S. E. CARLIN.

CALCULATING MACHINE.

APPLICATION FILED FEB. 26, 1906.

1,312,018.

Patented Aug. 5, 1919.

6 SHEETS—SHEET 1.

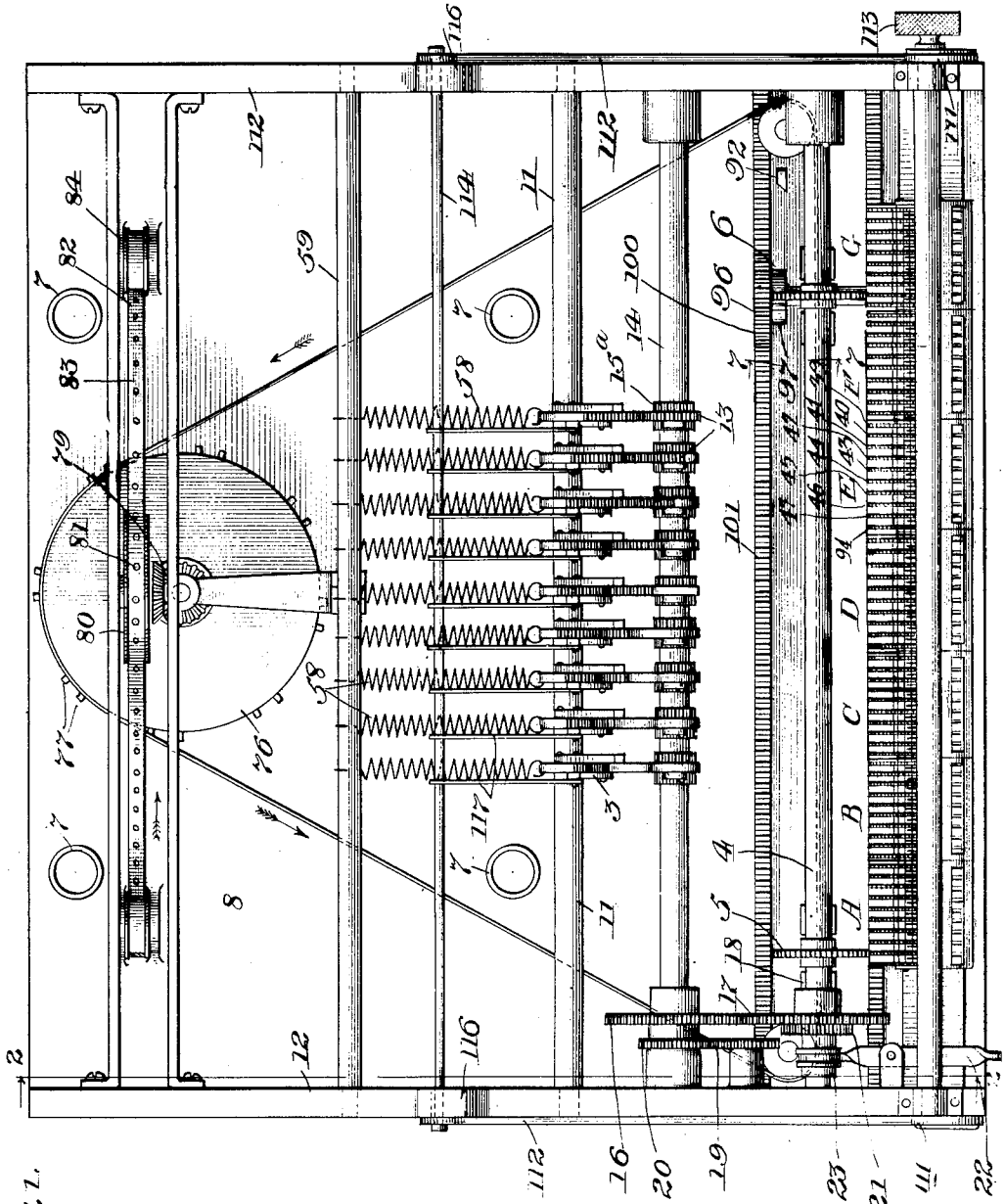


FIG. 1.

Witnesses:
Otto Munich
J. W. Jochum, Jr.

Inventor:
S. E. Carlin.
by Brown Earley & Hopkins
Attys.

S. E. CARLIN.

CALCULATING MACHINE.

APPLICATION FILED FEB. 26, 1906.

1,312,018.

Patented Aug. 5, 1919.

6 SHEETS—SHEET 2.

Fig. 18.

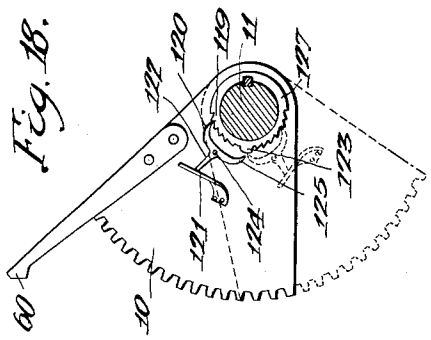


Fig. 2.

Witnesses:

C. M. Kennicl

J. K. Jochum, Jr

Inventor:

S. E. Carlin.

by Brownell & Hopkins

Attys.

S. E. CARLIN.

CALCULATING MACHINE.

APPLICATION FILED FEB. 26, 1906.

1,312,018.

Patented Aug. 5, 1919.

6 SHEETS—SHEET 3.

Fig. 3.

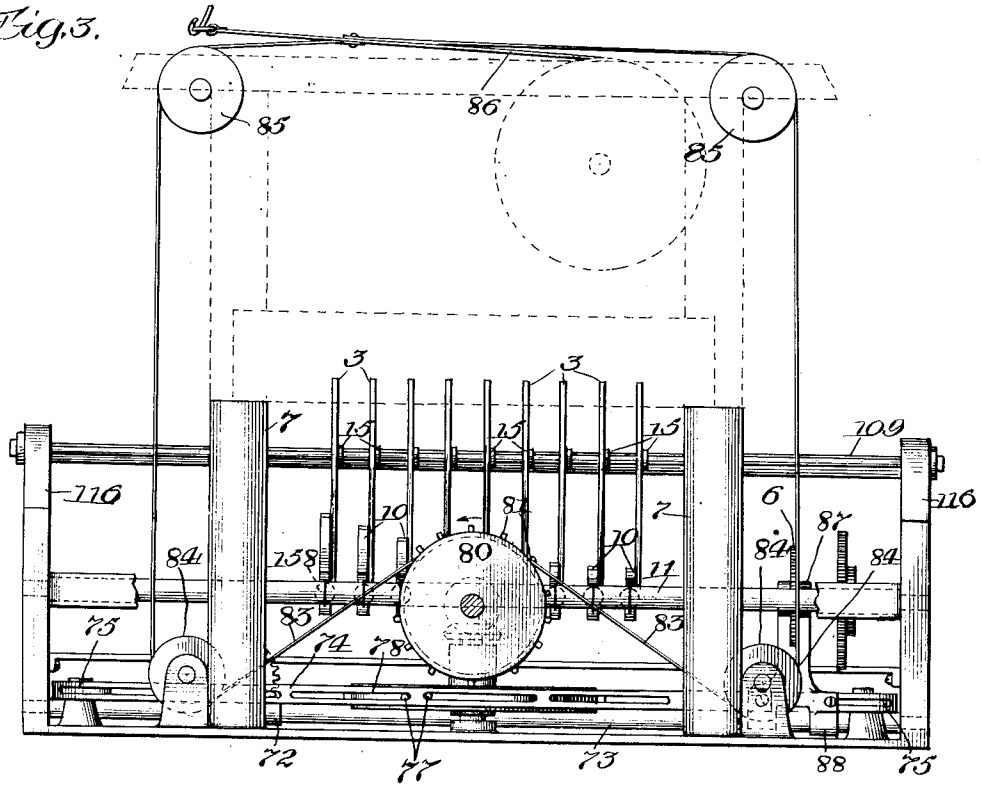
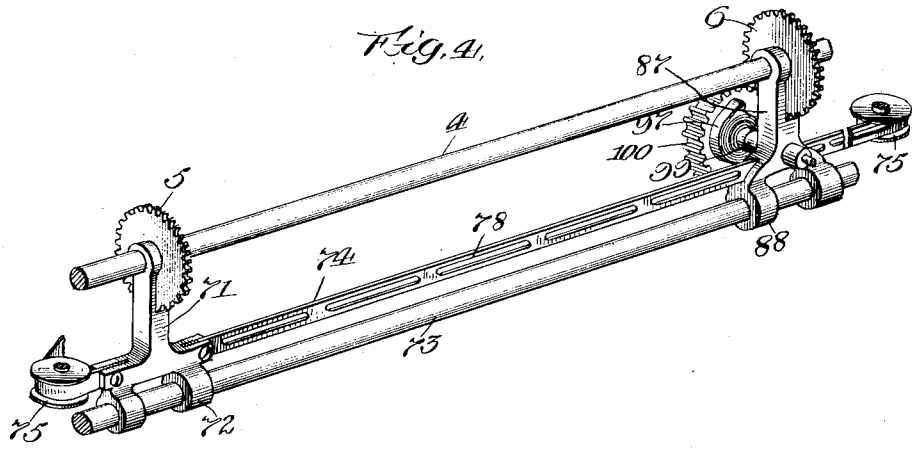


Fig. 4.



