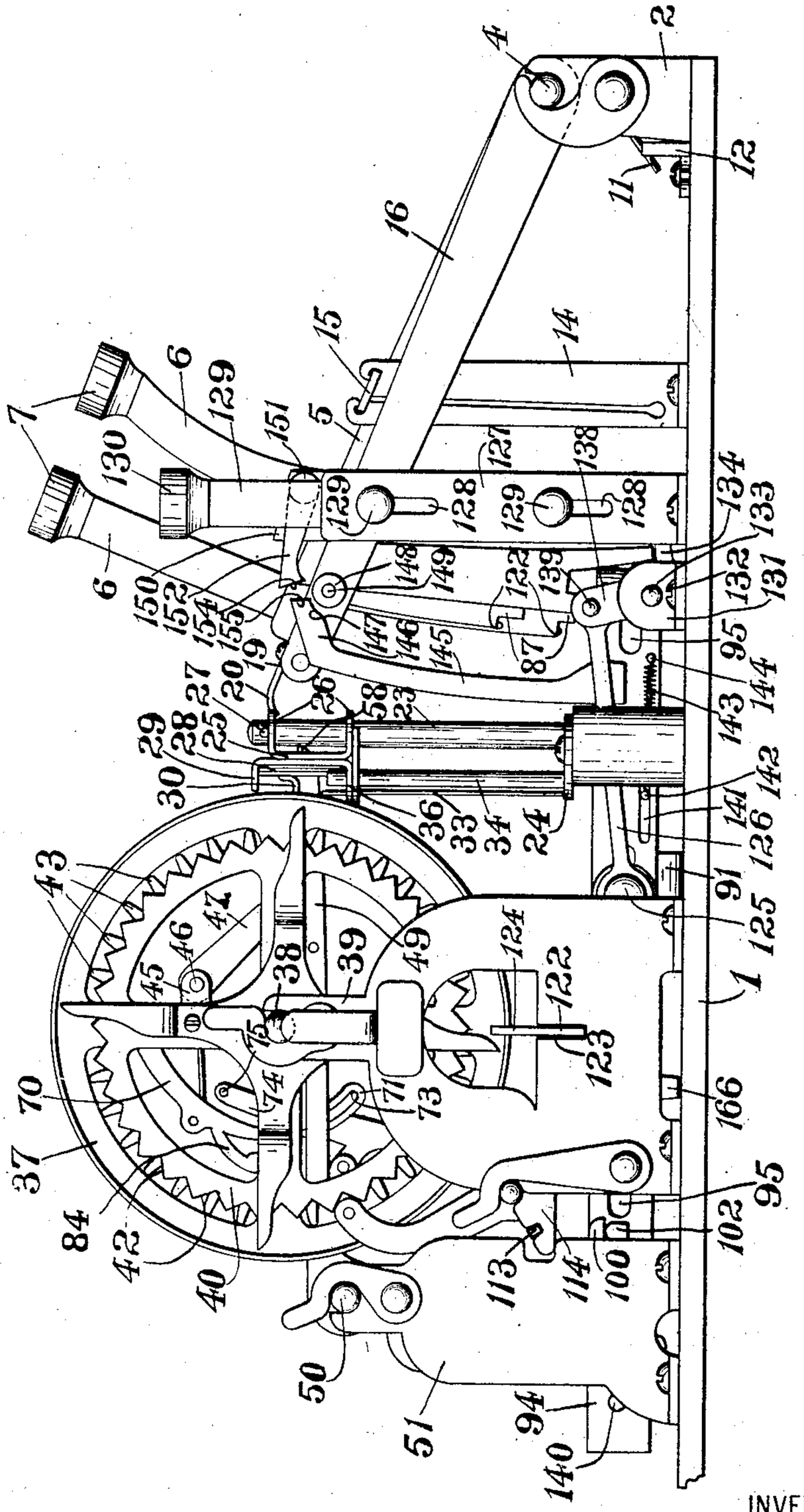
APPLICATION FILED DEC. 4, 1912.

1,155,048.

Patented Sept. 28, 1915.

8 SHEETS—SHEET 2.

FIG. 2



WITNESSES:

Fredk. W. Frantzel

Harry E. Pfeiffer

INVENTORS:

Levi I. Darby,

and Charles N. Walsh

by Frantzel and Richards, ATTORNEYS

L. I. DARBY & C. N. WALSH.

CALCULATING MACHINE.

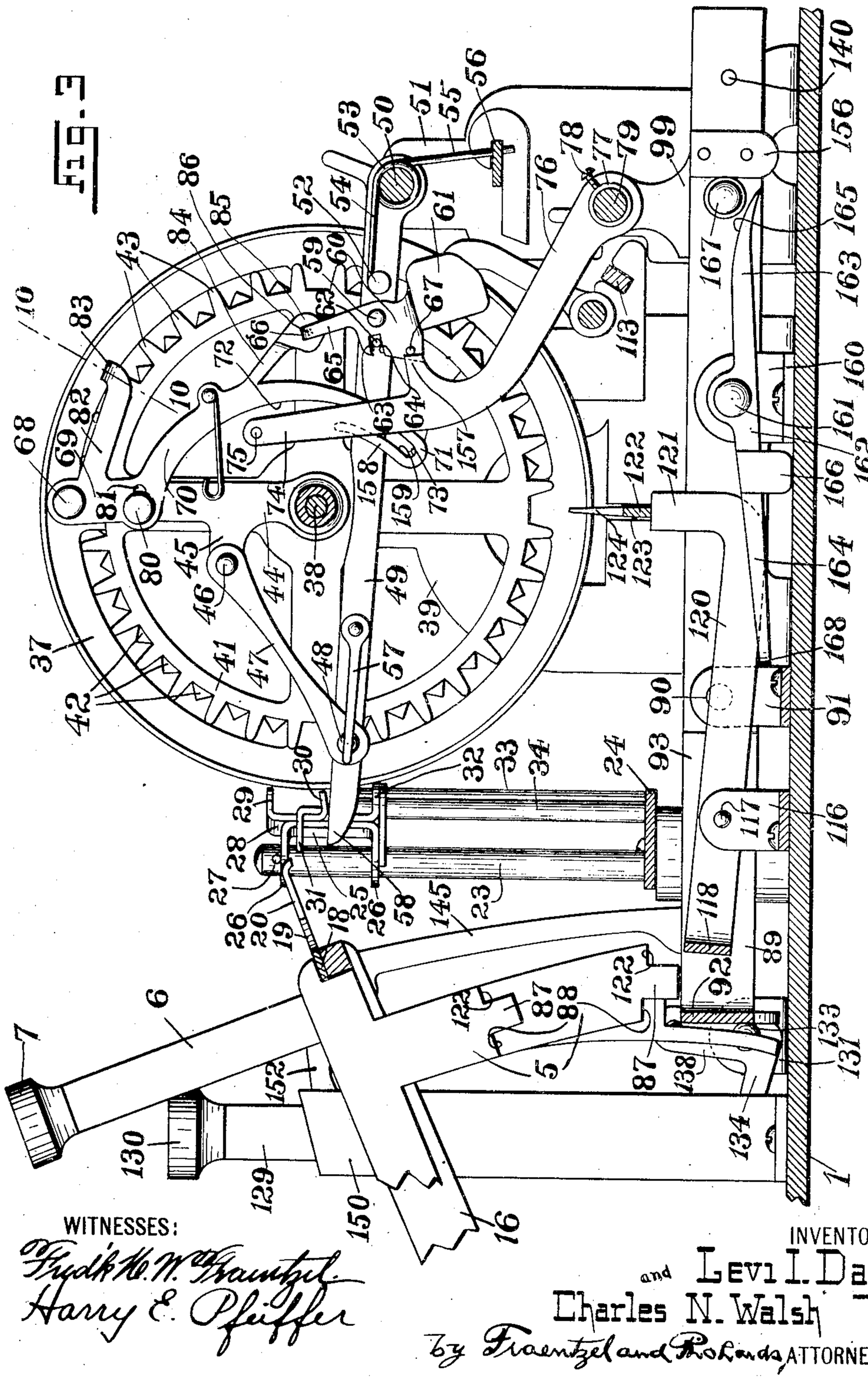
APPLICATION FILED DEC. 4, 1912.

1,155,048.

Patented Sept. 28, 1915.

8 SHEETS—SHEET 3.

FIG. 3.



WITNESSES:

Fredk W. Fraentzel.

Harry E. Pfeiffer

INVENTORS:

Levi I. Darby,

and Charles N. Walsh

by Fraentzel and Rolands, ATTORNEYS.

L. I. DARBY & C. N. WALSH.

CALCULATING MACHINE.

