

Oct. 27, 1931.

A. VETHE

1,829,379

COMPUTING MACHINE

Filed Oct. 20, 1926

2 Sheets-Sheet 1

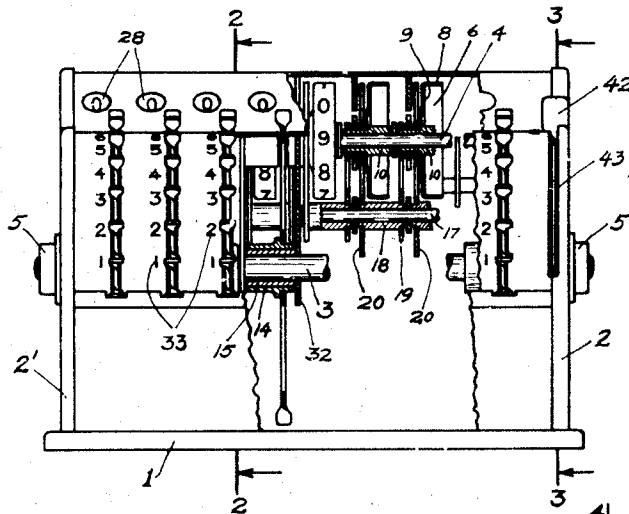


Fig. 1.

Fig. 3.

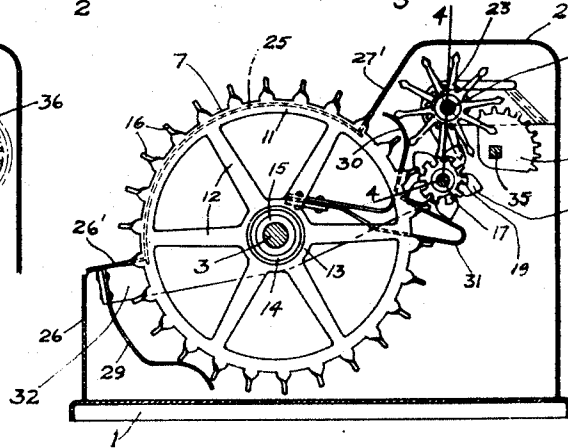
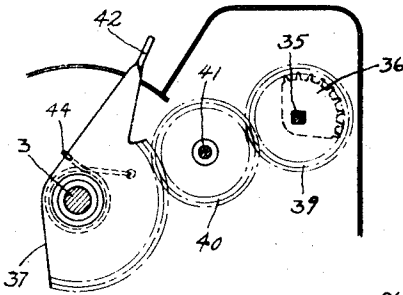


Fig. 2.

Fig. 5.

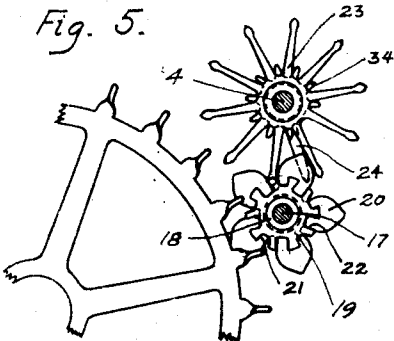
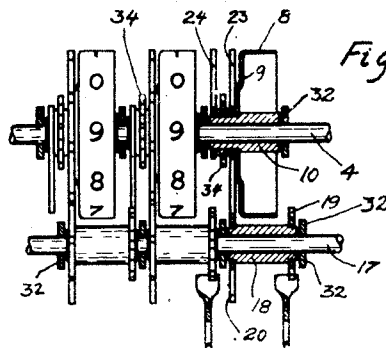


Fig. 4.