Witnesses:
O. M. Kennick
J. H. Jochums, Jr.

Inventor:
S. E. Carlin.
by Brownsdorley & Hoffman
Attys.

S. E. CARLIN.

CALCULATING MACHINE.

APPLICATION FILED FEB. 26, 1906.

1,312,018.

Patented Aug. 5, 1919.

6 SHEETS—SHEET 4.

Fig. 5.

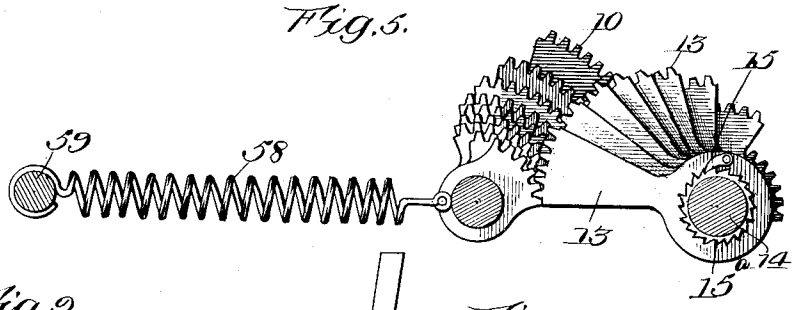


Fig. 9.

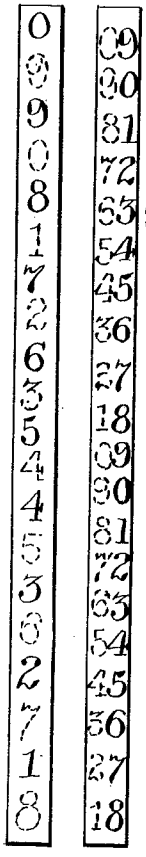


Fig. 10.

Fig. 6.

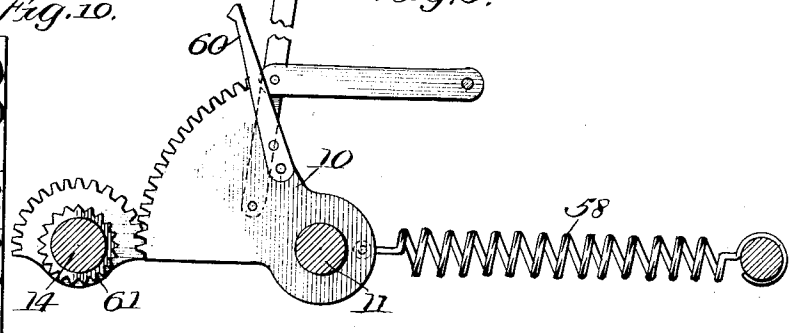


Fig. 7.

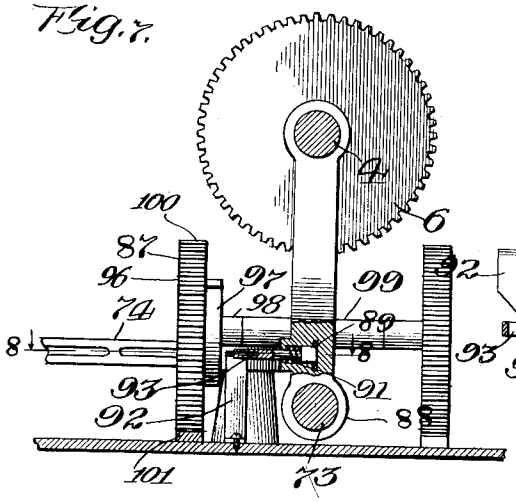
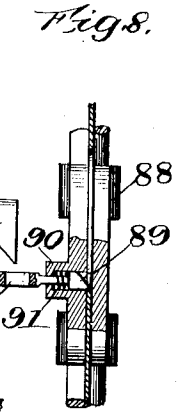


Fig. 8.



Witnesses:

O. M. Wunsch

J. N. Jochum, Jr.

Inventor

S. E. Carlin.

by Brownell, Seley & Hopkins

Attys.

S. E. CARLIN.

CALCULATING MACHINE.

APPLICATION FILED FEB. 26, 1906.

1,312,018.

Patented Aug. 5, 1919.

6 SHEETS—SHEET 5.

Fig. 12.

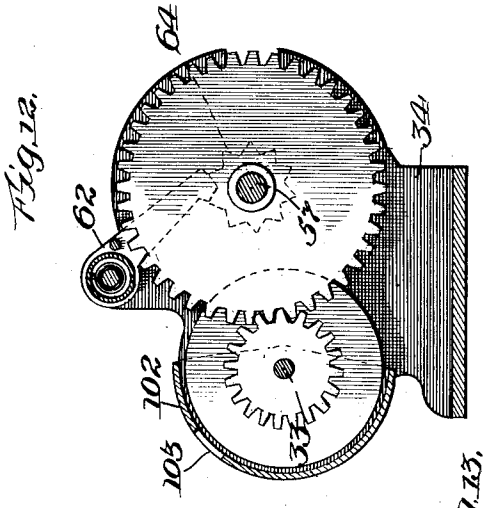


Fig. 11.

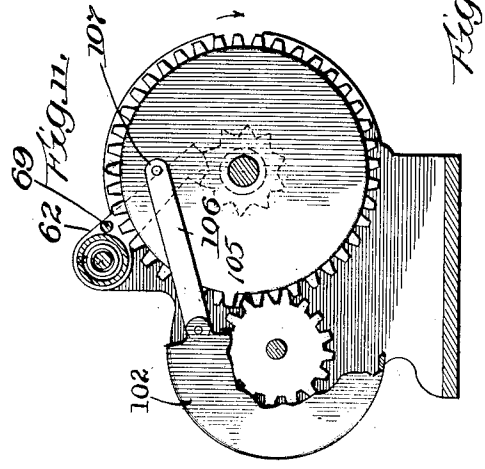
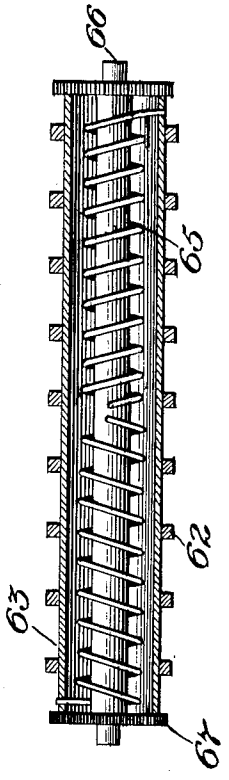


Fig. 13.



Witnesses:

O. M. Hamick

J. N. Jochum, Jr.

Inventor:

S. E. Carlin.

by Brownell & Hopkins

Attys.

S. E. CARLIN.

CALCULATING MACHINE.

APPLICATION FILED FEB. 26, 1906.

1,312,018.

Patented Aug. 5, 1919.

6 SHEETS—SHEET 6.

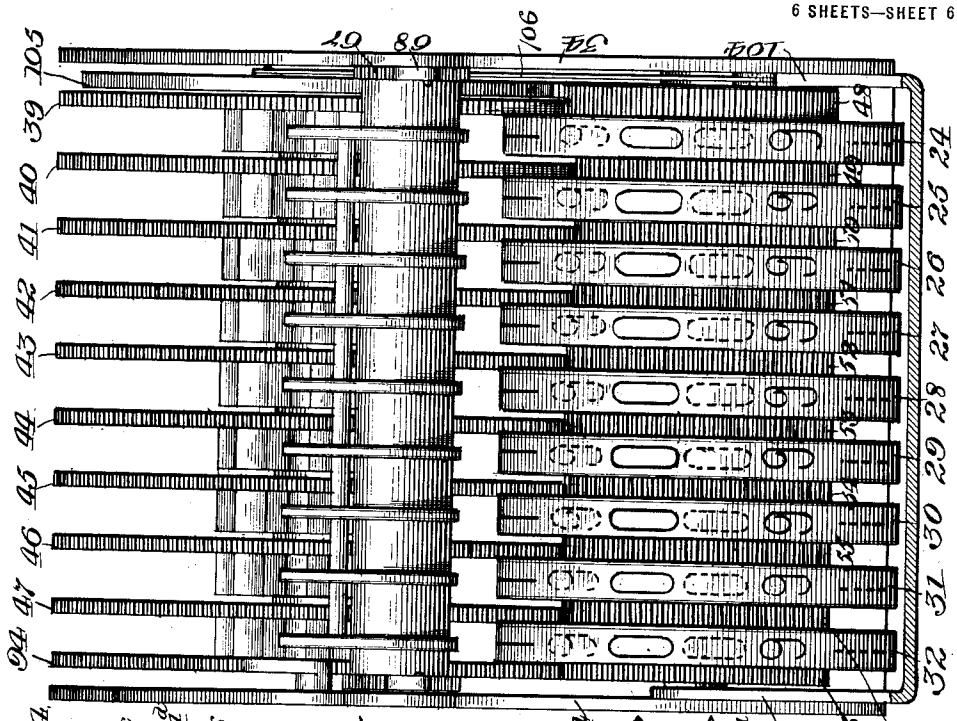


Fig. 14.