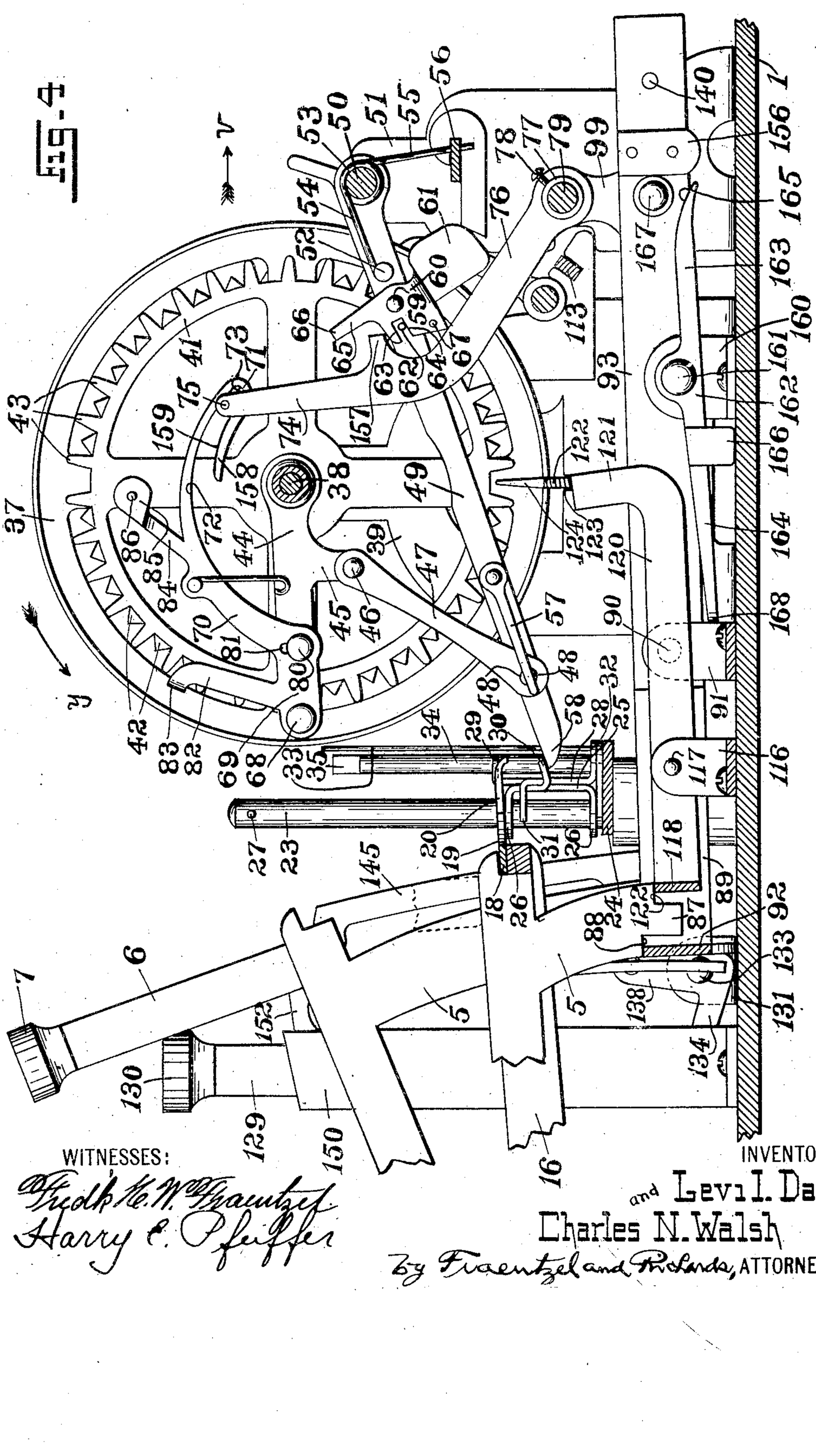
APPLICATION FILED DEC. 4, 1912.

1,155,048.

Patented Sept. 28, 1915.

8 SHEETS—SHEET 4.

FIG. 4



WITNESSES:

Fredk. W. Grantzel.

Harry E. Pfeffer

INVENTORS:

and Levi I. Darby,

Charles N. Walsh

By Fraentzel and Richards, ATTORNEYS

L. I. DARBY & C. N. WALSH.

CALCULATING MACHINE.

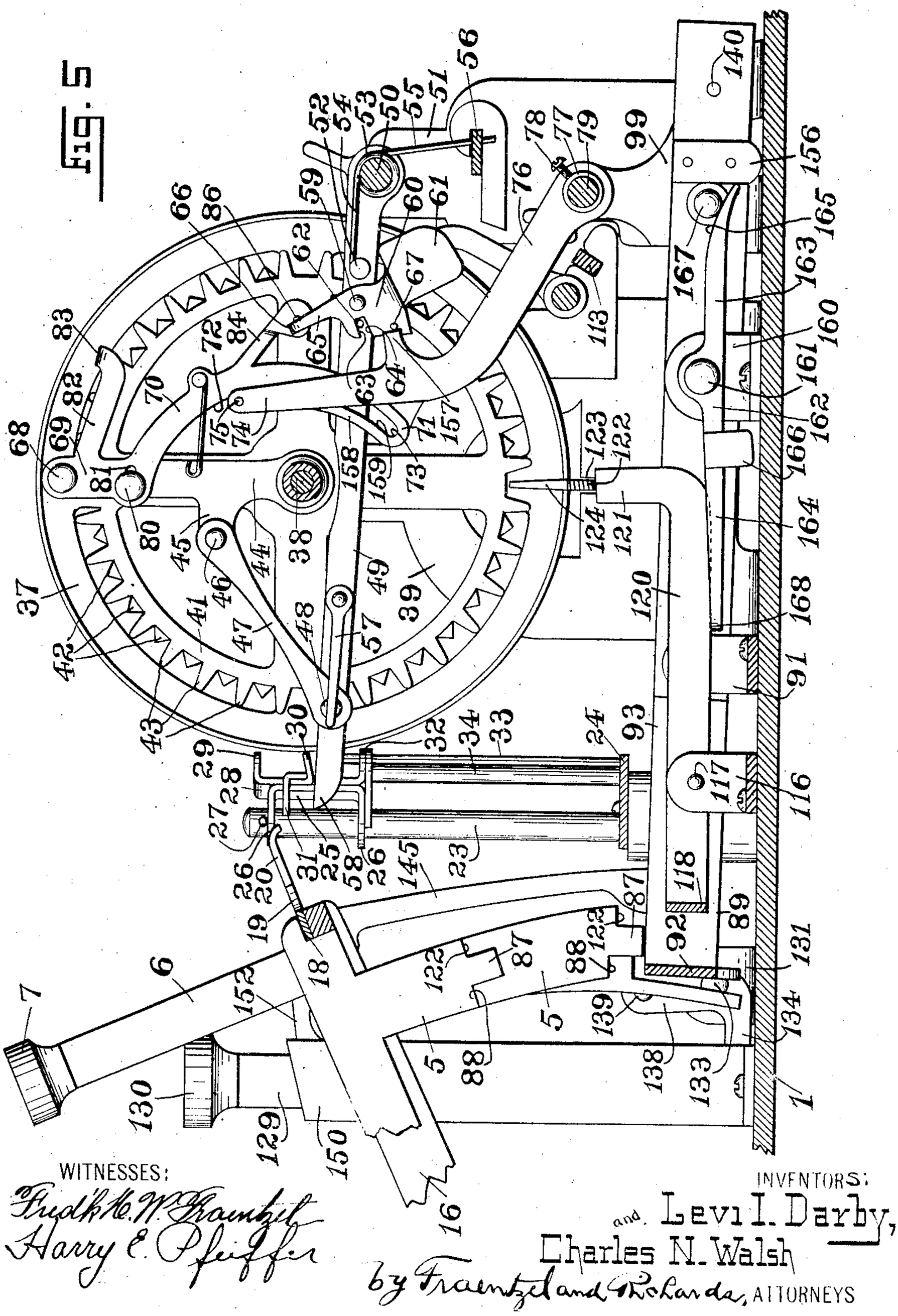
APPLICATION FILED DEC. 4, 1912.

1,155,048.

Patented Sept. 28, 1915.

8 SHEETS—SHEET 5.

Fig. 5



WITNESSES:

Fredk. W. Fraenzel

Harry E. Pfeiffer

INVENTORS:

Levi I. Darby,

and Charles N. Walsh

by Fraenzel and Rolands, ATTORNEYS

L. I. DARBY & C. N. WALSH.

CALCULATING MACHINE.

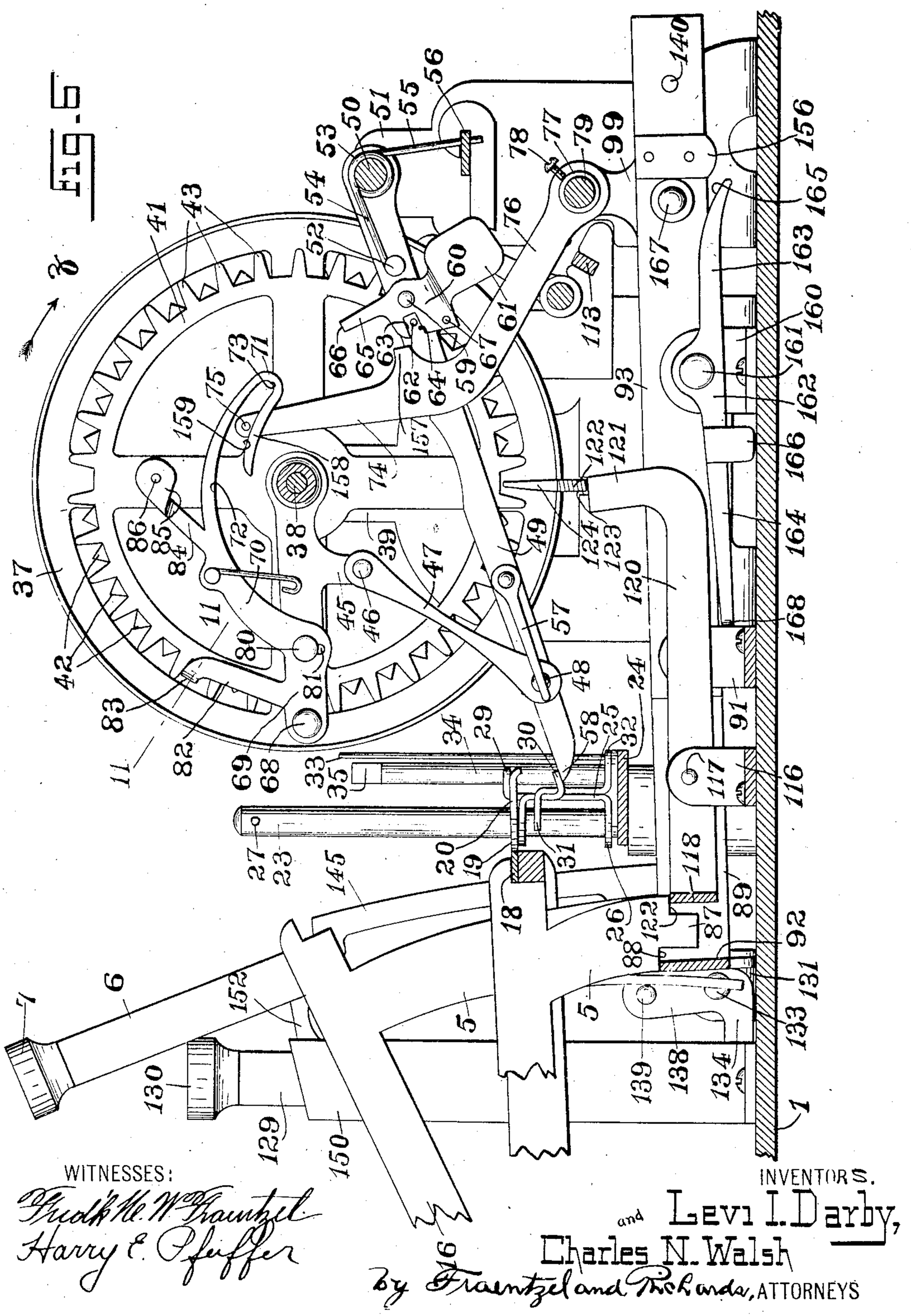
APPLICATION FILED DEC. 4, 1912.

