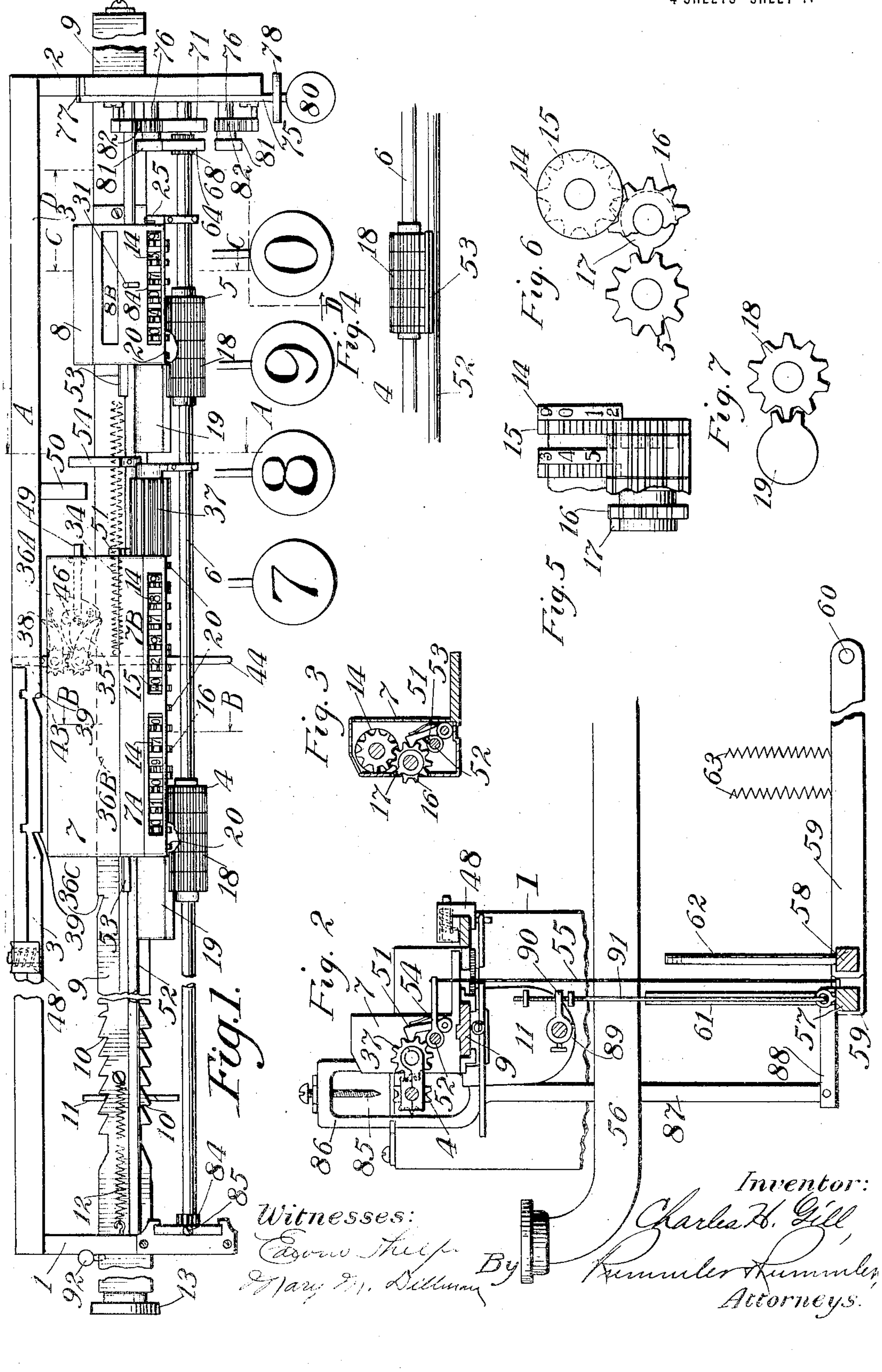
C. H. GILL.

COMPUTING ATTACHMENT FOR TYPE WRITERS.

APPLICATION FILED MAY 15, 1909.

1,228,107. Patented May 29, 1917.