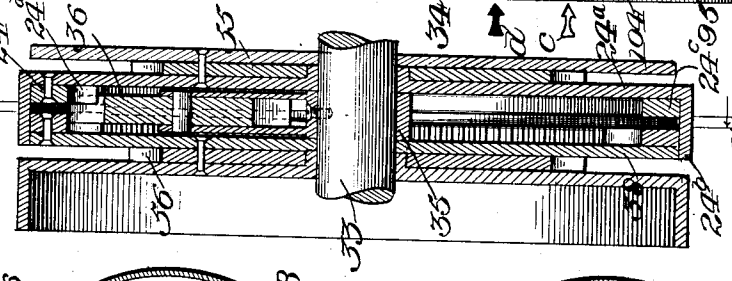


Fig. 15.

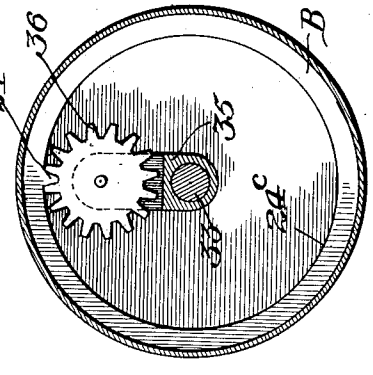


Fig. 16.

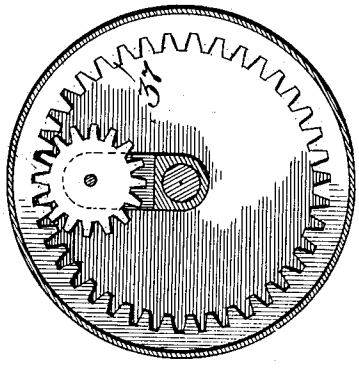


Fig. 17.

Witnesses:

C. M. Yennick

J. A. Jochum, Jr.

Inventor:

S. E. Carlin.

by Brownell & Hopkins

Attys.

UNITED STATES PATENT OFFICE.

SAMUEL EDWARD CARLIN, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO UNDERWOOD COMPUTING MACHINE COMPANY, A CORPORATION OF NEW YORK.

CALCULATING-MACHINE.

1,312,018. Specification of Letters Patent. Patented Aug. 5, 1919.

Application filed February 26, 1906. Serial No. 302,845.

To all whom it may concern:

Be it known that I, SAMUEL E. CARLIN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Calculating-Machines, of which the following is a specification.

This invention relates to calculating machines for general purposes, and more particularly to a machine especially designed for keeping accounts, and more desirably, for use in connection with an ordinary typewriter or a typewriter of any suitable form, whereby the computing mechanism may be operated by the number keys of the typewriter which control the spacing of the typewriter carriage and the printing of numbers on the work sheet.

In some systems of book-keeping and other calculations it is necessary or desirable to add together a number of amounts or figures in a horizontal line, or "cross-foot," so to speak; and also to add together the amounts or figures forming vertical columns, contained in a plurality of such horizontal lines, as well as to add up in a vertical column the various sums of the horizontal cross-footings; thus giving sub-totals horizontally and vertically, and a grand-total at the converging point of the horizontal line of sub-totals and the vertical column of sub-totals, so that if correctly footed the grand-total will be the common sum alike of the vertical and the horizontal lines of sub-totals. It is also desirable at times to not only add together such figures or amounts in both horizontal and vertical directions, but to subtract some of the amounts from the others, and to indicate the result at the end of the column.

One of the important objects of this invention is to provide improved means for performing either or both of the foregoing mathematical operations mechanically.

In the keeping of accounts it also becomes necessary at times to ascertain the difference between an amount to be credited and a smaller amount previously recorded as a debit. This invention has for its further object to provide an improved machine for automatically ascertaining or registering the result of two such entries, even though they may be recorded or registered in the order stated.

A still further object of the invention is to provide a calculating machine of the described character which will be inexpensive and simple in operation and construction.

With the described ends in view, the invention consists in certain features of novelty in the arrangement, construction, and combination of parts by which said objects, and certain other objects that will hereinafter appear, are attained, all as shown in the accompanying drawings, described in the specification with reference thereto, and particularly pointed out in the claims.

In the said drawings, Figure 1 is a plan view of the calculating machine constructed according to this invention.

Fig. 2 is a vertical transverse section thereof taken on the line 2, 2, Fig. 1, showing a portion of a typewriter.

Fig. 3 is a rear elevation.

Fig. 4 is a detail perspective view of the traveling gears which operate the totalizers and their associated parts, showing the gears at the extremes of their movement away from each other.

Fig. 5 is a detail side elevation of the segments through the medium of which the various typewriter keys impart motion to the gears for operating the totalizers.

Fig. 6 is another view of the same mechanism, looking from the opposite side.

Fig. 7 is a detail vertical transverse section, taken on the line 7, 7, Fig. 1, on an enlarged scale.

Fig. 8 is a horizontal section on the line 8, 8, Fig. 7.

Fig. 9 is a diagrammatic illustration of the numbering on one of the totalizer drums or number-bearing members.

Fig. 10 is a modification thereof.

Fig. 11 is a side elevation, partly broken away, of one of the totalizers said figure also showing a shiftable index in the form of a shield or mask.

Fig. 12 is a vertical cross-section thereof.

Fig. 13 is an enlarged longitudinal sectional view of the spring mechanism for forcing the totalizer-centering dogs into engagement, and showing other details hereinafter described.

Fig. 14 is an enlarged plan view of one of the totalizers, showing the mask in section.

Fig. 15 is a section of one of the units of the totalizer, taken lengthwise of its axis.

Fig. 16 is a sectional view thereof taken on the line 16, 16, Fig. 15.

Fig. 17 is a similar section taken on the line 17, 17, Fig. 15, looking in the opposite direction; both of the last two sections being drawn to a smaller scale.

Fig. 18 is a detail modification.

In this exemplification of the invention, it is shown in connection with an ordinary standard typewriter, which is illustrated in Figs. 2 and 3, 1 being the keys of the typewriter, which operate, respectively, the nine digits, and which are usually provided with key-bars, 2 arranged horizontally, or in any other suitable way. In order that these same key-bars which operate type-bars 2^a to perform the printing operation may at the same time be utilized for operating the calculating machine, or the various totalizers, as will be hereinafter explained, this invention contemplates the use of a number of rods or other suitable connections 3, one for each of the key-bars 2, arranged thereunder in such a manner that when any one of these key-bars is depressed in the act of performing the printing operation, that one of the rods or connections 3 which is disposed thereunder will also be depressed and, through suitable agencies, will impart a rotation, the extent of which will be determined by the key-bar depressed, to a totalizer gear operating shaft 4, and this shaft in turn will impart the necessary movement to that one of the totalizers which happens to be in operative relation to one or the other of the totalizer operating gears or master wheels 5, 6, suitably mounted upon and operatively connected with the shaft 4. The calculating machine is provided with suitable pillars or supports 7, which rise from a base 8, and are situated directly under the ordinary feet 9 of the typewriting machine, so as to receive and support said feet, while the key-bars 2 come directly over the connections or bars 3 of the calculating machine, and as a consequence the typewriter may be readily removed when it is not desired to use it in connection with the calculator, and as readily replaced for use in such connection when desired.

To the lower ends of the rods or bars 3 are pivotally secured, respectively, a plurality of toothed segments 10 equal in number to the number of the keys 1 intended for the operation of the calculating machine. In the ordinary standard typewriter keyboard, eight special keys are employed for the digits from 2 to 9 inclusive, while the small "l" and the capital "O" are used, respectively, for the digit 1 and the cipher, but whatever be the style of the key-board and the arrangement of the keys representing the nine digits, the bars or rods 3 would be so disposed as to fall under the key-bars 2 of those particular keys. Consequently, nine of these toothed segments will ordinarily be employed, and they may be arranged, as shown in the drawing, loosely upon a rod or axle 11 extending athwart the base frame members 12 of the lower portion of the calculating machine. Each of these segments 10 engages with one of a plurality of toothed segments 13 mounted loosely upon a shaft 14 journaled in side frames 12, but provided with pawls 15, as better shown in Fig. 5, adapted to engage, respectively, with ratchet wheels 15^a secured rigidly to the shaft 14, so that when the segments 13 are oscillated in one direction the shaft 14 will be rotated more or less, according to the extent of such oscillation, and the segments will be allowed to return to their former position without effect upon the shaft. These segments 10, 13, of both series are graduated in size, the longer segments of the series 10 being in mesh with the shorter segments of the series 13, and the size of each particular segment is dependent upon the extent to which the shaft 14 must be rotated in order to rotate a number wheel, in co-operative relation with the master wheel, an amount corresponding with the number of units represented by the key connected to said segment. This motion of the shaft 14 is transmitted to the number-wheels or members of the totalizers in the manner and by the means which will now be described.