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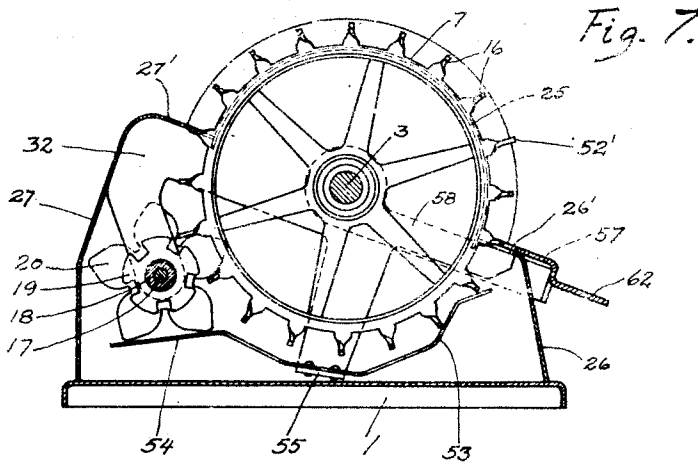
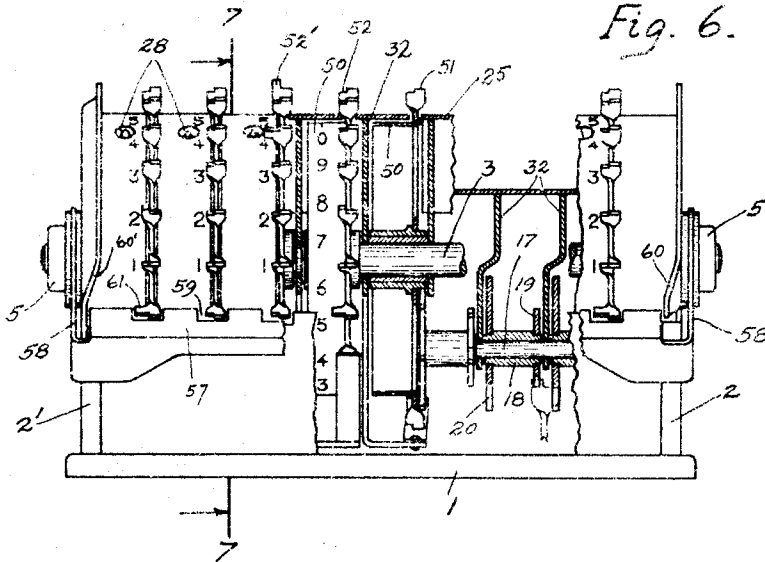
A. VETHE

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COMPUTING MACHINE

Filed Oct. 20, 1926

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

ANDERS VETHE, OF OSLO, NORWAY

COMPUTING MACHINE

Application filed October 20, 1928. Serial No. 142,953.

This invention relates to computing machines.

The object of the invention is to provide a computing machine adapted for effecting both addition and subtraction, which is of simple and relatively inexpensive construction, of strong and durable construction, and is effective and reliable in operation.

To effect the objects of the invention, my improved computing machine comprises a frame, shafts mounted therein, a plurality of counter-wheels, actuating wheels mounted to turn on said shafts, respectively, said actuating wheels comprising marginal lugs for turning the same, gearing rendered operative by the lugs on said actuating wheels when rotated, which connects said counter-wheels in series and each actuating wheel with a counter-wheel, said counter-wheels having numerals on their perimeters, a casing which encloses operative parts of the machine provided with sight openings through which the numerals on different counter-wheels, respectively, are exposed in operation, means for yieldingly holding said counter-wheels and actuating wheels against rotation when in positions corresponding to exposure of numerals on said counter-wheels through their associated sight openings, respectively, and means for resetting said counter-wheels following operation of the machine.

The invention also comprises the various other features, combination of features and details of construction hereinafter described and claimed.

In the accompanying drawings in which my invention is fully illustrated:

Fig. 1 is a front view of the machine with a section of the casing broken away to expose operative parts thereof,

Fig. 2 is a sectional view of the machine on the line 2—2 of Fig. 1,

Fig. 3 is a fragmentary sectional side view on the line 3—3 of Fig. 1,

Fig. 4 is a detached view showing the counter-wheels and operating gearing therefor partly in elevation and partly in section and on the line 4—4 of Fig. 2,

Fig. 5 is a fragmentary side view of the gearing which connects the counter-wheels

in a series and the actuating wheels with the counter-wheels,

Fig. 6 is a view substantially similar to Fig. 1 illustrating a modified construction, and

Fig. 7 is a sectional elevation taken substantially on the line 7—7 of Fig. 6.