4 SHEETS—SHEET 1.



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4 SHEETS—SHEET 2

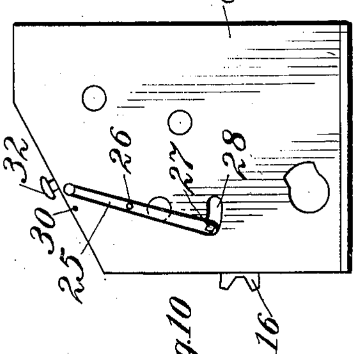

Fig.10

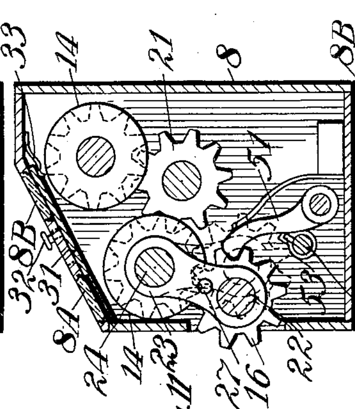

Fig.11

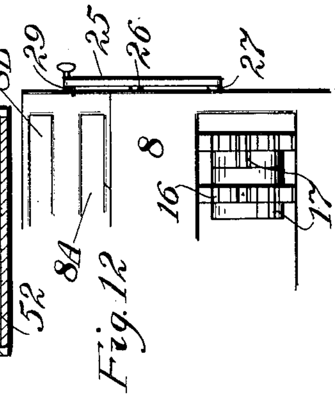

Fig.12

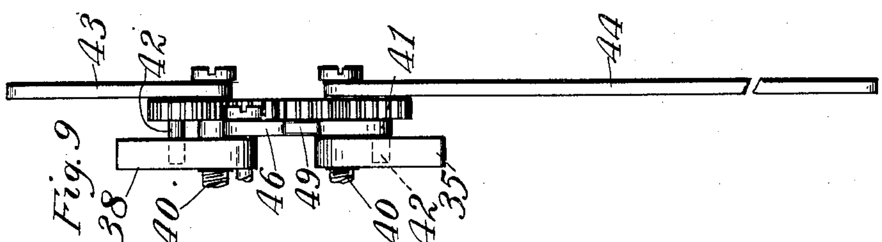

Fig. 9

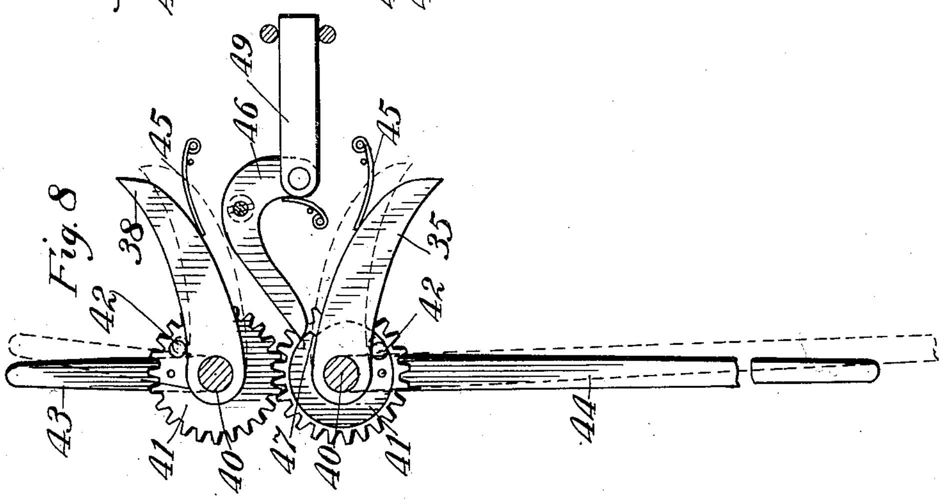

Fig. 8

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4 SHEETS—SHEET 3.