1,155,048.

Patented Sept. 28, 1915.

8 SHEETS—SHEET 6.

Fig. 6



WITNESSES:

Fredk W. Frantzel

Harry E. Pfeffer

INVENTORS.

Levi I. Darby,

and Charles N. Walsh

By Frantzel and Richards, ATTORNEYS

L. I. DARBY & C. N. WALSH.

CALCULATING MACHINE.

APPLICATION FILED DEC. 4, 1912.

1,155,048.

Patented Sept. 28, 1915.

8 SHEETS—SHEET 7.

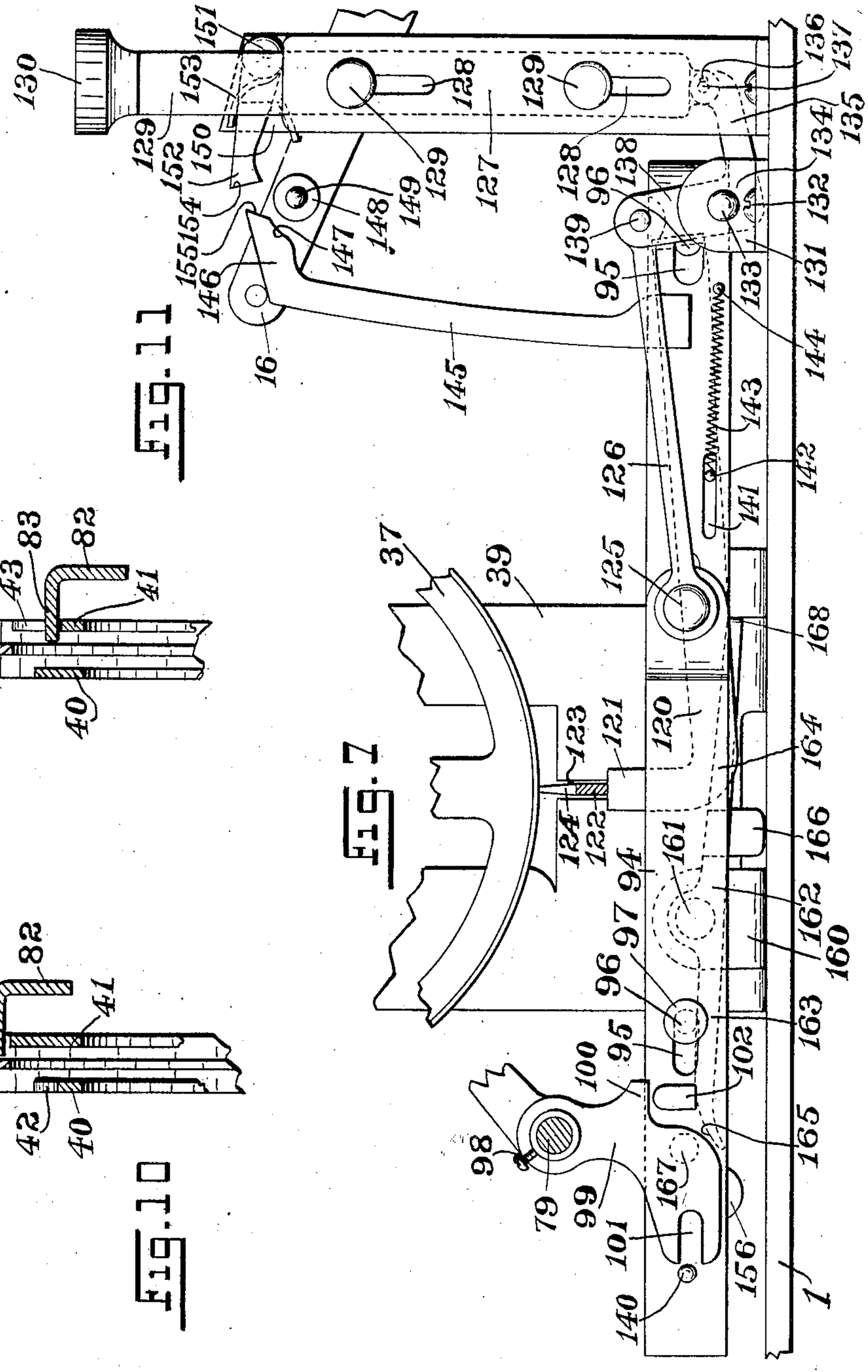


Fig. 11

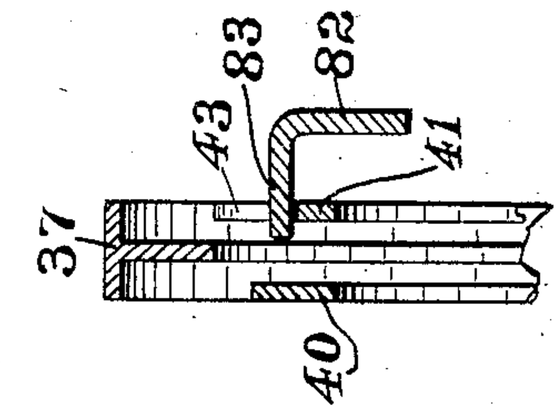


Fig. 7

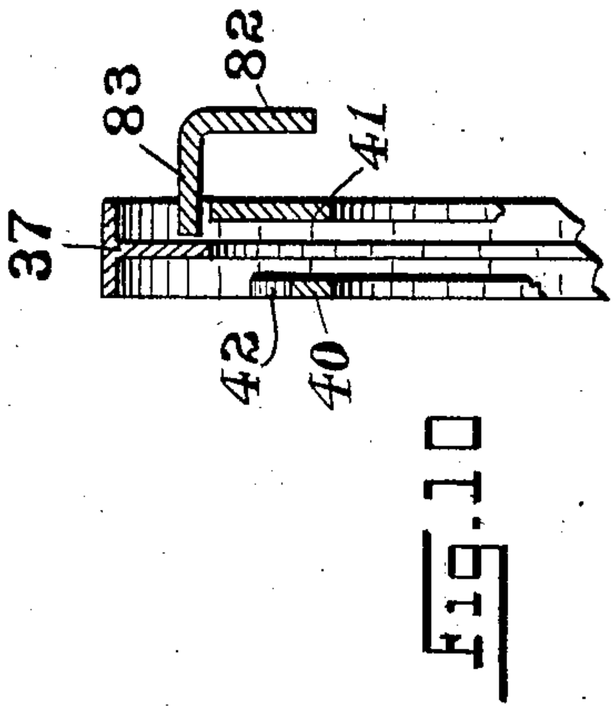


Fig. 10

WITNESSES:

Fredk H. W. Frantzel

Harry E. Pfeiffer

INVENTORS:

Levi I. Darby

and

Charles N. Walsh

By Frantzel and Rolande, ATTORNEYS

L. I. DARBY & C. N. WALSH.

CALCULATING MACHINE.

APPLICATION FILED DEC. 4, 1912.

1,155,048.

Patented Sept. 28, 1915.

8 SHEETS—SHEET 8.

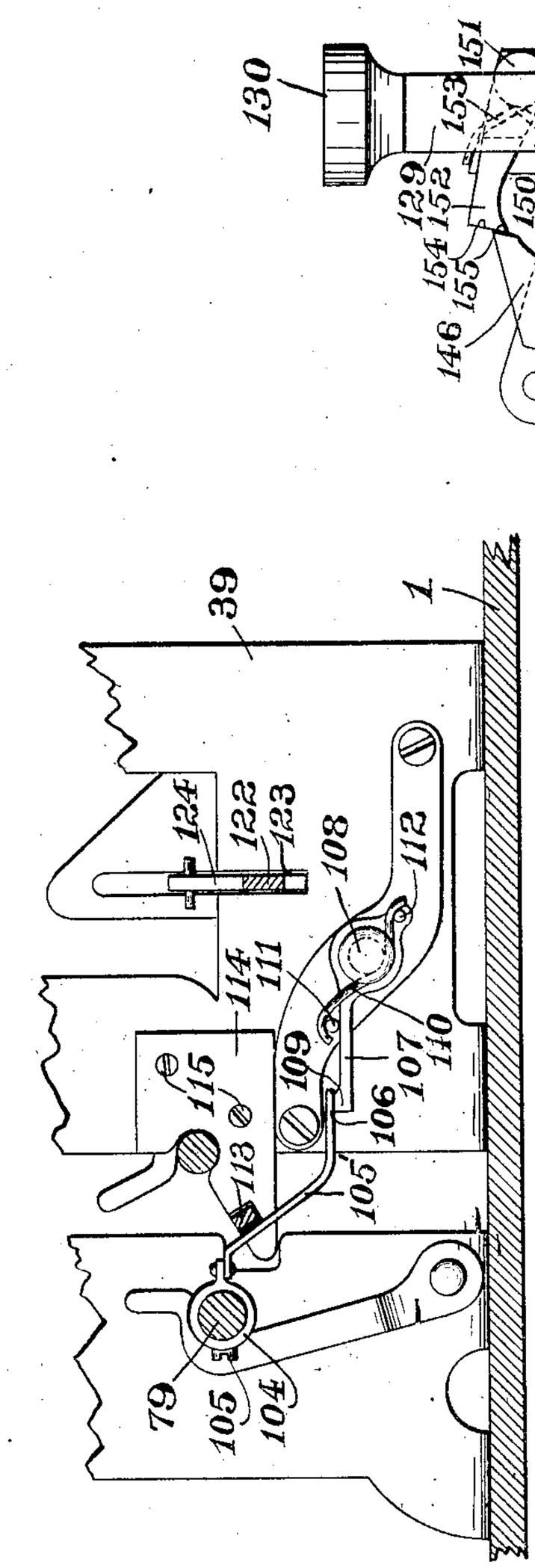


FIG. 5.