Describing the invention, in the first instance, with particular reference to Figures 1 to 5 of the drawings, in which I have shown what I now consider to be the preferable embodiment of the invention.

The operative parts of the machine are mounted on a suitable frame consisting of a base plate 1 and end plates 2, 2', rigidly secured thereto. Said base plate and end plates are preferably made of suitable sheet metal, as sheet steel, and may conveniently be formed by usual stamping processes.

Supported in the end plates 2, 2', and preferably secured thereto against rotation are shafts 3 and 4, both of which are provided with shoulders at their opposite ends and are held against rotation by clamping them between said end plates. Simple means for this purpose consist of nuts 5 threaded to the ends of the shaft 3 outside of said end plates, which provide for clamping said frame plates in firm engagement with shoulders formed on said shaft.

Mounted on the shaft 4 so as to turn freely thereon are a plurality of counter-wheels 6, and mounted on the shaft 3 are a plurality of what for purposes of convenient reference, may be designated actuating wheels 7, said counter-wheels and actuating wheels, respectively, being facsimiles of one another.

A description of one of said counter-wheels and one of said actuating wheels will, therefore, suffice for all and the accompanying description will, therefore, be in the singular.

As shown, the counter-wheels 6 are stamped from suitable sheet metal, preferably aluminum, so as to form a cylindrical portion 8, provided with a web portion 9, which is provided at its center with an opening in which is secured a hub portion 10 provided with an axial opening adapted to receive the shaft 4.

Formed on the cylindrical surface of said counter-wheels and arranged in uniformly spaced relation thereon are numerals arranged in series from zero to nine, the relation being such that by turning the different counter-wheels different numerals on different wheels may be brought into transverse alignment.

In accordance with my invention, rotation is adapted to be imparted to said counter-wheels in either direction by means as follows:—The actuating wheels are mounted on the shaft 3 so as to be separately rotatable thereon in both directions, the number of said actuating wheels being equal to the number of counter-wheels 6. In order that said actuating wheels may be very light and will thus have very little momentum in operation, they are preferably stamped from suitable sheet metal, as sheet steel, and are skeletoned to form a rim portion 11 and spokes 12 which connect said rim portion with a central disk 13, said rim portion and spokes being made as light as consistent with necessary strength.

Formed in the central disk of said actuating wheel is a hole, secured in which is a hub 14, which is provided with a bore loosely fitted to which is a bushing 15, which is slightly longer than the hub 14, thus providing necessary clearance to prevent binding of said wheels when the machine is assembled and the clamping nuts 5 are tightened.

Formed on the actuating wheels 7 are marginal projections 16. The outer ends of said marginal projections 16 are flat, the sides thereof extending radially and being substantially coincident with planes passing through the axis of the shaft 3. Said marginal projections 16 are so proportioned that they may conveniently be engaged by a finger of an operator to turn said wheels.

The counter-wheels 6 are connected in series, and said counter-wheels 6 and actuating wheels 7 are connected in pairs by suitable gearing, as follows:—Mounted in rigid parts of the frame of the machine is a shaft 17—shown as substantially intermediate the shafts 3 and 4, and which extends parallel therewith—rotatably mounted on which are sleeves 18, secured to opposite ends of each of which is what may be described as a pinion 19 and a star wheel 20, said pinion being shown as provided with two sets of teeth or notches 21 and 22, which are arranged alternately. The arrangement is such that upon rotation of the actuating wheels 7 in clockwise direction in Fig. 5 the teeth 22 are engaged by the marginal projections 16 for rotating the pinions, and that upon rotation of the actuating wheels 7 in counter-clockwise direction in said figure the teeth 21 are engaged by said projections 16 for driving the pinions in clockwise direction. Said gearing also comprises a second star wheel

23 secured to the hub 10 of the counter-wheel 6, said star wheel consisting of radiating spokes or fingers which project into the path of movement of the teeth of the star wheel 20. Thus, as the actuating wheel 7 is rotated in operation, the marginal projections 16 thereof will engage the teeth or notches 21 or 22 in the pinion 19 and will impart rotation thereto and also to the sleeve 18 to which said pinion is secured and to the star wheel 20 secured to the opposite end of said sleeve, rotation of said star wheel 20 operating, in turn, to impart rotation to the star wheel 23 secured to the hub of the counter-wheel 6, whereby rotation will, in turn, be imparted to said counter-wheel.