Secured to the shaft 14 is a gear 16, which meshes with gear 17 mounted upon the shaft 4 (shown more clearly in Figs. 1 and 2) and secured thereto by a key or feather 18 so as to be compelled to rotate therewith, while capable of sliding longitudinally thereon. This imparts motion to shaft 4, which, as before stated, carries the two totalizer-operating gears 5, 6, and which serve to rotate the number wheels or members of the totalizers in one direction or the other, according to whether it is desired to add or subtract, either direction of rotation being imparted to the shaft 4 from the shaft 14, whose direction of rotation is always the same, the gear 17 serving to rotate the shaft 4 in the opposite direction to the direction of rotation of the shaft 14, while the shaft 4 is given the same direction of rotation as the shaft 14 by means of any suitable back-gearing, such, for example, as an idler 19 meshing with a pinion 20, secured to shaft 14, and arranged to be engaged by a pinion 21, secured to or formed on the side of the gear 17, when the gear 17 is shifted out of engagement with the gear 16 in a direction toward the pinion or idler 19. This shifting may be accomplished by any suitable

means, such as a shift lever 22 engaging a grooved collar 23 on the hub of pinion 21.

The invention contemplates the use of as many totalizers as there are columns of amounts to be footed up. In this exemplification of the invention, seven totalizers are employed, and they are designated generally by the reference characters A to G, inclusive, in Fig. 1 of the drawings. These are all the same in construction, the details of one of which are shown in Figs. 11 to 16 of the drawings, and hence the description of this one will suffice for all. In this example of the invention, each totalizer is provided with nine number wheels or members 24 to 32 inclusive, which represent the different orders of units respectively, that is, they may stand respectively for units, tens, hundreds, thousands, tens of thousands, hundreds of thousands, millions, tens of millions and hundreds of millions, but it will nevertheless be understood that the number of the wheels or members employed is immaterial, and when the machine is employed for other systems of currency the number wheels, or their relation one to the other, may be modified accordingly without departing from the spirit of the invention. Upon each of these number wheels is indicated the nine digits and cipher in black, or any other distinguishing color or means, and alternating with these black numbers and the cipher are the same digits and cipher indicated in red, or other distinguishing color or means. This distinction is indicated in the drawings by making one set of numbers and cipher in solid lines, while the other set is indicated in dotted lines. In the particular positioning of these figures and ciphers herein illustrated in Fig. 9, the two nines are arranged together and the cipher of each set is arranged immediately contiguous to the nine of the other set, while the eight of each set is arranged immediately contiguous to the cipher of the other set, this system being continued throughout the series. Thus, assuming that the means for distinguishing one set of figures and cipher from the other set is the difference in color, as before mentioned, one being red and the other being black, the black 9 is arranged contiguous to the red 0, and between the red 0 and the red figure 9, while the red 9 is arranged between the black 0 and the black figure 9, and so on throughout with respect to the other figures as better illustrated in the diagram Fig. 9. It is not essential, however, that the red and black figures be arranged alternately one below another, as indicated in Fig. 9, for it is obvious that they may be situated in two columns, or side by side, as indicated in Fig. 10, for accomplishing substantially the same result, as will presently appear, and indeed they may be arranged in any other way so long as their relation is such that the sum of the contiguous figures is nine. With the figures thus arranged, it will be seen that when the number wheels are rotated in one direction one set of figures will progress from 1 to 9, while the other set will appear in the reverse order; but when the direction of rotation is reversed, this order will also be reversed, and as a consequence one direction of rotation produces addition and the opposite direction of rotation with respect to the same set of figures produces subtraction, and this is true as to both sets of figures. The carrying from one of the number wheels to the other may be effected by any suitable carrying mechanism well known in this art, but preferably by the means which will now be described. As better shown in Fig. 15, each of the number wheels is in the form of a drum or disk with a flanged periphery, the flange, serving to carry the figures and ciphers, and the disk (which is shown at 24^a,) serving as a means of mounting the number wheel upon a shaft 33, which is common to all of the number wheels, one of these shafts 33 being employed for each of the totalizers, and mounted at its ends in any suitable supports, such, for example, as end-plates or frames 34. The shaft 33 may be fixed in these end frames 34 in any suitable manner so as to serve as a rigid support for a plurality of arms or brackets 35, one for each of the number wheels, and which arms carry idle pinions 36, one mounted in each of the number wheels or drums, and having a face of sufficient width to simultaneously engage with an internal gear 37, which is secured to the inner face of plate 38, mounted on the shaft 33, and preferably inclosed within the flange 24^b of the number wheel, (shown more clearly in Fig. 17) and an internal gear 24^c having a single tooth 24^d which is secured to the inner face of the disk 24^a, (as shown more clearly in Fig. 16) so that for each rotation of the number wheel or disk 24^a a partial rotation will be imparted to the disk 38 while the tooth 24^d is passing in engagement with the idle pinion 36 and thus carrying the motion of one of the number wheels to the next in the series. The initial step-by-step rotation may be imparted to any one of the number wheels by a series of gears 39 to 47, inclusive, respectively, which engage respectively with gear wheels 48 to 56, inclusive, respectively. The series of gear wheels 39 to 47 are mounted loosely upon a shaft 57, while the gears 48 to 56 are secured to the number wheels, the first one being secured to the disk 24^a of the first number wheel, while the next and succeeding ones in the series are secured to the disks 36 and 24^a of the adjacent number wheels, as better shown in Fig. 15, and the entire series are in engagement with the

gear wheels 39 to 47, inclusive, respectively. Step-by-step rotation may be imparted to any one of the gears 39 to 47 by one or the other of the totalizer operating gears 5, 6, as the latter slide longitudinally upon their shaft 4 and are at the same time rotated by said shaft from one of the typewriter operating keys for the purposes before described, and the direction of rotation may be changed at will, as before explained, by shifting the clutch lever 22. When one of the typewriter keys is depressed, the shaft 14 is rotated throughout a greater or less degree accordingly as the key which has been depressed is connected to one of the long or to one of the short segments 10, and when the key is released the segment is returned to its initial position by a spring 58, one of these springs being employed for each of the segments 10, as better shown in Fig. 1, and connected to any suitable support, such as a cross rod or bar 59. The exact movement intended to be imparted to the segments 13 and the shaft 14 by the segments 10, is limited and defined by a stop 60, one of which is secured to each of the segments 10, and adapted to engage between the teeth of a spur wheel 61 mounted upon the shaft 14, (better shown in Fig. 6) one of these spur wheels being provided for each of the stops 60, and so arranged with relation thereto that when the segment 10 has completed its allotted movement in a downward direction the point of the stop 60 will accurately register between two of the teeth of the spur wheel 61, and thereby prevent further rotation of both the segment 10 and the shaft 14. The exact movement intended to be imparted to each of the gear wheels 39 to 47 by the stroke of any one of the segments 10 is limited and defined by a series of stops or centering dogs 62, secured on a drum 63 and pressed permanently into engagement with a corresponding series of spur wheels 64, secured one to each of the gears 39 to 47, by a spring 65 arranged within the drum on a rod or shaft 66, the shaft being secured to the spring at its mid length, while the extremities of the spring are attached to the drum, as better shown in Fig. 13, and the ends of the shaft are provided with ratchets 67, engaged by pawls 68, (see Fig. 14) pivoted to the end frames 34 of the totalizer and serving to hold the ratchets against rotation in one direction while permitting them to be rotated in the other direction when it is desired to change the tension of the spring. The dogs 62, however, serve primarily for centering the gear wheels 39 to 47, and consequently centering the number wheels with respect to their index, which will be presently described, while permitting the gear wheels and number wheels to be rotated in either direction and as far as need be by the operation of the segments 10. The centering dogs 62 may be secured to their supporting drums 63, so that all the dogs will rise and fall together when any one of them is moved, in any suitable way. In the example of the invention shown in the drawings they are connected together by a rod 69, thus making the one spring serve for all of the dogs 63.

The means for imparting the escapement of the typewriter carriage or other suitable type spacing device employed in connection with the printing mechanism, to the totalizer operating gears 5, 6, will now be described, reference being had particularly to Figs. 1 and 4.