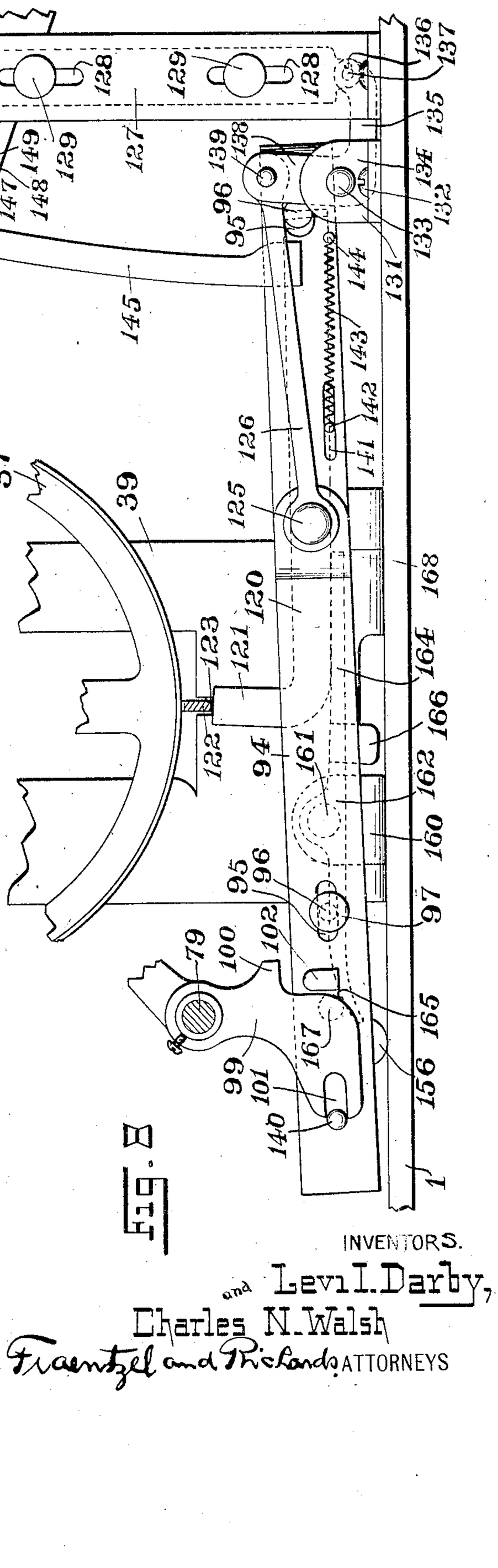


FIG. 6.

WITNESSES:

Fredk W. Fraentzel

Harry E. Pfeiffer

INVENTORS.

Levi I. Darby,

and Charles N. Walsh

by Fraentzel and Richards, ATTORNEYS

UNITED STATES PATENT OFFICE.

LEVI I. DARBY, OF NEWARK, AND CHARLES N. WALSH, OF EAST ORANGE, NEW JERSEY, ASSIGNORS TO DARBY MACHINE COMPANY, A CORPORATION OF NEW JERSEY.

CALCULATING-MACHINE.

1,155,048. Specification of Letters Patent. Patented Sept. 28, 1915.

Application filed December 4, 1912. Serial No. 734,856.

To all whom it may concern:

Be it known that we, LEVI I. DARBY and CHARLES N. WALSH, both citizens of the United States, residing at Newark, in the county of Essex and State of New Jersey, and at East Orange, county of Essex, and State of New Jersey, respectively, have invented certain new and useful Improvements in Calculating-Machines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to characters of reference marked thereon, which form a part of this specification.

The present invention has reference, generally, to improvements in calculating machines; and, this invention relates, more particularly, to a machine or apparatus of the general character hereinafter set forth, which can be used primarily as a substracting machine, but which may also be used as a combined adding and subtracting machine, for registering and recording figures, and comprising a series of numbered disks which may, at the will of the operator, be rotated in forward or backward directions, so that the same can be used as an adding machine, or as a subtracting machine, or as a combined adding and subtracting machine.

The present invention, therefore, has for its principal object to provide a machine or apparatus of the character herein-above stated, the mechanism of which is simple and operates most efficiently; and, the invention has for its further object to provide a machine in which the mechanism, when used for adding purposes is positively locked against the movement of the parts for subtracting purposes, and vice versa, the mechanism, when used for subtracting purposes, being positively locked against the movement of the parts for adding purposes.

This invention, furthermore has for its object to provide a subtracting machine provided with depressible keys, which may be used to rotate the released number-bearing disk in a forward direction, when using the machine as an adding machine, another key being employed to prevent movement of the released number-bearing disk in its forward direction, but moving said disk in its backward direction upon the release and return of the depressed key to its normal initial position, whereby the machine serves as a subtracting machine, the figures meanwhile being printed by suitable mechanism upon a strip of paper.

The invention has for its further purpose to improve that class of adding machines more particularly described and illustrated in Letters Patent No. 1,068,384 of July 22, 1913, whereby the machine shown in said Letters Patent by the arrangement of a most simple mechanism is also adapted for use as a subtracting machine.

Other objects of this invention not at this time more particularly enumerated will be clearly obvious from the following detailed description of the present invention.

With the various objects of the present invention in view, the said invention consists, primarily, in the novel subtracting machine hereinafter set forth; and, the invention consists, furthermore, in the general arrangements and combinations of the various devices and parts, as well as in the details of the construction of the same, all of which will be more fully described in the following specification, and then finally embodied in the clauses of the claim which are appended to and which form an essential part of this specification.

The invention is clearly illustrated in the accompanying drawings, in which:—

Figure 1 is a detail plan view of a portion of a calculating machine, illustrating the principles of the present invention, and certain portions of the mechanism which embody the principles of the adding machine represented in said Letters Patent No. 1,068,384 being omitted from this view. Fig. 2 is a side elevation of the parts of the machine represented in said Fig. 1, looking in the direction of the arrow *x* in said Fig. 1. Fig. 3 is an enlarged longitudinal vertical section of the machine, showing the various devices and parts in their normal initial positions, said section being taken on line 3—3 in said Fig. 1, looking in the direction of the arrow *y*; and Fig. 4 is a similar sectional representation of the said devices and parts illustrated in said Fig. 3, showing the relative positions of the parts of the mechanism and of the actuated numbering disk in a forward direction or in the direction of the arrow *y* in said Fig. 4, during the adding operation of the machine.

Fig. 5 is an enlarged longitudinal vertical section of the machine, similar to that represented in said Fig. 3, and taken in a vertical plane on the same line 3—3 in Fig. 1, illustrating the first or initial operation of certain parts of the mechanism, when the machine is used for subtracting purposes; and Fig. 6 is a longitudinal vertical section of the machine, similar to that represented in Fig. 4, showing the relative positions of the parts of the mechanism and of the actuated numbering disk in a backward direction, or in the direction of the arrow *z* in said Fig. 6, during the subtracting operation of the machine. Fig. 7 is an enlarged detail elevation of the key-actuated releasing and setting machanism for bringing certain parts of the general mechanism into their released or set relations for permitting the use of the numbering disk or disks for subtracting purposes, the parts represented in said Fig. 7, being shown in their normal initial positions; and Fig. 8 is a similar view of the parts represented in said Fig. 7, but illustrating the said parts in their operated relations. Fig. 9 is a detail longitudinal vertical section, on an enlarged scale, said section being taken on line 9—9 in Fig. 1, looking in the direction of the arrow *u*. Fig. 10 is a detail transverse vertical section, also on an enlarged scale, said section being taken on line 10—10 in Fig. 3; and Fig. 11 is a similar section, said section being taken on line 11—11 in Fig. 6.

Similar characters of reference are employed in all of the above described views, to indicate corresponding parts.

Before setting forth in detail the particular construction of the several devices and their various parts which embody the principal features of the calculating machine as a subtracting machine illustrated in the accompanying drawings, we will state that while the subtracting mechanism is adapted admirably in connection with an adding machine of the general character set forth more particularly in said Letters-Patent, No. 1,068,384, still it will be understood that the principles of the present invention may be applied also to other forms of adding machines. The present invention being described in this application in connection with the form of adding machine described and illustrated in said Letters Patent No. 1,068,384, certain devices and parts of the mechanism comprising the said adding machine are omitted from the drawings of the present application, and for the description of these devices and parts, in so far as they have any bearing to the mechanism in connection with the subtracting machine of the present application, the drawings and description of Letters Patent No. 1,068,384 should be referred to.