Also secured to the hub of the counter-wheel 6 is a finger 24 which, at the critical point in every complete revolution of said counter-wheel will engage a tooth or notch 21 or 22 in the pinion 19 of the gear train through which rotation is adapted to be imparted to the counter-wheel of next higher denomination, for the usual carrying operation by which said counter-wheel is moved either forwardly or backwardly a distance equal to that between adjacent numerals thereon.

Operative parts of the machine are enclosed in a suitable casing which comprises a cylindrical section 25, the outer surface of which is substantially flush with the periphery of the rim portions of the actuating wheels 7, and front and back sections 26 and 27, which comprise portions 26' and 27' below and above said cylindrical portion 25, which extend substantially radially with reference to the axis of the shaft 3. Said portions 26', 27', form stops with which the finger of the operator will contact in operating the machine, thus limiting rotation of the actuating wheel 7 in operation.

Formed in the portion 27' of the casing section 27 are sight openings 28, there being a sight opening for each counter-wheel 6 and the relation being such that, in positions of rest of said counter-wheels, a numeral on each thereof will be exposed.

An important feature of my improved computing machine is that the counter-wheels 6, actuating wheels 7, and the gearing connecting the same will operate equally well both frontwards and backwards, thus adapting the machine for performing subtraction as well as addition.

The actuating wheels 7, the bushings 18—together with the pinions 19 and the star wheels 20—and also the star wheel 23, are adapted to be maintained yieldingly in positions of rest corresponding to register of a numeral on each of the counter-wheels with the sight openings 28 associated therewith, respectively, by means of springs 29, 30, and 31, respectively, which are adapted to engage adjacent marginal projections 16 on the

actuating wheels 7, the outer ends of adjacent spokes or figures of the star wheel 23 secured to the counter-wheels and adjacent points of the star wheel 20.

As shown the springs 29, 30, 31 are mounted on members 32 positioned between adjacent counter-wheels 6 and actuating wheels 7 and which are provided with bearings adapted to receive the shafts 3 and 4 and also the shaft 17, said members 32 being clamped in position between the bushings 15 on which the actuating wheels 7 are mounted.

Said members 32 will operate in an obvious manner, to tie the shafts 3 and 4 together and to support the intermediate shaft 17 independently of the end plates 2, 2', of the machine frame, if desired, and will also effectually prevent springing or buckling of said shafts.

As shown, the intermediate shaft 17 is supported entirely by the members 32, but may also be provided with bearings in the end frames of the machine, if desired.

As shown, also, said members 32 afford convenient means for supporting the casing section 25, which comprises a plurality of separate parts positioned between adjacent actuating wheels 7 and which are proportioned to provide slots of suitable width to receive the rim portions of said actuating wheel.

For convenience, numerals from 1 to 9, designated by the reference numeral 33, are provided in association with the actuating wheels 7, being preferably imprinted in any suitable manner on different parts of the casing section 25 in such positions that they will align transversely with the marginal projections 16, when in positions of rest.

In order that adjacent counter-wheels of higher denominations may be actuated by means of the fingers 24 secured to the hubs of counter-wheels of next lower denominations without rotating the actuating wheel associated with such counter-wheels of higher denominations, the extreme distances between adjacent marginal projections 16 on the actuating wheels 7 and the diameters of the pinions 19 are so proportioned, and the relative positions of said actuating wheels and pinions are such that, in positions of rest, the marginal projections 16 will "escape" the teeth of the pinions 19, so that said pinions 19 will be free to rotate independently of said rotating wheels. This is an important feature of my improved computing machine, since it very materially reduces the strain on the operating mechanism during a carrying operation and particularly so when a number of carrying operations are performed simultaneously, as when 1 is to be added to a number ending in a series of 9's. In such case, the train of gearing to the last operated part at the left as shown in Fig. 1 is comparatively long, so that the elimination of the op-

erating wheels 7 and the springs 29 from such operation is correspondingly important.