The gear 5 is capable of a continuous movement longitudinally of its shaft 4 from the outer extremity of totalizer A to the remote extremity of totalizer F, while the gear 6 is limited in its longitudinal movement on the shaft 4 to the confines of totalizer G, which is the grand totalizer. The gear 5 is mounted between the bifurcations of a two-part or forked arm 71, which is formed on or secured to a slide 72, mounted upon a guide-rod 73, arranged in a horizontal position at any suitable place, preferably under the totalizers. This slide 72 is attached to the extremities of a tape or band 74, which passes around two sheaves or pulleys 75, mounted idly on the base frame and thence around a drum or pulley 76, arranged in a horizontal position at the back of the machine, and provided with teeth or pins 77 adapted to engage in slots or apertures 78 in the band 74, or otherwise operatively connected with said band, so as to compel the band to move in unison therewith. The wheel or drum 76 is connected by means of bevel gears 79, or other suitable devices, to the drum or wheel 80, which is also provided with pins 81, or any other suitable means for causing it to positively engage with or to be engaged by a band or belt 82, having pin holes or apertures 83, running under idlers 84, and thence passing upwardly over idlers 85 (mounted on the typewriter frame) and connected to the typewriter carriage 85^a in any suitable way, as, for example, by being attached to the tape or band 86 usually employed on the standard typewriter for impelling the typewriter carriage forward at each stroke of the type keys or spacing bar, which for this purpose usually operate a universal bar 86^a, connected by a rocker 86^b to spacing dogs 86^c, 86^d, which control the escapement wheel 86^e, the latter driven by a pinion 86^f, in mesh with a letter-feeding rack 86^g on the typewriter carriage 85^a. With this arrangement, it will be seen that as the typewriter carriage 85^a thus escapes, a corresponding escaping movement will be imparted to the totalizer operating gear 5, and since the gears 39 to 47 are proportionately spaced

the gear 5 will successively engage the latter series of gears; but in order that the totalizer number wheels or drums may be of liberal size, which necessitates placing the gears 39 to 47 farther apart than the distance between the type spaces of an ordinary typewriting machine, the gears 76 and 80 are so proportioned as to multiply in the movement of the gears 5 and 6 the movement of the typewriter carriage.

The band 74 is attached permanently or positively to the carriage or slide 72 carrying the gear 5, but its connection with the gear 6 is detachable. It will be seen from Fig. 4 that gear 6 is mounted in a carriage similar to that carrying the gear 5, the same comprising a bifurcated standard 87 through which the shaft 4 passes, and a slide 88 mounted upon the rod 73, and through which slide the band 74 passes freely, excepting when the band and the slide are connected together by a disengageable catch or latch 89 mounted in a suitable socket or casing 90 in the slide, and pressed normally toward the band 74 by any suitable means, such as a spring 91, (better shown in Fig. 8). While the latch 89 is at the limit of its inward movement, it engages in one of the slots 78 in the band 74, and thereby compels the slide 88, with gear 6, to move with the band 74, step-by-step, as the typewriter carriage, or other type-spacing device, escapes, but when the gear 6 reaches the end of its excursion—that is, comes into engagement with the gear wheel 39 of totalizer G—any further movement of the band 74 will automatically cause the disengagement of the latch 89 therefrom. This may be accomplished in any suitable way, as, for example, by a trip 92, fixed with relation to the movement of the slide 88, and arranged to engage in an apertured extension 93 on the outer end of the latch 89, the parts 92 and 93 being so formed and positioned with relation to each other that their engagement causes the latch 89 to withdraw. When this takes place, the slide 88, with the gear 6, instantly returns to its starting point or initial position, where it is in engagement with gear 47 of highest denomination, adjoining which is a supernumerary gear wheel 94, which is similar in size and arrangement to the series of gears 39 to 47, and which engages with a gear wheel or pinion 95 on the outer side of the last one of the disks 38 belonging to the last number wheel of each of the totalizers, one of these gears 94 and pinions 95 being provided for each of the totalizers A to G inclusive, and arranged in each as shown in the example illustrated in Fig. 14, for a purpose which will be presently described. The grand totalizer operating gear 6 may be thus driven back to its initial position in the opposite direction of the direction of movement of the band 74, by any suitable means, as, for example, a spring-motor comprising a spring driven element 96 and a coil-spring 97 and attached at one end to said element 96 and at the other end to a shaft 98 journaled in a suitable bearing 99 on the slide 88, the connection and relation of the spring 97 to the element 96 being such that when said element is moved in one direction by the slide 88 the tension of the spring is increased or the spring is wound up, but when the slide 88 is released from the band 74 the spring acts to rotate said element 96 in the opposite direction. This latter rotation of said element 96 is rendered effective, or the element given suitable direction with the base of the machine, by providing said element 96 with peripheral teeth 100, and arranging thereunder a toothed track or rack-bar 101. The slots 78 in the band 74 are of such a length that when the gear 6 returns to its initial position in accurate mesh with the gear 47, the latch 89 will be at the left-hand end of the slot, as viewed in Fig. 4, the spring 91 serving to return the latch 89 into the slot 78 as soon as, or shortly after, the projection 93 leaves the beveled end of the trip 92. Thus, it will be seen that while the typewriter carriage, or other suitable type-spacing device used with the printing mechanism, is traveling once the length of its excursion and the totalizer-operating gear 5 is or may be traversing the entire series of totalizers A to F inclusive, the gear 6 will make a plurality of trips the length of its totalizer G, and hence in the use of the machine every amount recorded on each of the totalizers A to F will be duplicated or summed up on the grand totalizer G.

In the consideration or reading of the characters which appear upon the various number wheels or members 24 to 32, inclusive, it is of course necessary or desirable to employ some suitable means for indicating the particular characters to be considered. Such a means may be termed an index, and as an example of the same there is shown in Figs. 11 and 12 a mask shutter or shield 102, of semi-circular form, partially embracing the number wheels, and having a longitudinal slot 103, arranged transversely with respect to the number wheels, so that all of the characters or numbers except one on each number wheel will be excluded from view, the slot or aperture 103, in this example, constituting the index. One of these masks 102 is employed for each of the totalizers, and they are provided at their ends with arms 104 pivoted on the rod 33 so that the masks 102 will be movable concentrically with relation to the number wheels, and the masks of the various totalizers will be movable independently of each other. The object in thus moving the shield or mask is to shift the reading line from characters of

one series to characters of the other, that is, from black to red, (the black being represented by solid lines and the red by dotted lines) when the number to be read has changed in character, as from a positive amount to a negative amount, for example, or from a negative amount to a positive amount.

So long as the computation to be effected does not call for the algebraic addition of a number of relatively greater magnitude to a number of relatively smaller magnitude, and of opposite character, previously recorded in the totalizer, the mechanism herein disclosed may be operated exactly as any other totalizer of the prior art would be operated and there would be no occasion for a movement of the shield. In general bookkeeping and various other systems of accounting, however, it is necessary, at times, to effect such algebraic computations, as, for example, in the case of accounts involving debit and credit balances. Whenever the totalizer herein disclosed is used to effect computations of this character it is essential, whenever a reading is to be made from the totalizer, after a large number has been added algebraically to a relatively smaller number of different character, previously recorded in the totalizer, to shift the shield so as to cause the reading to be made from characters of the series other than those including the characters in which the number previously recorded in the totalizer had been indicated, as will hereinafter be more fully explained.

Since the normal movement of the number wheels in either direction is always proportional to a single step or a number of whole steps, as represented by characters of one series, and since, in the form illustrated in Fig. 9, the characters of each series are spaced intermediately of the characters of the other, it will be apparent that if the shield were not moved there would always be exposed, at the sight opening of the totalizer shield, but one character on each number wheel, said characters all being of corresponding series. The characters of the other series would always be skipped over and remain concealed. Whenever, therefore, the number to be read should be represented in characters of the opposite series, as will be true after an algebraic computation or overdraft has been effected, it is necessary to have the shield moved to a position corresponding to one half step, or one half step in addition to any number of full steps, in either direction, depending upon the relative arrangement of the characters of the two series, so as to expose characters of the alternate series. With the characters of the two series relatively arranged as indicated in Fig. 9, it is necessary, whenever a reading is thus to be made from characters of the series opposite to those including the characters in which a number had been previously recorded and indicated in the totalizer, to cause said shield to be rotated one half a step in a direction the reverse of that of the rotation of the number wheel of highest denominational order by which, as will hereinafter be explained, said movement is effected. By this one half step of rotation of the shield the complementary characters of the alternate series will be exposed at the sight opening.

It is also essential, when such an algebraic computation has been effected, and a reading is to be taken from the totalizer, for reasons which will hereinafter be more fully explained, to provide for the number-wheel of highest denominational order, means in the nature of tens carrying mechanism having a coöperative relation with the number-wheel of lowest denominational order, and comprising, when effecting a carry, a direct train of driving elements between said wheels, whereby said wheel of lowest order may be rotated one step simultaneously with said wheel of highest order and in the same direction.