Referring now to the several figures of the drawings accompanying the present application, the reference-character 1 indicates a suitably formed base-plate which is provided at or near its front edge with suitably disposed bearing-posts or members 2 and 3 in which is suitably mounted a laterally extending and non-rotative rod 4. Pivotally mounted upon said rod 4 are a suitable number of digit-indicating key-levers, as 5, of which there are always ten, each key-lever being provided with an upwardly extending arm 6 which carries upon its upper end a finger-piece 7. These finger pieces are respectively provided with the several digit-representing symbols 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. The return of these key-levers 5 to their normal initial positions, after depression, is produced by means of suitably arranged coiled springs, as 8, said springs having their free end-portions 9 in holding engagement with suitable pins or projections 10 which extend from the sides of the said key-levers, near the pivoted end-portions of said levers, and the other free end-portions 11 of said springs 8 resting in suitably disposed slots 13 of a suitable spring-holder 12, suitably secured upon the base-plate 1, as indicated in Fig. 1 of the drawings. To limit the return-action of the said springs, and the corresponding return-movements of the said key-levers 5, suitable posts 14 are secured upon the said base-plate 1, the said posts being connected by means of a bar or rod 15, at a point above the said key-levers, and against which the depressed key-lever is returned by the action of the corresponding spring 11, so as to arrest its returning movement in an upward direction and to stop the key-lever in its proper place. Referring now more particularly to said Fig. 1 of the drawings, it will be seen that the set of depressible keys, located at the right hand side of the machine, and as shown in said former Letters Patent No. 1,068,384, and which are used for actuating the laterally movable releasing or setting carriage, are omitted from the drawings of the present application; and, likewise, the said releasing or setting carriage, as well as the means for producing the movements of said carriage, when one of the said keys is depressed, are also omitted from the drawings of the present application.

The means for operating the registering or indicating disks, by means of the downward motion of any one of the previously-mentioned digit-indicating key-levers 5, is by means of a rock-frame which is pivotally mounted upon the previously-mentioned non-rotating rod 4, said frame consisting, essentially, of a pair of rearwardly extending arms 16 which are connected near the ends where the said arms are pivotally mounted upon the rod 4 by means of a later-

ally extending rod or bar 17. At their rear end-portions, the said arms 16 are suitably connected by means of a second laterally extending bar or plate, as 18, said bar or plate being formed along its rear marginal edge-portion, and at proper intervals, with V-shaped extensions or lugs, as 19, and each extension or lug 19 being provided with a rearwardly extending finger 20 The said rock-frame is moved in its downward direction, by the depression of any one of the said digit-bearing key-levers 5, in the manner of said former Letters Patent No. 1,068,384, and the rock-frame after it has been depressed is returned upwardly into its normal position, by means of end springs 21 which encircle the said rod 4, similar to the previously-mentioned springs 8, and the free end-portions of which engage, respectively, with suitable projections or pins, as 22, which extend from the sides of the arms 16, near the pivoted end-portions thereof, and with the previously-mentioned spring-holder 12.

The reference-character 23 indicates a series of vertically disposed posts, extending upwardly from a bar 24 which is suitably secured upon the base-plate 1 of the apparatus or machine, and slidably arranged upon each post 23 is a slide. Each slide consists, essentially, of a main body 25 which is provided with forwardly extending and perforated ears or guide-lugs 26 which embrace the post 23 in such a manner, that each slide is slidably mounted upon a post 23. Extending through each post 23 is a pin 27, the purposes of said pins being to limit the upward movements of said slides upon the respective posts. The body 25 of each slide is also provided with a laterally projecting lug 28, and extending rearwardly from each lug 28 is a projection or pin 29, adapted at the proper time to be engaged by a suitable arm or finger of the previously-mentioned laterally moving releasing or setting carriage, not here shown, and operating in the manner specified in said Letters Patent No. 1,068,384. Projecting laterally from the body-portion 25 of each slide is a lug 30 which is provided with a forwardly extending finger 31. Each body-portion 25 is also provided with a perforated ear or lug 32, into and through which extends the upper end-portion of an upright or vertically disposed spring-rod 33, each spring-rod 33 having its lower end-portion permanently fixed to the previously-mentioned bar 24. Directly back of said series of posts 23, and longitudinally of the machine in alinement with said posts 23, is a second series of posts, as 34, the said posts 34 being also secured at their lower end-portions to the said base or plate 24. The said posts 34 are shorter than the posts 23, and at their upper end-portions the said posts 34 are cut away, so as to form off-sets or seats, as 35, into resting engagement with which, under normal conditions, the spring-rods 33 force the said perforated ears or lugs 32, when the said slides are in their normally raised positions, so as to support the said slides in their raised and inactive positions upon their respective rods, and thus retain the said slides in a slightly angular relation with respect to a single vertical plane passing through each axis of the several posts 23, and longitudinally of the apparatus or machine. The body 25 of each slide is further provided with a rearwardly extending lug or finger 36 which moves against the post 34 when the perforated ear 32 has been forced from its supporting engagement with the off-set or seat 35 by the sliding action of the previously-mentioned releasing or setting carriage, in the manner described in said former Letters Patent No. 1,068,384, so as to bring the said moved releasing or setting carriage into its arrested position, until released by the downward movement of the depressed key-lever 5. This action and engagement of the parts also causes a rotary motion of the proper actuated slide upon its rod or post 23, whereby the slide is brought into proper alinement to be engaged and moved in a downward direction by the engaging finger 20 connected with the respective lug 19 of the plate 18, during the downward movement of the previously-mentioned rock-frame.

The previously-mentioned recording or indicating disks, of which there may be any suitable number, are indicated by the reference-character 37, the several disks, of which but two are shown in Fig. 1 of the drawings, being suitably spaced apart, and being loosely and rotatably mounted upon a laterally extending main shaft or rod, as 38, and being adapted of independent or combined rotation upon said rod, in either direction, according to the actuation of the proper mechanism, either for adding or subtracting purposes, as will be hereinafter more fully described. The main shaft or rod 38 is nonrotatably disposed in suitably formed bearing-members 39 which are suitably secured to and extend in upward directions from the base-plate 1. Permanently affixed to the hub of each disk 37 are a pair of disk or wheel-like members 40 and 41, the member 40 being provided with inverted V-shaped teeth, as 42, extending from its peripheral edge-portions, and the other member 41 having extending in radial lines from its circumferential edge, a series of suitably disposed fingers or projections, as 43, the said members 41 serving as prime movers for moving the recording or indicating disks 37, at the will of the operator, in either a forward or backward direction, as may be

desired. Pivotally mounted upon the said laterally extending main shaft or rod 38, at side-faces of the respective disk or wheel-like members 41, are suitably formed arms or levers, as 44, each arm or lever being provided with a perforated ear or lug 45. Pivotally connected with each ear or lug 45, by means of a pin 46, is a link 47, each link 47 being pivotally attached at its opposite end-portion, by means of a pin 48, to a long lever or arm 49. These levers or arms 49 which, of course, correspond in number to the number of indicating or recording disks 37, are pivotally mounted at their rear end-portions upon a laterally extending rod 50, supported in suitably disposed bearing-members 51 which extend upwardly from the base-plate 1. Each arm or lever 49 is provided, near its point of pivotal support, with a projection or pin 52 with which is operatively connected the one end-portion 54 of a coiled spring 53, each spring encircling the said laterally extending rod 50, and having its other free end-portion 55 extending in a downward direction and suitably secured to a bar or plate, as 56, which extends laterally between and is suitably secured at its end-portions to the said bearing-members 51. The purposes of these springs 53, as will be evident, is to return the actuated parts to their normal initial positions, after the said arms or levers 49 and parts connected therewith have been released and have served their purposes. If desired, each arm or lever 49 may also be provided with a leaf-spring, as 57, having a portion thereof bearing directly upon the pivotal connection of the link 47 and the lever or arm 49, so as to take up any lateral play, and also to prevent any accidental separation of the said parts. At their forward end-portions, the said levers or arms 49 are each provided with finger-like extremities or members, as 58, which are adapted to be engaged, for downward depression, by the laterally extending lugs 30 of the respective slides 25 upon the posts 23, when the lug of the respective slide has been brought into proper alinement with such finger-like extremity or member 58, and when the said alined slide is being moved in its downward direction upon the post 23 by the actuated rock-frame hereinbefore mentioned.

Pivotally mounted upon the side of each arm or lever 49, by means of a pin or pivot 59, is a suitably constructed gravity dog, as 60, the lower portion of which is made with an enlarged or suitably weighted part 61, which by its weight, under certain conditions, produces a slight pivotal or swinging movement of the said dog, for the purposes to be presently more fully specified. The said dog 60 is also made with a slotted part, as 62, so as to provide two guiding edges 63 and 64, and projecting in an upward direction from said dog 60 is an arm or finger-like member 65, the upper free end-portion of which is provided with an angularly bent holding portion 66, extending laterally therefrom and toward the face of the disk or wheel-like member 41. The said gravity dog 60 is also provided with a laterally extending pin or projection 67, the purpose of which will be hereinafter more fully stated. Pivotally connected with each arm or lever 44, by means of a pivot or pin 68, is a downwardly extending swing-member or element 69 which is formed with an arc-shaped portion 70 terminating at its free end-portion in a hook-like member 71, the inner curved marginal edge-portion 72 of said portion 70, and the inner marginal edge-portion 73 of said hook-like member 71 being adapted, at predetermined times, to be brought into sliding and operative engagement with a laterally extending pin or projection 75 upon the end-portion 76 of an arm or lever 74, said arm or lever being suitably fixed by means of its hub 77 and screw 78, or in any other suitable manner, upon a rod 79 which extends between and is rotatably mounted in bearing-portions of the previously-mentioned bearing-members 51, said rod having a slight oscillatory movement in the said bearing-portions of said member 51. The pivotal or swinging movement of the said swing-member or element 69 is limited by a stud or pin 80 which projects from the side of the arm or lever 44 and extends into an elongated opening 81 with which the member 69 is provided. Extending from the said member 69 is another arm-like member or element, as 82, the free end-portion of which is bent at an angle, as at 83, so as to form a pull-piece, which is normally out of engagement with the fingers or projections 43 of the disk or wheel-like member or element 41, but which is adapted to immediately pass between two of said fingers or projections 43, as soon as the machine is operated. Extending from the outer convex marginal edge-portion of the portion 70 of the swing-member or element 69 is an extension 84 having a bent part 85 which is provided with a pin or projection 86 over which the holding portion 66 of the arm or finger-like member 65 of the gravity dog 60 rests, under normal conditions, the pivotal movement of the dog 60 and consequent downward movement of the portion 66 with the pin or projection 86, as the arm or lever 49 is moved in a downward direction, causing the pull-piece 83 to enter between the said fingers or projections 43, so as to retain or lock the swing-member or element 69 against accidental movement upon its pivot.