Another characteristic feature of my improved machine resides in the fact that all of the parts of the machine are constructed and arranged to function in both directions, thus providing for performing addition and subtraction on the machine, rotation of the actuating wheels 7 in one direction advancing their associated counter-wheels, thereby increasing the total of the number represented by the numerals exposed through the sight openings 28, and rotation of said actuating wheels in the reverse direction, will reduce the number formed by the numerals exposed through said sight openings 28.

After a computation has been finished, the machine is adapted to be reset so that the characters zero on all of the counter-wheels will be exposed at the sight openings 28, thus putting the machine in condition for a new computation or calculation.

In accordance with my invention, this is effected by means, as follows:—

Secured to the hubs 10 of the counter-wheels 6 are pinions 34, and rotatably mounted in the end plates 2, 2', of the machine frame is a shaft 35 secured to rotate with which are segmental gears 36, the teeth of which are adapted to engage the teeth of the pinions 34 when any numeral other than zero is exposed at a sight opening associated with a given counter-wheel.

The pinions 34 are made of a diameter corresponding to a number of teeth thereon equal to the number of numerals on the counter-wheel, to wit: 10, a tooth of each of said pinions being cut away and the pinions 34 and segmental gear 36 being made of such relative diameters that, when the pinions 34 are in positions corresponding to exposure of the characters zero (0) at the sight openings 28, a right line passing through the axes of said pinions 34 and segmental gears 36, will pass substantially through the centers of the spaces formed by the cut-away teeth of said pinions, respectively, and the teeth of said segmental gears 36 will "escape" the teeth of the pinions 34, but will engage the teeth of said pinions when any numerals or characters other than zero are exposed at said sight openings.

Thus, when any counter-wheel is in position corresponding to exposure of a numeral other than the character zero at a sight opening and rotation is imparted to the shaft 35 and thus to the segmental gears 36, rotation will be imparted to the pinion 34 associated with said counter-wheel, thereby turning said counter-wheel until the character zero is exposed at the sight opening, in which position the teeth of the segmental gear 36 will pass out of engagement with the teeth of the pinion 35 and the counter-wheel will come to rest with the character zero exposed at its

sight opening and the detent spring 30 in engagement with the points of the star-wheel 23.

In accordance with my invention rotation is adapted to be imparted to the shaft 35 to reset the machine by means of a train of gears comprising a segmental gear 37 (Fig. 3) rotatably mounted on the shaft 3 adjacent to the end plate 2 of the machine frame, a pinion 39 secured to the shaft 35 which carries the segmental gears 36 and a gear 40 rotatably mounted on a stud 41 secured in the end plate 2 and which intermeshes with the teeth of the gears 37 and 39.

Rotation is adapted to be imparted to the segmental gear 37 by means of a lever arm 42 secured thereto, the end of which projects through a slot 43 in the cylindrical portion 25 of the casing of the machine. In position to be engaged by a finger of the operator to exert a pull on the lever arm 42, the ends of said slot forming stops, contact of said lever arm with which, limits turning movement of said segmental gear. The segmental gear 37 is maintained yielding in position corresponding to full disengagement of the segmental gear 36 from the pinion 34 by a coiled spring 44 applied thereto, one end of which is connected to the segmental gear 37 and the opposite end thereof to the adjacent member 32, displacement of said spring being prevented by coiling it about the hub of said segmental gear 37.

During operation of the machine the segmental gears 36 are fully disengaged from the pinions 34 in order that said gears 36 shall not interfere with free turning movement of the counter-wheels.

As a modification of my invention, I contemplate dispensing entirely with separate counter-wheels and utilizing the actuating wheels both as actuating wheels and counter-wheels, thereby greatly simplifying the machine, particularly as regards the gearing by which counter-wheels of higher denominations are operatively connected with those of lower denomination, as the units counter-wheel with the tens, the tens with the hundreds etc., thereby correspondingly reducing the cost of manufacture.