The means for effecting the aforesaid movements of the shield and number wheel of lowest denominational order will now be described.

The gear wheel 94 is rigidly secured to the shaft 57, while, as before explained, the gear wheels 39 to 47 inclusive are loose on said shaft, and the gear wheel or pinion 48 is arranged to be engaged not only by the gear wheel 39, but also by a single-toothed gear 105, also rigidly fixed to the shaft 57. The mast or index member 102 is connected by a link 106 to the disk 105 constituting said single-toothed gear, so that as the gear 105 moves, the mask 102 will be correspondingly moved in the same direction. When the single tooth 24^d of the highest number wheel of the series—that is, the number wheel 32—comes into engagement with the idle pinion 36 of that wheel, it imparts a tenth of a rotation to the gear wheel 95, and this in turn is imparted, through the described connections, to the single-toothed gear 105, which gives the pinion 48 a corresponding degree of rotation in the same direction of rotation as the number wheel 32, and consequently moves the units number wheel 24 the distance of one step in the same direction of arithmetical progression as that in which the number wheel 32 was moving in producing the rotation of gear 95, and at the same time, the link 106 rotates the mask 102 a half a space or step in a direction opposite to the direction of rotation of the number wheel 32, the distance which the mask moves being gaged or regulated by the radii of the gears and the distance which the crank-pin 107 of the gear disk 105

is placed from the center, or by any other suitable method to cause it to move a half a space while the units wheel 24 moves a whole space and in the opposite direction of rotation. This shifting of the mask and further rotation of the units number wheel must be occasioned whenever a reading is to be taken from the totalizer after an amount of greater magnitude and of opposite character has been algebraically added to an amount of smaller magnitude previously recorded and indicated by the totalizer, or in other words, whenever a reading is to be taken after the direction of rotation has been reversed and the amount to be recorded is greater than an amount previously recorded.

As heretofore stated, unless it is desired to use the totalizer in connection with some form of accounting involving algebraic computations, it may be operated like any other totalizer of the prior art, and neither the mechanism for carrying from the number-wheel of highest order to that of lowest order, nor the mechanism for operating the shield will be called into activity. When it is desired, however, to effect algebraic computations and to read the results from the totalizer, these special parts of the mechanism will be caused to coöperate with other parts of the totalizer to effect the desired results. If, for example, the typewriter carriage has been brought to a position such as to cause one of the master wheels 5 or 6 (Figs. 1 and 4) to register with the gear 40 (Fig. 14) which drives the number-wheel 25 of tens order in any of said totalizers, and, with the reversing mechanism controlled by the shift lever 22 (Fig. 1) set to cause a rotation of the number-wheels in the order of increasing magnitude with respect to the characters represented in black, the number-keys of the typewriter be operated to print 20 on the work sheet, the said tens number-wheel will be rotated (assuming that said totalizer was originally set so that its shield exposed a row of black zeros at the sight opening) so as to expose a "2" at the shield and since the zero key has no connection with the computing mechanism the units number wheel will remain at "0" thus indicating 20 in black characters on the totalizer. If, now, it be desired to subtract 100 from the 20 previously indicated on the totalizer, this computation might be effected in the following manner. The typewriter carriage would first be so positioned as to bring the master wheel into coöperative relation with the number-wheel of hundreds order and with the shift lever 22 moved to its position such as to cause the rotation of the number-wheels in accordance with the decreasing order of magnitude of black numbers. The "1" number-key of the typewriter would then be depressed and, through the totalizer operating mechanism hereinbefore described, the hundreds number wheel would be rotated backwardly one step, which, disregarding the operation of the shield, would cause to be exposed a black "9". Because of the usual carrying mechanism with which the totalizer is provided, the rotation of the hundreds number-wheel from "0" back to "9" would effect a one step rotation of the number-wheel of thousands order from "0" back to "9", and this carrying operation would be continued from order to order up to the number-wheel of highest order which would rotate from "0" back to "9". Due to the presence of the special carrying mechanism between the number-wheel of highest denominational order and that of lowest order, which constitutes an essential feature of the invention herein disclosed, the rotation of the number-wheel of highest order from "0" back to "9" would effect a simultaneous rotation of the units number-wheel from "0" back to "9", and this, in turn, due to the presence of the usual carrying mechanism, would effect a rotation of the number wheel of tens order from "2" back to "1". The subsequent operation of the typewriter mechanism to print the zeros of tens order and units order to complete the writing of the number 100 on the work sheet would not affect the number registered in the totalizer which, if means were not provided for moving the shield, would be represented, reading from the number wheel of highest order to that of lowest by a series of black nines followed by a "1" on the tens number wheel and a "9" on the units number wheel. Due, however, to the presence of the above described mechanism for rotating the shield a one half step in a direction opposite to the rotation of the number wheel of highest order, when turned from zero back to "9", the shield would be caused to conceal the last mentioned black characters and would be caused to expose the complementary set of red zeros followed by an "8" on the number-wheel of tens order and a "0" on the number-wheel of units order, thus indicating "80" in red, signifying—80, which is the correct result. It will be apparent therefore that as a result of the combined operation of the tens carrying mechanism between the number-wheels of highest and lowest order and the mechanism for moving the shield in the manner above described, the subtraction of "100" from "20" has been accomplished directly and correctly indicated on the totalizer.

By far the larger proportion of algebraic computations which the totalizer might be called upon to perform in general accounting work could be effected directly in the above described manner. As will now be shown, however, a relatively small percentage of the possible computations which the machine might be called upon to perform

could not be effected, by the mechanism herein disclosed, if operated in the above described manner, without giving erroneous results which would have to be overcome by corrections or special manipulations of the mechanism, from time to time, calling for the constant attention of a skilled operative. One example of a computation which could not be effected with correct results, were the machine operated in the manner above set forth, may be illustrated by describing an attempt to subtract the number "200" from the totalizer after the number "100" has been previously recorded and indicated in characters of the series represented in black. When attempting to effect this computation, after properly setting the carriage and the shift lever, as above indicated, the depression of the "2" key would cause the number-wheel of hundreds order to be rotated backwardly, that is, in the direction corresponding to decreasing orders of magnitude of black numbers, from "1" to "0" and from "0" to "9". Due to the presence of the carrying mechanism the rotation of the number-wheel of hundreds order from "0" to "9" would effect a rotation of the number-wheel of thousands order from "0" back to "9" and this carrying operation would be continued from order to order to the number-wheel of highest order, thence to the number-wheel of lowest or units order, and since the number-wheels of units order and tens-order each stand at "0", the carry should continue from the number-wheel of units order to the number-wheel of tens order and from that to the number-wheel of hundreds order. It must be remembered, however, that this carrying operation takes place practically simultaneously, since each number wheel, in turn, as it commences its movement, brings the carrying mechanism of the wheel of next higher order into effect.

It will be apparent, therefore, that the last mentioned carrying operation, from the number wheel of tens order to the number-wheel of hundreds order, takes place simultaneously with the initial rotation of the number-wheel of hundreds order from "0" to "9", which was the cause of the whole chain of carrying operations. The result is that there would be no effective carry from the number-wheel of tens order to the number-wheel of hundreds order which would merely be moved one step by the master wheel at the same time that it would be moved one step by the carrying mechanism from the number-wheel of next lower order. The carrying from the number-wheel of tens order to the number-wheel of hundreds order would therefore be uneffective, or lost, and after the one half step rotation of the shield to expose characters of the series indicated in red the totalizer would exhibit a series of zeros instead of indicating a "1" on the hundreds number-wheel which should appear after subtracting "200" from "100".

The illustration just set forth is typical of others which would likewise produce erroneous results, the error always amounting to a difference of one in the denominational order corresponding to the number-wheel directly rotated by the master wheel. The operation of the machine in this manner, therefore, to effect algebraic computations, would call for close attention on the part of the operative, a comparison of each number to be entered with that previously recorded in the totalizer, and special manipulation of the mechanism, at infrequent but variable intervals, to avoid errors of the above noted characters. The machine, is however, capable of being used to effect algebraic computations in a very simple and efficient manner which calls for no special attention or thought on the part of the operative except when taking a reading, and this may also be accomplished in a simple and practicable manner and will always directly indicate the correct result of the computation. This method of operating the machine will now be described.

When the operative is about to use the machine to effect algebraic computations, the first step in the operation, assuming the totalizer to be so set as to expose a row of black zeros, will be to first enter a fictitious "1" in the number-wheel of highest denominational order which will then give the reading in black characters:

100,000,000

This insertion of "1" in the number-wheel of highest denominational order is preliminary to taking up the actual work in hand. The work may then proceed as usual, adding for instance, 176,500, 59,900, 233,400, 1,122,200, after which the following result will be indicated at the sight opening in the shield of the totalizer:

101,592,000

In reading this number, the left hand figure "1," being fictitious, is of course disregarded and merely indicates that the result of the computations previously made is positive. This result being read from the totalizer by disregarding the "1" and the following "0" and being therefore, 1,592,000.