As soon as any one of the indicating or digit-bearing key-levers 5 is depressed, and the corresponding slide 25 has been properly set upon its vertical post 23 by the laterally

moved releasing or setting carriage, in the manner described in said former Letters Patent No. 1,068,384, the depressed key-lever 5 which also forces the previously-mentioned rock-frame in its downward direction, causes the corresponding arm or lever to move in its forward direction, or in the direction of the arrow *y* in said Fig. 4 of the drawings. At the same time, the corresponding movement of the long arm or lever 49, in carrying the gravity-dog 60 with it, brings the angularly bent portion 66 of the arm or finger-like projection 65 of the gravity-dog firmly into a downward pressing engagement with the pin or projection 86 of the extension 84 of the swing-member or element 69, and owing to the arrangement of the elongated opening 81 allowing the swing-member or element to swing slightly upon the pivot or pin 68, independent of the movement of the arm or lever 44. This independent movement of the said swing-member or element 69, as will be evident, will force the angularly bent portion 83 of the arm-like member or element 82 down between two of the fingers or projections 43 of the disk or wheel-like element 41, into holding engagement therewith, so that the combined movement of the arms or levers 49 and 44, and of the swing-member or element 69, will rotate the said disk or wheel-like member 41 and the indicating disk 37 in its forward direction, or in the direction of the arrow *y*, in said Fig. 4. At the same time, the finger or projection 75 of the pivoted arm or lever 74 rides upon the marginal edge-portion 72 of the portion 70 of the swing-member or element 69, and according to the degree of the depression of the key-lever 5 also into the hook-shaped portion, without effecting the forward movements of the said parts, until an off-set 88 upon an extension 87 with which the key-lever 5 is provided strikes a rock-frame 89 adapted to swing upon pintles 90 carried by bearing-brackets 91 mounted upon the base-plate 1. This rock-frame 89 consists, essentially, of a cross-plate or bar 92, with which said off-set 88 is adapted to be brought into engagement, and a pair of rearwardly extending side-bars or members 93 by means of which the said rock-frame is pivotally mounted upon the said pintles 90. Slidably arranged upon the outer side of one of the said side-bars or members 93, for the purposes hereinafter more fully stated, is a plate or bar 94, said plate having a pair of elongated openings 95, and the side-bar or member 93 being provided with corresponding guide-pins 96, one of which is headed, as at 97, to prevent displacement, but still permit of the sliding movement of said plate or bar 94, as will be evident. Suitably secured upon the previously mentioned rod 79, by means of a screw 98, or other suitable fastening means, is a crank-like element, as 99, which extends down the outer side of the said plate or bar 94, and is provided with an off-set 100 and a slot 101, substantially as shown in Figs. 7 and 8 of the drawings. Extending from the side of the said plate or bar 94 is a lug or projection, as 102, which, as the off-set 88 of the extension 87 of the depressed key-lever 5 is brought down upon the cross-plate or bar 92 of the rock-frame 89, causes said lug or projection 102 to forcibly move against the off-set 100 of the crank-like element 99, so as to produce a slight but quick movement of the arm or lever 74 in the direction of the arrow *v* indicated in Fig. 4 of the drawings. This movement of the arm or lever 74 in the direction of the said arrow *v*, causes the pin or projection 75 of the arm or lever 74 to kick against the curved marginal edge-portion 72 of the swing-member or element 69, so that the angularly bent portion 83 of the arm-like member or element 82 will be removed from its operative engagement with the fingers or projections 43 of the disk or wheel-like element 41, leaving the indicating or recording disk 37 and the disk or wheel-like member 41 in their forwardly rotated positions, while the levers or arms and their parts are returned to their normal initial positions by the action of the spring 53, as soon as the pressure is removed from the depressed key-lever 5 which is also returned to its normal initial position by the spring 8 connected with the said key-lever 5.

In Fig. 9 of the drawings, we have shown one means for returning the shaft or rod 79 and the arms or levers to their normal initial positions, said means consisting essentially of a collar, as 104, which is secured to said shaft or rod by means of a screw 105, or other suitable fastening means, said collar 104 being provided with a suitably formed spring-plate 105′ which bears by means of its free end-portion 106 upon an arm or stud, as 107, pivotally secured to one of the main bearing-members 39 by means of a pivot-pin 108, and the free end 109 of said arm or stud 107 being caused to constantly exert an upward pressure against the end-portion 106 of the spring-plate 105′ by the action of a spring 110 which encircles said pivot-pin 108, and has its respective end-portions bearing upon a pair of pins or lugs 111 and 112 which project from the inner side of the bearing-member 39. The upward movement of the said spring-plate 105′ is limited by bearing upon a laterally extending bar or plate 113 which is arranged between the two main bearing-members 39, said bar or plate 113 being carried by suitably formed bracket-like members or elements 114 which are secured to the said bearing-members 39 by means of screws 115, or in any other suitable manner.

The relative movements of the said indi-

cating or recording disks 37 and the disk or wheel-like members 41, as well as the parts for producing the rotary movements thereof, are limited or controlled by the downward movement of the desired key-lever 5 which has been depressed by the operator. The movements of the several key-levers 5 vary, as will be understood, and the downward movements of said key-levers are limited by the varying lengths of the downwardly projecting extension 87 of each key-lever 5, so that the movements of all the key-levers are different, and that the various slides 25 which are movably disposed upon the posts 23, as has been stated, may be variously moved in downward directions upon said posts 23 to the desired depths, and whereby, by means of the intermediately disposed disk-operating mechanism is correspondingly controlled, to move the disks 37 only the necessary distance that may be desired. In order to prevent the overthrow of the actuated disks 37 in their indicating or recording positions, after the full depression of the key-lever 5 and rotation of the disk, the base-plate 1 is provided with another set of bearing-members 116 having pintles or pins 117 upon which is pivotally mounted another rock-frame. This rock-frame consists, essentially, of a cross-bar or plate 118 and a pair of rearwardly extending side-bars 120 which are adapted to oscillate upon said pins 117 and are provided at their free ends with upwardly extending portions 121. To produce the oscillation of said rock-frame, the extensions 87 of the key-levers 5 are provided with off-sets 122 which are adapted to bear down upon the cross-bar or plate 118, and thereby correspondingly raise the upwardly extending portions 121 of the side-bars 120. The upward movement of said portions 121, at the end of the downward stroke of the depressed key-lever 5, are brought into lifting engagement with the lower marginal edges of a plate or bar 122′, having its ends slidably arranged in slots 123 which are vertically disposed in the main bearing-members 39, said plate or bar 122 being provided with upwardly projecting lugs or fingers 124 which are made to enter between two of the fingers or projections 43 of the disk or wheel-like member or element 41, at the end of its rotation, see Fig. 5 of the drawings, and thereby prevents any further rotation of the said member or element 41, as will be clearly evident. After the depressed key-lever 5 is released, and returns to its normal initial position, the said rock-frame and the plate or bar 122 and its lugs or fingers 124 return by gravity to their initial positions, as will be clearly understood from an inspection of the drawings.

Having in the foregoing set forth the mechanism and manner of actuating the recording or indicating disks 37, so as to move them in a forward direction, or in the direction of the arrow *y*, see Fig. 4, for adding purposes, we will now describe the means for setting the mechanism in such a manner, that the said recording or indicating disks 37 may be actuated and moved in a backward direction, or in the direction of the arrow *z* for subtracting purposes.

Referring now more particularly to Figs. 7 and 8 of the drawings, it will be seen that the previously-mentioned plate or bar 94 which, as has been stated, is slidably disposed upon one of the side-bars or members 93 of the rock-frame 89, has pivotally connected therewith, by means of a pivot-stud 125, a link 126. Extending upwardly from the base-plate 1 of the machine, is a post 127, said post being formed with elongated openings, as 128. Slidably secured upon the side of said post 127 is a stem 129, said stem being provided with headed pins or studs 129′ which are movably disposed in said elongated openings 128, to permit of the slidable movement of said stem 129 upon said post 127. It will be understood, however, that the said stem 129 may otherwise be slidably connected with said post 127, if desired. The upper end-portion of the stem 129 extends above the said post 127 and is provided upon its free end with a suitably formed finger-piece 130 for depressing the said stem 129. Pivotally mounted upon a pivot-stud or pin 133 extending from a bearing-bracket 131 which is suitably mounted upon the bed-plate 1, by means of a screw 132, or other suitable fastening means, is a bell-crank 134. The said bell-crank has a forwardly projecting arm-like member 135 having a slotted end-portion 136 by means of which it is operatively connected with a stud or projection 137 with which the lower end-portion of the said stem 129 is provided. The said bell-crank 134 also has an upwardly extending arm-like member 138 which is pivotally connected at its upper end-portion, by means of a pivot 139, to the previously-mentioned link 126. From an inspection of said Figs. 7 and 8 of the drawings, it will be clearly evident, that when the operator depresses the key-lever, thus provided by the slidably disposed stem 129, the bell-crank 134 will be actuated, whereby the plate or bar 94 will be drawn sufficiently in a forward direction, to cause a pin or projection 140 on said plate or bar 94 to enter into a slotted part 101 of the previously mentioned crank-like element 99 which is secured upon the rod 79, in the manner illustrated in Fig. 8 of the drawings. The said plate or bar 94 is also provided with a slot or elongated opening, as 141, into and through which extends a pin 142 which projects laterally from the side-bar or member 93 of the rock-frame 89, said pin 142 hav-

ing attached thereto the one end-portion of a coiled spring 143. The opposite end-portion of said spring is secured to a pin 144 which projects laterally from the forward end-portion of the plate or bar 94, the said spring 143 becoming stretched when the stem 129 of the depressible key is depressed, and the purpose of said spring being to return the said actuated plate and bar 94 and the operated parts connected therewith to their normal initial positions, as soon as the downward pressure has been released from the stem 129, as will be clearly evident.