This modification is illustrated in Figs. 6 and 7 of the drawings, in which, so far as can be done without confusion, the same or substantially similar parts are designated by the same reference characters as in Figs. 1 to 5, to wit:—1, designates the base of the machine; 2, 2', end plates supported thereon, on which the operative parts of the machine are mounted; 3, a shaft secured in said end plates and which rigidly connects the same; 5, nuts threaded to the projecting ends of said shaft adapted to clamp said end plates against shoulders formed on said shaft, thus binding the frame structure rigidly together; 7, actuating wheels mounted to turn freely on the shaft 3 in both directions; 16, marginal pro-

jections on said actuating wheels providing means for turning the same; 17, a gear shaft the ends of which are reduced, forming shoulders thereon, the reduced ends thereof being adapted to engage holes in the end plates 2, 2', of the machine, being so proportioned that when the clamping nuts 5 are tightened, the shoulders on said shaft will be clamped between said end frame members and held against rotation; 18, sleeves mounted to turn freely on the shaft 17 secured to opposite ends of each of which, respectively, is a pinion 19 and a star wheel 20.

Excepting as hereinafter particularly described and pointed, all of the foregoing parts are substantially similar to the same or corresponding parts of the preferred embodiment of my invention shown in Figs. 1 to 5 of the drawings and heretofore described, and will be readily understood therefrom without a description thereof in detail.

In the modified construction shown in Figs. 6 and 7, the counter-wheels are formed by cylindrical flanges 50 formed on and which project laterally from the rim portions of the actuating wheels 7, said flanges bearing on their outer cylindrical surfaces, a plurality of series of numerals from 0 to 9 arranged in uniformly spaced relation thereon, and the number of marginal projections on the different actuating wheels being equal to the total number of numerals on each wheel, that is, the number of said marginal projections being a multiple of 10. As shown, also, the pinions 19 are secured to the right hand end of the sleeves 18 and the star wheels 20 to the left hand ends thereof, the star wheels and pinions secured to the adjacent ends of adjacent sleeves being positioned in such close proximity to each other that the marginal projections on a single actuating wheel will engage the star wheel on the right hand sleeve and the pinion on the left hand sleeve. Said marginal projections are so shaped and proportioned that each marginal projection will engage the points of the star wheel associated therewith, while only every 10 marginal projection will engage a tooth of said pinion, the relation being such, that when an actuating wheel is turned a distance equal to the circumferential distance between adjacent marginal projections 16, the counter-flanges 50 will be turned a distance equal to that between adjacent numerals thereon.

To insure continuous engagement of the marginal projections 16 with the points of the star wheel 20, the right hand sides 51 of said marginal projections, which align with said star wheel are made of suitable length always to engage the points of said star wheel, while, to provide for engagement of every tenth marginal projection with the teeth or notches of the pinion 19, the left hand sides of said marginal projections, other than those designed to engage the teeth of

said pinions, are cut away, as shown at 52, so that they will escape the pinions 19, and the left hand sides of every tenth marginal projection being made sufficiently long so that they will engage the teeth or notches of said pinions, as shown at 52'.

The actuating wheel and thus the counter-flanges 50 secured thereto are held yieldingly against rotation during periods of rest by means of spring pawls or detents 53 which engage adjacent marginal projections 16, and the pinion 19 and star wheel 20 are held against rotation during periods of rest by spring pawls or detents 54 applied to adjacent points of said star wheel, all in substantially the same manner as in the preferred form of the apparatus shown in Figs. 1 to 5. As shown, the spring pawls or detents 53 and 54 are formed integral with each other and are supported at the ends of arms 55 on members 32 arranged between adjacent actuating wheels and associated parts, and which are provided with holes or openings to receive the shafts 3 and 17, respectively.