Other amounts may then be subtracted for example, 366,600, 51,100, 190,000, after which the reading on the totalizer will be as follows:

100,984,300

The presence of the "1" in the number wheel of highest denominational order indicates that the result is still positive and of a value represented by the number 984,300. If it now becomes necessary to make an algebraic

computation or overdraft, as by subtracting a number such as 1,255,500, greater than the totalizer reading of 984,300, the totalizer will show:

099,728,800

It will be noted that the preliminary or fictitious "1" has now disappeared from the number-wheel of highest denominational order. This disappearance notifies the operative that there has been an overdraft. It tells him that the aggregate of his *bona fide* subtractions is more than the aggregate of his *bona fide* additions.

Although knowing this, the operative may, unless a reading of the result is desired at the time, proceed to subtract more, add more, subtract, add and so on, without giving any special attention to the readings on the totalizer. If he should add, say, 2,345,600, the totalizer would read:

102,074,400

The operative would thereupon notice the reappearance of the fictitious "1" on the highest number-wheel and therefore understand that the amount 2,074,400, disregarding said fictitious "1," is the correct result of his calculations. Suppose he were to now again subtract a larger number, for example, 3,500,000, the totalizer would be caused to read:

098,574,400

The disappearance of the preliminary "1" from the highest wheel again indicates that there has been an overdraft, but the machine does not yet show the true value of the result of the computation. If, however, the operative desires to know this true value, all that is necessary is to subtract the fictitious "1" which had previously been inserted in the number wheel of highest denominational order at the beginning as a preliminary step. Upon doing this the number wheel of highest order would be stepped back from "0" to "9" and, through the agency of the carrying mechanism between that number wheel and the wheel of units order, the latter would also be stepped back from "0" to "9." As a result of the ordinary carrying mechanism with which the totalizer is provided, the number-wheel of tens order would likewise be stepped back from "0" to "9," and the number wheel of hundreds order would be stepped back from 4 to 3. If it were not for the shield the totalizer would then read, as represented in black characters:

998,574,399

The rotation of the number-wheel of highest order from "0" to "9", however, would rotate the shield one half step in the opposite direction and expose the complementary characters in red which would read as follows:

001,425,600

This is the correct reading of the result of all the additions and subtractions previously made. Having gained this information the operative may re-insert the preliminary or fictitious "1" in the highest number-wheel of the totalizer and proceed as before.

When putting the machine to this use, the operative needs never to watch the machine or keep anything on his mind and is never called upon to make any mental calculation. He simply inserts the preliminary "1" in the number wheel of highest denominational order. If at any time he desires to read the result, he first looks to see whether the fictitious "1" is still present. If so, the result is indicated in the number appearing upon the totalizer disregarding the fictitious "1". If the fictitious "1" has disappeared the operative knows that the result is an overdraft, that is, is negative in character, and may obtain the correct reading by subtracting the fictitious or preliminary "1" from the number wheel of highest order. So long as he does not care to take a reading, he may proceed with his adding and subtracting until the work in hand is concluded. The fictitious "1" may at times disappear from and re-appear on the highest number-wheel indicating that the result has changed from positive to negative and from negative to positive in character but with this the operative is not concerned, except when it is desired to take a reading, which may always be accomplished in the manner above indicated.

In using the Carlin machine in the last described manner, all that is necessary is to provide a totalizer having one more number-wheel than will be required for use to represent the largest number to be recorded and indicated. As will be apparent if a totalizer of large capacity should be used, and the computations involve numbers of but few denominational orders, any number-wheel of higher denomination than that of the largest number to be recorded may be used as the one in which the fictitious "1" may be inserted. The use of the machine in the manner above described calls for no special care or observation on the part of the operative and will always give correct results without calling for any mental computations or special manipulations at uncertain and infrequent intervals, by the operative.

It may be observed that since the character of the result indicated in the totalizer is always represented as being either positive or negative, depending upon whether the fictitious "1" is present or absent, it will be possible to read said result without the aid of the movable shield, provided the numbers of the different series are distinguishable, as by being represented in different

color, or by any other appropriate means. All that would be required would be to read the numbers of one series if the fictitious "1" is still visible on the totalizer and to read the result in the characters of the other series, after subtracting "1" from the number-wheel of highest order if the preliminary "1" has disappeared.

It may also be noted that since the numbers of the different series are arranged upon the number wheels in complementary groups so that adjacent numbers of the different series will add "9" the negative results could be read directly from the same characters employed to represent positive results by subtracting each digit, as so represented, from "9", thus rendering the use of the second set of characters unnecessary.

The addition of the alternate set of distinguishable characters, so as to represent the result directly, and the further addition of the movable shield so as, in each instance, to conceal all characters except those which represent the number to be read, are in the nature of refinements which will tend to increase the rapidity with which the readings may be made but are not necessarily essential to the usefulness of the mechanism as an algebraic totalizer.

Should it be desired to throw the calculating machine out of operation or disconnect it from the typewriter so that the printing operation might be performed without registering the result on the totalizer, the connections 3 may be shifted from under their respective typewriter key-bars, by any suitable means, such as eccentrics 108, journaled at 109 in suitable supports 110, and said eccentrics being provided with straps 111 and rods 112 operatively connected to the rods 3 so that when the eccentrics 108 are turned in one direction, by any suitable knob 113, the rods 3 will be shifted from under the key-bars 2. The rods 112 are pivoted directly to cross-rod 114, sliding in slots 115 in standards 116, and to this cross-bar 114 are pivoted short links 117, one for each of the rods 3, and which are pivotally secured thereto.

In Fig. 20 of the drawing is shown a modification for preventing the segments 10 from rising to their initial position in the event they should not be depressed the full extent of their allotted movements by the typewriter key-bar, the typewriter key-bar being in this form pivotally connected by removable pins 118 (see Fig. 2) to the rods 3, respectively, so that the typewriter key-bar also will be held down, and indicate to the operator the imperfect operation of the machine unless it is depressed the full extent of its intended movement. This device (see Fig. 18) comprises a ratchet wheel or segment 119, rigidly secured to the shaft or cross-rod 11 on which the segments 10 are loosely pivoted or journaled, and a dog 120 adapted to engage with the ratchet or its toothed segment 119, and against which it is normally pressed by a spring 121 mounted on the segment 10, and bearing against a tail-piece 122 on the dog. The dog 120 is so arranged with respect to the ratchet 119, and the tail-piece 122 with respect to the spring 20, that so long as the segment 10 is moving downwardly the dog 120 will not interfere but will slide over the ratchet teeth, although pressed thereagainst by the spring 121, but should the typewriter key be released before the segment 10 has arrived at the limit of its downward stroke, the dog 120 will engage the teeth of ratchet 119 and hold segment 10 from rising, thereby compelling the operator to observe his mistake. As soon as segment 10 reaches the limit of its downward movement, however, the dog 120 is thrown away from the ratchet 119 by a plain portion or trip 123 arranged at the lower end of the series of teeth 119, causing the tail-piece 122 of the dog to be thrown downwardly beyond the direct line of pressure of the spring 121, whereby the spring will press tail-piece 122 downwardly with respect to the pivot 124 of dog 120, and will hold it in that position while the dog and segment 10 rise to their initial or normal position, whereupon the dog 120 will be again dropped down into engagement with the teeth of ratchet 119 by a dog 125 coming into engagement with trip 123. This dog 125 is secured to, or formed integrally with, the dog 120, and so arranged as to engage the trip 123 and shift the tail-piece 122 upwardly above center 124 when the dog 120 reaches the limit of its upward movement. The dog 125 is also utilized for preventing the typewriter key from being again depressed before it is allowed to arrive at the limit of its upward movement. In accomplishing this, a second segment or ratchet 127, having teeth turned in the direction opposite to those of the teeth of ratchet 119, is employed. Consequently, when trip 123 throws dog 120 out of engagement with its ratchet, it effects the engagement of dog 125 with its ratchet 127, and vice-versa.

Variations may be resorted to within the scope of the invention, and portions of the improvements may be used without others.

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

1. In a combined typewriting and computing machine, in combination, a printing mechanism comprising a traveling character-spacing carriage, a computing mechanism comprising totalizing mechanis-

means for operating the same, said operating means and said totalizing mechanism being relatively movable, a constantly effective connection from said carriage to the movable element of said computing mechanism to cause said element to move in accordance with the movements of said carriage throughout the whole range of movement of the latter, said connection including motion multiplying mechanism for amplifying the movements of the movable element of the computing mechanism relatively to the corresponding movements of the carriage, and means operatively connecting the totalizer operating means with said printing mechanism.

2. In a calculating machine, the combination of a series of multidecimal totalizers having carry-over trains and also number wheels and gears for operating the same, totalizer-operating master gears, a reversible shaft on which said master gears slide into mesh with the first said gears, having rotative connection with said sliding gears, a spacing mechanism for causing said sliding gears to successively engage said totalizer gears, and keys operatively connected with said shaft for rotating it, and also with said spacing mechanism for actuating the latter.