In order that the said rock-frame 89 will be actuated, during the forward movement of the said plate or bar 94, before the depression and downward movements of any one of the digit-indicating key-levers 5 and the previously first-mentioned rock-frame, comprising the rearwardly extending arms 16 and the two laterally extending bars 17 and 18, the said plate or bar 94 has rigidly connected therewith, and secured thereto, in any suitable manner, a finger 145, said finger extending in an upward direction and being provided upon its upper end-portion with an extension, as 146, formed with a marginal edge-portion 147 of a convex or other suitable configuration which moves against and rides upon a roller 148, rotatably mounted upon a pin 149 which projects from the side of the arm 16 of the said last-mentioned rock-frame. To prevent any jamming of the said extension 146 with the roller 148, due to the rapidity with which the machine might be operated, the base-plate 1 is provided near said post 127 with another post 150 having a pivot 151 upon which is mounted a stop-dog 152, held in the positions shown in the drawings by the end-arms of a spring 153, and against the stop-edge 154 of which stop-dog 152, the marginal edge 155 of the extension 146 of the finger 145 is adapted to be brought, when the parts are operated for the purposes herein-above stated.

It will be noticed from Fig. 8, that the forward portion of the rock-frame 89 is raised when the extension 146 is caused to ride over the roller 148. The reason for this is that the springs 8 keep the bar 16 raised, the power exerted by said springs 8 being much stronger than the yielding action of the plate or bar 94 and its finger 145.

In using the machine for the purpose of subtracting, the corresponding slide 25 is first properly set upon its vertical post, according to which one of the indicating or digit-bearing key-levers 5 and the recording or indicating wheel or disk is to be rotated in a backward direction, by the laterally moved releasing or setting carriage, in the manner described in said former Letters Patent No. 1,068,384, whereupon the stem 129 is depressed by means of its finger-piece, so as to move the said plate or bar 94 in its forward direction. This forward movement of the said plate or bar 94 moves the pin or projection 140 into the slotted part 101 of the crank-like element 99, the parts being retained in these relative positions as long as the operator presses downwardly upon the finger-piece 130. At the same time the convex marginal edge-portion 147 of the extension 146 of the finger 145 is caused to ride or move over the roller 148, as indicated in Fig. 8 of the drawings, whereby the forward portion of the rock-frame 89 is moved in an upward direction, and the rear portion of said rock-frame is moved in a downward direction, its downward movement being limited by a downwardly extending stop-bar or foot 156 which is brought into engagement with the bed-plate 1. During the subtracting operation, when a key-lever 5 is depressed, the off-set 88 is brought into engagement with the cross-plate or bar 92, so as to move the forward end of the bar or plate 94 in a downward direction, and its rear end in an upward direction, in the same manner as during the addition operation. The pin or projection 140, as has been stated, having been previously moved into the slotted part 101 of the crank-like element 99, produces a sufficient rock-motion of said crank-like element 99, and the latter being rigidly fixed to the previously-mentioned rod 79, causes the latter also to receive a corresponding rock or rotary motion in its bearing-portions in which it is mounted, but in a direction opposite from that, during the adding operation. This rock or rotary motion of the said rod 79, as will be evident, produces a corresponding movement of the arm or lever 74, also fixed upon the said rod 79, in a forward direction, thereby forcing a rearwardly projecting stud-like extension or heel 157 against the previously-mentioned pin or projection 67 of the gravity dog 60. A sudden or slight movement of the gravity dog upon its pin or pivot 59 is produced in consequence of such contact of the extension or heel 157 with the pin or projection 67, so that the angularly bent holding portion 66 of the arm or finger-like projection is thrown out of its position for engagement with the pin or projection 86 of the swing-member or element 69, and so that the angularly bent portion 83 of the arm-like member 82 will remain in its normal position above and out of its active engagement with the fingers or projections 43 of the disk or wheel-like element 41.

The desired digit-bearing key-lever 5 is now depressed, whereby, in the manner herein-before stated, the mechanism which is actuated by the downward rotary motion of the long arm or lever 49 is caused to move

in a forward direction to the positions indicated in Fig. 6 of the drawings, the angularly bent-portion 83 of the arm-like member 82 moving in an arc-shaped path, above the fingers or projections 43 of the disk or wheel-like element 41, so that the latter and the indicating or recording disk 37 will remain stationary or immovable. At the end of the downward stroke of the digit-bearing key-lever 5, however, the action of the arm or lever 74 is such that the laterally extending pin or projection 75 of said arm or lever 74 will bear directly upon the marginal edge-portion 159 of the member 158 of the hook-like member 71 of the swing-member or element 69, whereby said swing-member or element 69 receives a sufficient pivotal movement which brings the angularly bent portion 83 of the arm-like member 82 down into operative engagement between a pair of the fingers or projections 43 of the disk or wheel-like element 41, directly below said portion 83, as clearly indicated in said Fig. 6 of the drawings, with the result, that upon the release of the depressed key-lever 5 by the operator, the said disk or wheel-like element 41 and the recording or indicating disk 37 will move backward, or in the direction of the arrow *z*, shown in said Fig. 6, so that the disk 37, instead of being used as an adding disk, will serve as a subtracting disk. As soon as the digit-bearing key-lever 5, and the other actuated devices and parts have returned to their normal initial positions, the mechanism can again be used either for adding or subtracting purposes, as may be desired.

To positively prevent any rotary movement of the disk 37, during the subtracting operations of the mechanism, and while the mechanism is moving in a forward direction without being brought into operative engagement with the disk or wheel-like element 41, the rock-frame heretofore mentioned, and which consists of the cross-bar or plate 118 and the rearwardly extending side-bars 120 provided with the upwardly extending lifting portions 121, is provided. This rock-frame, as has been stated, is pivotally mounted between the bearing-members 116, and to tilt the said rock-frame and bring the said lifting portions 121 thereof in lifting engagement with the lifting bar or plate 122 and its retaining lug or finger 124 between the lower two of the fingers or projections 43 of the disk or wheel-like element 41, as indicated in Fig. 5 of the drawings, the base-plate 1 is provided at the proper place with a bearing-portion 160 which is provided with a pivot-pin 161. Pivotally mounted upon this pin 161 is an oscillating lever 162, comprising two arm-portions 163 and 164, the upper marginal edge-portion of the free end-portion of the arm 163 being suitably curved, as at 165, and the other arm-portion 164 being provided with a foot or stop-piece 166 which is for the purpose of limiting the downward movement of the said arm-portion 164, and in consequence thereof the entire movement of the said oscillating lever 162. As shown, the slidable plate or bar 94 is also provided upon its inner surface, and at a point near the said curved end-portion 165 of said arm-portion 163, with a laterally extending pin or projection, as 167, which during the forward movement of the said bar or plate 94 is caused to move directly over the said curved end-portion 165 of the arm-portion 163, so as to move said arm-portion 163 in a downward direction, and the said arm-portion 164 in an upward direction, as will be clearly evident. The result is that the free end-portion 168 of the arm-portion 164, which lies directly beneath one of the side-bars 120, will raise said side-bars sufficiently, and cause the upwardly extending portions 121 of said side-bars to lift the plate or bar 122 and bring the proper upwardly projecting lug or finger 124 into its retaining or holding engagement with the two lowermost fingers or projections 43 of the disk or wheel-like element 41, so that the latter and the corresponding indicating or recording disk 37 can not be rotated. After the depressed key-lever 5 is released, and returns to its normal initial position, the said last-mentioned rock-frame, as well as the oscillating lever 162, while the disk or wheel-like element 41 and the recording or indicating disk 37 are being moved backward, or in the direction of the arrow *z*, shown in Fig. 6, in the manner hereinbefore set forth, will also return automatically to their normal initial positions, when the machine is again ready for the next adding or subtracting operation, that may be necessary or desired.

From the foregoing description of the present invention, it will be clearly evident that an operative and efficient apparatus or machine has been produced which is adapted for use as a combined adding and subtracting machine, or which may be put to the independent uses of adding or of subtracting, as may be desired by the operator, and in which the number of the parts has been greatly reduced. The operations of the various devices and parts which act either singl or in conjunction with one another will be readily understood by those skilled in the art.

We are fully aware that changes may be made in the general arrangements and combinations of the various devices and parts, as well as in the details of the construction of the same, without departing from the scope of the present invention as set forth in the foregoing specification, and as defined in the clauses of the claim which are appended to the said specification. Hence, we do not

limit the present invention to the exact arrangements and combinations of the various devices and the parts thereof as described in the said specification, nor do we confine ourselves to the exact details of the construction of the said parts as illustrated in the accompanying drawings.

We claim:—

1. In a machine of the character specified, in combination with a depressible key-lever, a rotatably arranged recording or indicating disk, a disk-operating mechanism adapted to be actuated during the downward stroke of the key-lever and thrown into engagement with the recording or indicating disk to rotate the latter in a forward direction, and an auxiliary means coöperating with said key-lever acting independent of the said downward stroke of the key-lever for maintaining the disengagement of the disk-operating mechanism during the downward stroke of the said key-lever, but causing the engagement of said mechanism with the recording or indicating disk at the end of the downward stroke of the key-lever and rotating the recording or indicating disk in a rearward direction during the return-stroke of the key-lever.