Operative parts of the machine are enclosed in a casing which is substantially similar in construction with the casing of the preferred form of machine shown in Figs. 1 to 5, and the parts thereof are designated by the same reference numerals, to wit:—The front and rear sections are designated by the reference numerals 26 and 27, and comprises radially extending portions 26' and 27', which form stops which limit turning movement of the actuating wheels 7 by a finger of the operator. Said casing also comprises a circular section 25 consisting of separate parts secured to the members 32 positioned between the actuating wheels. The separate parts of said cylindrical casing section 25 are proportioned and are mounted in proper position to define slots through which the marginal projections 16 of the actuating wheels extend, and enclose the portions of the counter-flanges 50 which extend above the radial portions 26', 27', of the casing of the machine. Also, the separate parts of said casing section 25 are provided with sight openings 28 formed therein in convenient position so that the numerals on the counter-flanges 50 will be exposed therethrough when the actuating wheels are in positions of rest.

To provide for turning the actuating wheels 7 to expose any numeral from zero to nine, inclusive, through a sight opening 28 by continuous turning movement of an actuating wheel, the casing of the machine is constructed and arranged so that at least nine marginal projections 16 of each wheel will be exposed for operation.

Also as in the preferred form of the machine, first described, said modified machine is constructed and arranged to be operated in both directions, thus providing for per-

forming both addition and subtraction and for making corrections, in case a mistake has been made, as by turning the actuating wheel by means of a wrong marginal projection.

After operation, the machine is adapted to be reset so that the character zero on all of the counter-flanges 50 will be exposed at the sight openings 28. In accordance with the disclosure of Figs. 6 and 7, this is effected by means as follows:—

Pivotaly supported so as to swing over the cylindrical section 25 of the casing of the machine between the radial sections 26' and 27' thereof, is a bar 57, said bar being pivotally connected to the ends of the shaft 3, which project beyond the end frame members 2, 2', by spring arms 58. Formed in the inner edge of said bar 57 are spaced notches 59 which are in substantial alignment with the different actuating wheels 7 and are proportioned to permit the passage therethrough of the marginal projections 16 on the different actuating wheels. When at the forward limit of its pivotal movement, the right hand end of said bar 57 rides upon a fixed cam 60 formed on the right hand end plate 2 which operates to force said plate endwise so as to permit the passage through the marginal notches 59 therein of all of the marginal projections 16 on the different wheels. Such endwise movement of the bar 57 is effected by flexure of the spring arms 58, which are normally under tension adapted to maintain the right hand end of the resetting bar in contact with the right hand end frame 2, which extends above the casing section 25, in which position, the left hand edges of the notches 59 will project into the path of movement of laterally projecting lugs 61 on every tenth marginal projection of each wheel, the relation being such, that when said resetting bar is moved from its forward position in contact with the stop surface 26' of the machine casing to its rearward position in contact with the rear stop surface 27', any marginal projection carrying a laterally projecting lug 61 will be moved into the plane of the stop surface 26', 27', extending through the axis of rotation of the shaft 3, and in which position the character zero on all of the counter-flanges 50 will be exposed at the different sight openings 28. Before beginning another computation, the resetting bar 57 will be swung back to its extreme forward position into engagement with the cam 60 which will operate to spring it endwise to again bring the notches 59 therein in register with the marginal projections 16 on the actuating wheels and to permit said marginal projections to pass freely therethrough.

For convenience in manipulating the resetting bar 57, a frontwardly projecting lip 62 is formed thereon in position to be conveniently gripped by the operator.

I claim:

1. In an adding and subtracting machine, the combination of a housing, a plurality of toothed operating wheels revolubly mounted upon a common axis in said housing with at least nine of the teeth of each operating wheel projecting from the housing for manual operation of the wheels thereby, a plurality of sets of mechanism cooperating with said operating wheels respectively and each comprising rotary driving means revolubly mounted in said housing in position to be rotated in either direction by the operating wheel of the same set of mechanism, a rotary device in each set of mechanism revolubly mounted in said housing, driving connections between the rotary device and the rotary driving means of each set of mechanism, and means in connection with each set of mechanism and each carried around by the rotary device of said set adapted by engagement with the rotary driving means of the next adjacent set of mechanism to give said rotary driving means of said other set and the mechanism driven thereby a single step movement upon the movement of said rotary device past a predetermined critical point.