3. In a calculating machine, the combination of a series of multidecimal totalizers having carry-over trains and also number wheels and gears individual to the number wheels for operating the same, totalizer-operating master gears, a reversible shaft on which said master gears slide into mesh with said totalizer gears, having rotative connection with said sliding gears, a type-spacing carriage operatively connected with said sliding gears, printing mechanism, and keys operatively connected with said shaft, carriage and printing mechanism.

4. In a computing machine, in combination, a totalizer comprising a plurality of reversible number-wheels representative of different denominational orders, each of said number-wheels, except that of highest order, having a tens-carrying device in coöperative relation with the number-wheel of next higher order, and said number-wheel of highest order having a tens-carrying device in coöperative relation with the number-wheel of lowest order and comprising, when effecting a carry, a direct train of driving elements between said wheels, whereby said wheel of lowest order will be rotated simultaneously with said wheel of highest order.

5. In a combined typewriting and computing machine, the combination with printing mechanism, a traveling carriage, a set of number-keys and mechanism controlled by said keys for operating said printing mechanism and for controlling the movements of said carriage, of computing mechanism comprising a set of reversible number-wheels, means controlled by said number-keys, and including valuating mechanism and reversing mechanism, for rotating said number-wheels, one at a time, in either direction, amounts varying in extent as determined by said valuating mechanism, means controlled by the movement of said carriage for determining the particular number-wheel to be affected at each depression of a number key, each of said number-wheels except that of highest denominational order having a tens-carrying device in coöperative relation with the number-wheel of next higher order, and said number-wheel of highest order having a tens-carrying device in coöperative relation with the number-wheel of lowest order and comprising, when effecting a carry, a direct train of driving elements between said wheels, whereby said wheel of lowest order will be rotated simultaneously with said wheel of highest order.

6. In a computing machine, in combination, a totalizer comprising a plurality of reversible number-wheels representative of different denominational orders, each of said number-wheels, except that of highest order, having a tens-carrying device in coöperative relation with the number-wheel of next higher order, and said number-wheel of highest order having a tens-carrying device in coöperative relation with the number-wheel of lowest order and comprising a train of gearing from one of said last mentioned wheels to the other including normally disengaged gear teeth brought into engaging relation so as to form a continuous train of meshed gearing between said last mentioned wheels when effecting a carry.

7. In a computing machine, in combination, a totalizer comprising a plurality of reversible number-wheels representative of different denominational orders, each of said wheels bearing characters arranged in two series of oppositely increasing orders of magnitude, the characters of each series comprising the numbers from "0" to "9", respectively, an index for selectively directing attention to characters of corresponding series on said wheels, each of said number-wheels, except that of highest order, having a tens-carrying device in coöperative relation with the number-wheel of next higher order, said number-wheel of highest order having a tens carrying device in coöperative relation with the number-wheel of lowest order and comprising a train of gearing from one of said last mentioned wheels to the other including normally disengaged gear teeth brought into engaging relation so as to form a continuous train of meshed gearing between said last mentioned wheels when said number-wheel of highest order is rotated backwardly one step from "0" in either direction, and said index having an operative connection with one of the ele-

ments of said train of gearing comprising means for varying its relation with respect to characters of the different series on movement of the number-wheel of highest order backwardly one step from "0" in either direction.

8. In a combined typewriting and computing machine, the combination with printing mechanism, including a traveling carriage, a set of number-keys and mechanism controlled by said keys for operating said printing mechanism and for controlling the movements of said carriage, of computing mechanism comprising a series of totalizers and reversible actuating mechanism controlled by said keys for operating said totalizers, said actuating mechanism comprising means for causing one of said totalizers to be operated a plurality of times during a single traverse of said carriage and at the same time operating a plurality of the remaining totalizers in succession, one or more of said totalizers comprising a set of reversible number-wheels representative of different denominational orders, each of said number-wheels, except that of highest order, having a tens-carrying device in cooperative relation with the number-wheel of next higher order, and said number-wheel of highest order having a tens-carrying device in coöperative relation with the number-wheel of lowest order and comprising, when effecting a carry, a direct train of driving elements between said wheels, whereby said wheel of lowest order will be rotated simultaneously with said wheel of highest order.

9. In a computing machine, in combination, a totalizer comprising a plurality of reversible number-wheels representative of different denominational orders, and bearing two systems of numbers, one system the reverse of the other, a number-wheel of each denominational order except the highest having a tens-carrying device in coöperative relation with the number-wheel of next higher order, and the number-wheel of highest denominational order having a tens-carrying device in coöperative relation with the number-wheel of lowest order and comprising, when effecting a carry, a direct train of driving elements between said wheels, whereby said wheel of lowest order will be rotated simultaneously with said wheel of highest order.

10. In a computing machine, in combination, a revoluble drive shaft, a plurality of master wheels on said shaft, a series of multi-decimal totalizers, a set of numeral keys, means controlled by said keys for effecting relative step-by-step movements between the master wheels and the totalizers and including a pick-up and release mechanism for causing one of said master wheels to be stepped along one of said totalizers a plurality of times during a single step-by-step advancement of another of said master wheels along other totalizers of said series in succession, valuating mechanism controlled by said keys, and reversible connections between said valuating mechanism and said drive shaft.

11. In a computing machine, in combination, a revoluble drive shaft, a plurality of master wheels on said shaft, a series of totalizers, a set of numeral keys, means controlled by said keys for effecting relative stepping movement between one of said master wheels and a succession of said totalizers engageable thereby *seriatim*, a cross-totalizer, means for concomitantly repeating a relative stepping movement between another of said master wheels and said cross-totalizer, valuating mechanism controlled by said keys, and reversible connections between said valuating mechanism and said drive shaft.

12. In a combined typewriting and computing machine having a stationary keyboard including numeral keys, and also having a typewriter carriage under the control of said keys, the combination with a plurality of stationary totalizers, of a shaft extending along said totalizers, a plurality of master wheels on said shaft, connections extending from said typewriter carriage to said master wheels to advance and return them relatively to said shaft, spline connections being provided between the master wheels and the shaft to permit such relative movement, valuating mechanism under the control of said numeral keys, and reversible connections between said valuating mechanism and said drive shaft.

13. The combination, with a typewriter comprising a traveling carriage, a set of numeral keys and means operable thereby to control the movements of said carriage, of a series of totalizers, a plurality of master wheels connected for simultaneous rotation under the control of said numeral keys, connecting means extending from said typewriter carriage to effect relative movements between said master wheels and the totalizers, said connecting means including movement-multiplying gearing, one of said master wheels connected to coöperate with a succession of totalizers at each run of the typewriter carriage, and means being provided for automatically effecting a repeated coöperation of the other master wheel with a single totalizer during such run of the typewriter carriage.

14. The combination, with a typewriter comprising a traveling carriage, a set of numeral keys and means operable thereby to control the movements of said carriage, of a totalizer, a master wheel connected for rotation under the control of said numeral keys, and connecting means extending from

said typewriter carriage to effect relative reciprocatory movements between said master wheel and said totalizer repeatedly during each run of the typewriter carriage, said connecting means including movement-multiplying gearing.

15. In a computing machine, in combination, a totalizer comprising a plurality of reversible number-wheels representative of different denominational orders, each of said wheels bearing characters arranged in two differentiated series of oppositely increasing orders of magnitude, the characters of each series comprising the numbers from "0" to "9", respectively, each of said number-wheels, except that of highest order, having a tens-carrying device in coöperative relation with the number-wheel of next higher order, and said number-wheel of highest order having a tens-carrying device in coöperative relation with the number-wheel of lowest order and comprising, when effecting a carry, a direct train of driving elements between said wheels, whereby said wheel of lowest order will be rotated simultaneously with said wheel of highest order.

16. In a computing machine, in combination, a totalizer comprising a plurality of reversible number-wheels representative of different denominational orders, each of said wheels bearing characters arranged in two series of oppositely increasing orders of magnitude, the characters of each series comprising the numbers from "0" to "9", respectively, and an index for selectively directing attention to characters of corresponding series on said wheels, each of said number-wheels, except that of highest order, having a tens-carrying device in coöperative relation with the number-wheel of next higher order and said number-wheel of highest order having a tens-carrying device in coöperative relation with the number-wheel of lowest order and comprising, when effecting a carry, a direct train of driving elements between said wheels, whereby said wheel of lowest order will be rotated simultaneously with said wheel of highest order, said index having an operative driving connection with said number-wheel of highest order comprising means for varying its relation with respect to characters of the different series on movement of the number-wheel of highest order backwardly one step from "0" in either direction.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 13th day of February A. D. 1906.

SAMUEL EDWARD CARLIN.

Witnesses:
FRANCIS A. HOPKINS,
J. H. JOCHUM, Jr.