2. In a machine of the character specified, in combination with a depressible key-lever, a rotatably arranged recording or indicating disk, means adapted to be actuated by a depressed key-lever for holding said disk against movement at the end of the stroke of the key-lever, a disk-operating mechanism adapted to be actuated during the downward stroke of the key-lever and thrown into engagement with the recording or indicating disk to rotate the latter in a forward direction, and an auxiliary means coöperating with said key-lever acting independent of the said downward stroke of the key-lever for maintaining the disengagement of the disk-operating mechanism during the downward stroke of the said key-lever, but causing the engagement of said mechanism with the recording or indicating disk at the end of the downward stroke of the key-lever and rotating the recording or indicating disk in a rearward direction during the return stroke of the key-lever.

3. In a machine of the character specified, in combination with a depressible key-lever, a rotatably arranged recording or indicating disk, a disk-operating mechanism adapted to be actuated during the downward stroke of the key-lever and thrown into engagement with the recording or indicating disk to rotate the latter in a forward direction, a releasing or setting means adapted to be brought into engagement with said disk-operating mechanism, and an auxiliary means coöperating with said key-lever acting independent of the said downward stroke of the key-lever for maintaining the disengagement of the disk-operating mechanism during the downward stroke of the said key-lever, but causing the engagement of said mechanism with the recording or indicating disk at the end of the downward stroke of the key-lever and rotating the recording or indicating disk in a rearward direction during the return-stroke of the key-lever.

4. In a machine of the character specified, in combination with a depressible key-lever, a rotatably arranged recording or indicating disk, means adapted to be actuated by a depressed key-lever for holding said disk against movement at the end of the stroke of the key-lever, a disk-operating mechanism adapted to be operated during the downward stroke of the key-lever and thrown into engagement with the recording or indicating disk to rotate the latter in a forward direction, a releasing or setting means adapted to be brought into engagement with said disk-operating mechanism, and an auxiliary means coöperating with said key-lever acting independent of the said downward stroke of the key-lever for maintaining the disengagement of the disk-operating mechanism during the downward stroke of the said key-lever, but causing the engagement of said mechanism with the recording or indicating disk at the end of the downward stroke of the key-lever and rotating the recording or indicating disk in a rearward direction during the return-stroke of the key lever.

5. In a machine of the character specified, in combination with a depressible key-lever, a rotatably arranged recording or indicating disk, and a peripherally-toothed wheel-like member coöperating with said recording or indicating disk to rotate the latter, an operating mechanism adapted to be actuated during the downward stroke of the key-lever, said mechanism comprising a pivotally-disposed and spring-controlled lever adapted to be actuated by the downward stroke of the key-lever, a pivotally mounted arm, a link-connection between said arm and said lever, a swing-member pivotally connected with said arm, a pull-arm connected with said swing-member, an oscillatory lever in engagement with said swing-member for producing the active engagement of said pull-arm with the peripheral teeth of said wheel-like member during the downward stroke of the key-lever to rotate said wheel-like member and the recording or indicating disk in a forward direction, and means coöperating with said key-lever and the said oscillatory lever for maintaining the disengagement of said pull-arm with the peripheral teeth of said wheel-like member during the downward stroke of the key-lever, but causing the engagement of said pull-arm with the peripheral teeth of said wheel-like member at the end of the downward stroke of the key-lever and rotating said

wheel-like member and the recording or indicating disk in a rearward direction during the return-stroke of the key-lever.

6. In a machine of the character specified, in combination with a depressible key-lever, a rotatably arranged recording or indicating disk, and a peripherally-toothed wheel-like member coöperating with said recording or indicating disk to rotate the latter, an operating mechanism adapted to be actuated during the downward stroke of the key-lever, said mechanism comprising a pivotally-disposed and spring-controlled lever adapted to be actuated by the downward stroke of the key-lever, a pivotally mounted arm, a link-connection between said arm and said lever, a swing-member pivotally connected with said arm, a pull-arm connected with said swing-member, an oscillatory lever in engagement with said swing-member for producing the active engagement of said pull-arm with the peripheral teeth of said wheel-like member during the downward stroke of the key-lever to rotate said wheel-like member and the recording or indicating disk in a forward direction, and means coöperating with said key-lever and the said oscillatory lever for maintaining the disengagement of said pull-arm with the peripheral teeth of said wheel-like member during the downward stroke of the key-lever, but causing the engagement of said pull-arm with the peripheral teeth of said wheel-like member at the end of the downward stroke of the key-lever and rotating said wheel-like member and the recording or indicating disk in a rearward direction during the return-stroke of the key-lever, and means adapted to be actuated by the depressed key-lever for holding the recording or indicating disk against movement at the end of the stroke of the key-lever.

7. In a machine of the character specified, in combination with a depressible key-lever, a rotatably arranged recording or indicating disk, and a peripherally-toothed wheel-like member coöperating with said recording or indicating disk to rotate the latter, an operating mechanism adapted to be actuated during the downward stroke of the key-lever, said mechanism comprising a pivotally-disposed and spring-controlled lever adapted to be actuated by the downward stroke of the key-lever, a pivotally mounted arm, a link-connection between said arm and said lever, a swing-member pivotally connected with said arm, a pull-arm connected with said swing-member, a releasing or setting means adapted to be brought into engagement with said pivotally disposed and spring-controlled lever for actuating said lever during the downward stroke of the key-lever, an oscillatory lever in engagement with said swing-member for producing the active engagement of said pull-arm with the peripheral teeth of said wheel-like member during the downward stroke of the key-lever to rotate said wheel-like member and the recording or indicating disk in a forward direction, and means coöperating with said key-lever and the said oscillatory lever for maintaining the disengagement of said pull-arm with the peripheral teeth of said wheel-like member during the downward stroke of the key-lever, but causing the engagement of said pull-arm with the peripheral teeth of said wheel-like member at the end of the downward stroke of the key-lever and rotating said wheel-like member and the recording or indicating disk in a rearward direction during the return-stroke of the key-lever.

8. In a machine of the character specified, in combination with a depressible key-lever, a rotatably arranged recording or indicating disk, and a peripherally-toothed wheel-like member coöperating with said recording or indicating disk to rotate the latter, an operating mechanism adapted to be actuated during the downward stroke of the key-lever, said mechanism comprising a pivotally-disposed and spring-controlled lever adapted to be actuated by the downward stroke of the key-lever, a pivotally mounted arm, a link-connection between said arm and said lever, a swing-member pivotally connected with said arm, a pull-arm connected with said swing-member, a releasing or setting means adapted to be brought into engagement with said pivotally disposed and spring-controlled lever for actuating said lever during the downward stroke of the key-lever, an oscillatory lever in engagement with said spring-member for producing the active engagement of said pull-arm with the peripheral teeth of said wheel-like member during the downward stroke of the key-lever to rotate said wheel-like member and the recording or indicating disk in a forward direction, and means coöperating with said key-lever and the said oscillatory lever for maintaining the disengagement of said pull-arm with the peripheral teeth of said wheel-like member during the downward stroke of the key-lever, but causing the engagement of said pull-arm with the peripheral teeth of said wheel-like member at the end of the downward stroke of the key-lever and rotating said wheel-like member and the recording or indicating disk in a rearward direction during the return-stroke of the key-lever, and means adapted to be actuated by the depressed key-lever for holding the recording or indicating disk against movement at the end of the stroke of the key-lever.

9. In a machine of the character specified, in combination with a depressible key-lever, a rotatably arranged recording or indicat-

ing disk, a disk-operating mechanism adapted to be actuated during the downward stroke of the key-lever, a rock-frame adapted to be actuated by the downward stroke of the key-lever, an oscillatory shaft and means mounted upon said shaft for throwing the disk-operating mechanism into active engagement with said recording or indicating disk, and a crank-like element also mounted upon said shaft for oscillating the latter, said crank-like element being provided with an engaging off-set, a slide-plate slidably connected with said rock-frame, said plate being adapted to be brought into engagement with said off-set for oscillating said shaft in a forward direction, said crank-like element being also provided with a slotted portion, a pin extending from said slide-plate, said pin being adapted to enter said slotted portion of the crank-like element when said slide-plate is moved in a forward direction for oscillating said shaft in a rearward direction, and means connected with said slide-plate for producing a sliding movement of said plate in a forward direction.

10. In a machine of the character specified, in combination with a depressible key-lever, a rotatably arranged recording or indicating disk, a disk-operating mechanism adapted to be actuated during the downward stroke of the key-lever, a rock-frame adapted to be actuated by the downward stroke of the key-lever, an oscillatory shaft and means mounted upon said shaft for throwing the disk-operating mechanism into active engagement with said recording or indicating disk, and a crank-like element also mounted upon said shaft for oscillating the latter, said crank-like element being provided with an engaging off-set, a slide-plate slidably connected with said rock-frame, said plate being adapted to be brought into engagement with said off-set for oscillating said shaft in a forward direction, said crank-like element being also provided with a slotted portion, a pin extending from said slide-plate, said pin being adapted to enter said slotted portion of the crank-like element when said slide-plate is moved in a forward direction for oscillating said shaft in a rearward direction, and means connected with said slide-plate for producing a sliding movement of said plate in a forward direction, consisting of a vertically slidable stem, a bell-crank pivotally connected with said stem, and a link between said bell-crank and said slide-plate.

In testimony, that we claim the invention set forth above we have hereunto set our hands this 2nd day of December, 1912.

LEVI I. DARBY.
CHARLES N. WALSH.

Witnesses:
FREDK. C. FRAENTZEL,
FREDK. H. W. FRAENTZEL.