2. In an adding and subtracting machine, the combination of a housing, a plurality of toothed operating wheels revolubly mounted upon a common axis in said housing with at least nine of the teeth of each operating wheel projecting from the housing for manual operation of the wheels thereby, a plurality of sets of mechanism cooperating with said operating wheels respectively and each comprising rotary driving means revolubly mounted in said housing in position to be rotated in either direction by the operating wheel of the same set of mechanism, a rotary device in each set of mechanism revolubly mounted in said housing, driving connections between the rotary device and the rotary driving means of each set of mechanism, and means in connection with each set of mechanism and each carried around by the rotary device of said set adapted by engagement with the rotary driving means of the next adjacent set of mechanism to give said rotary driving means of said other set and the mechanism driven thereby a single step movement upon the movement of said rotary device past a predetermined critical point, said last named means of each of said sets of mechanism being so arranged with respect to the rotary driving means of the adjacent set of mechanism that it stands normally out of engagement therewith and is moved into engagement with said rotary driving means of said adjacent set of mechanism for actuation thereof and again out of such engagement at a single step movement of the operating parts.

3. In an adding and subtracting machine, the combination of a housing, a plurality of toothed operating wheels revolubly mounted

upon a common axis in said housing with at least nine of the teeth of each operating wheel projecting from the housing for manual operation of the wheels thereby, a plurality of sets of mechanism cooperating with said operating wheels respectively and each comprising a pinion revolubly mounted in said housing in position to be rotated in either direction by the operating wheel of the same set of mechanism, a rotary device in each set of mechanism revolubly mounted in said housing, driving connections between the rotary device and the pinion of each set of mechanism, and means in connection with each of said sets of mechanism and each carried around by the rotary device of said set adapted by engagement with the pinion of the adjacent set of mechanism to give said pinion of said other set and the mechanism driven thereby a single step movement upon the movement of said rotary device past a predetermined critical point.

4. In an adding and subtracting machine, the combination of a housing, a plurality of toothed wheels revolubly mounted upon a common axis in said housing with at least nine of the teeth of each operating wheel projecting from the housing for manual operation of the wheels thereby, a plurality of sets of mechanism cooperating with said operating wheels respectively and each comprising a pinion revolubly mounted in said housing on an axis at one side of the axis on which said operating wheels are mounted and positioned for rotation by the operating wheel of the same set of mechanism, a gear in each set revolubly mounted in said housing on an axis in triangular relation to said other two axes, a sleeve connected with the pinion of each set of mechanism, a second gear on the sleeve of each set of mechanism and each meshing with the first named gear of the same set of mechanism, and means in connection with each of said sets of mechanism and each carried around by the rotary device of such set of mechanism adapted by engagement with the pinion of the next adjacent set of mechanism to give said pinion of said other set and the mechanism driven thereby a single step movement upon the movement of said rotary device in either direction past a predetermined critical point.

5. In an adding and subtracting machine, the combination of a housing, a plurality of toothed operating wheels revolubly mounted upon a common axis in said housing with at least nine of the teeth of each operating wheel projecting from the housing for manual operation of the wheels thereby, a plurality of sets of mechanism cooperating with said operating wheels respectively and each comprising rotary driving means revolubly mounted in said housing in position to be rotated in either direction by the operating wheel of the same set of mechanism, a rotary

device in each set of mechanism revolvably mounted in said housing, driving connections between the rotary device and the rotary driving means of each set of mechanism, and
5 means in connection with each set of mechanism and each carried around by the rotary device of said set adapted by engagement with the rotary driving means of the next adjacent set of mechanism to give said rotary
10 driving means of said other set and the mechanism driven thereby a single step movement upon the movement of said rotary device past a predetermined critical point, the rotary driving means of each of said sets of mechanism being so arranged as to rotate in either
15 direction independently of rotation of the operating wheel of the same set of mechanism when such rotary driving means is given said single step movement by power applied
20 from the adjacent set of mechanism.

In witness that I claim the foregoing as my invention I affix my signature this 16th day of October, A. D. 1926.

ANDERS VETHE.

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