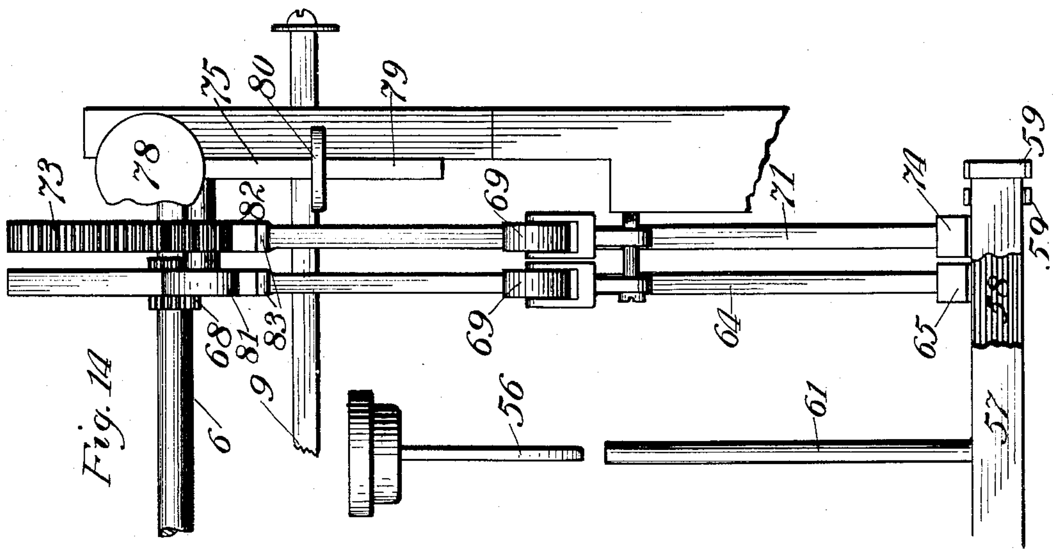

Fig. 14

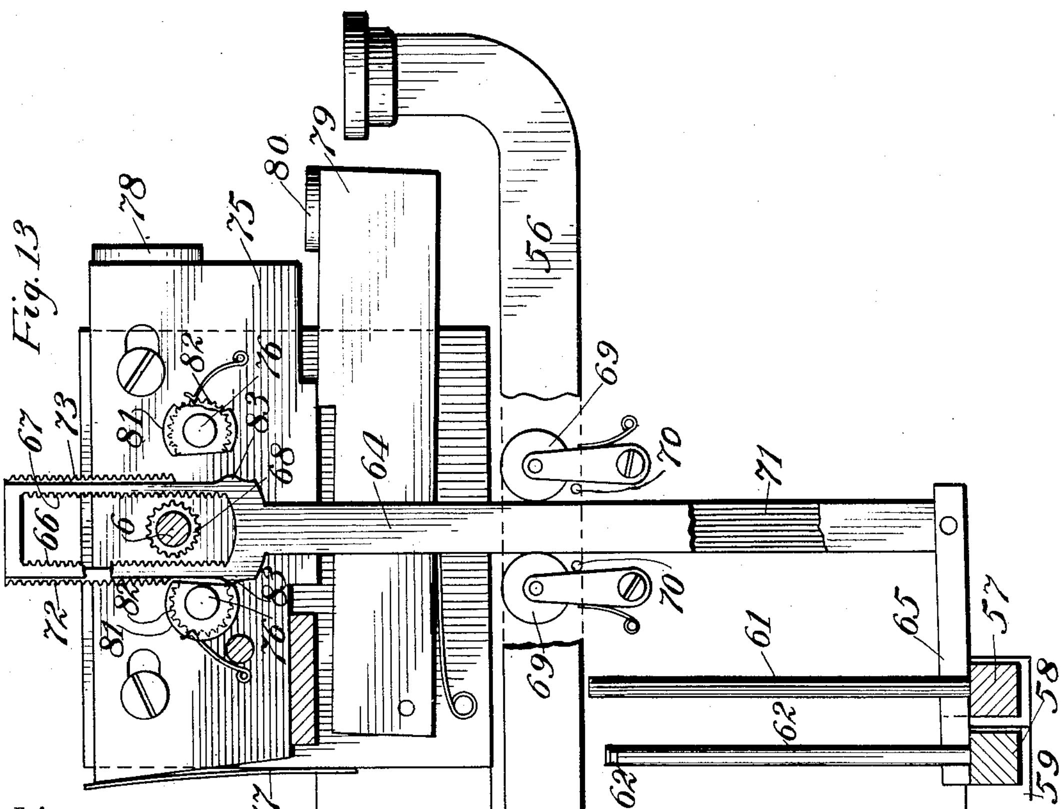

Fig. 13

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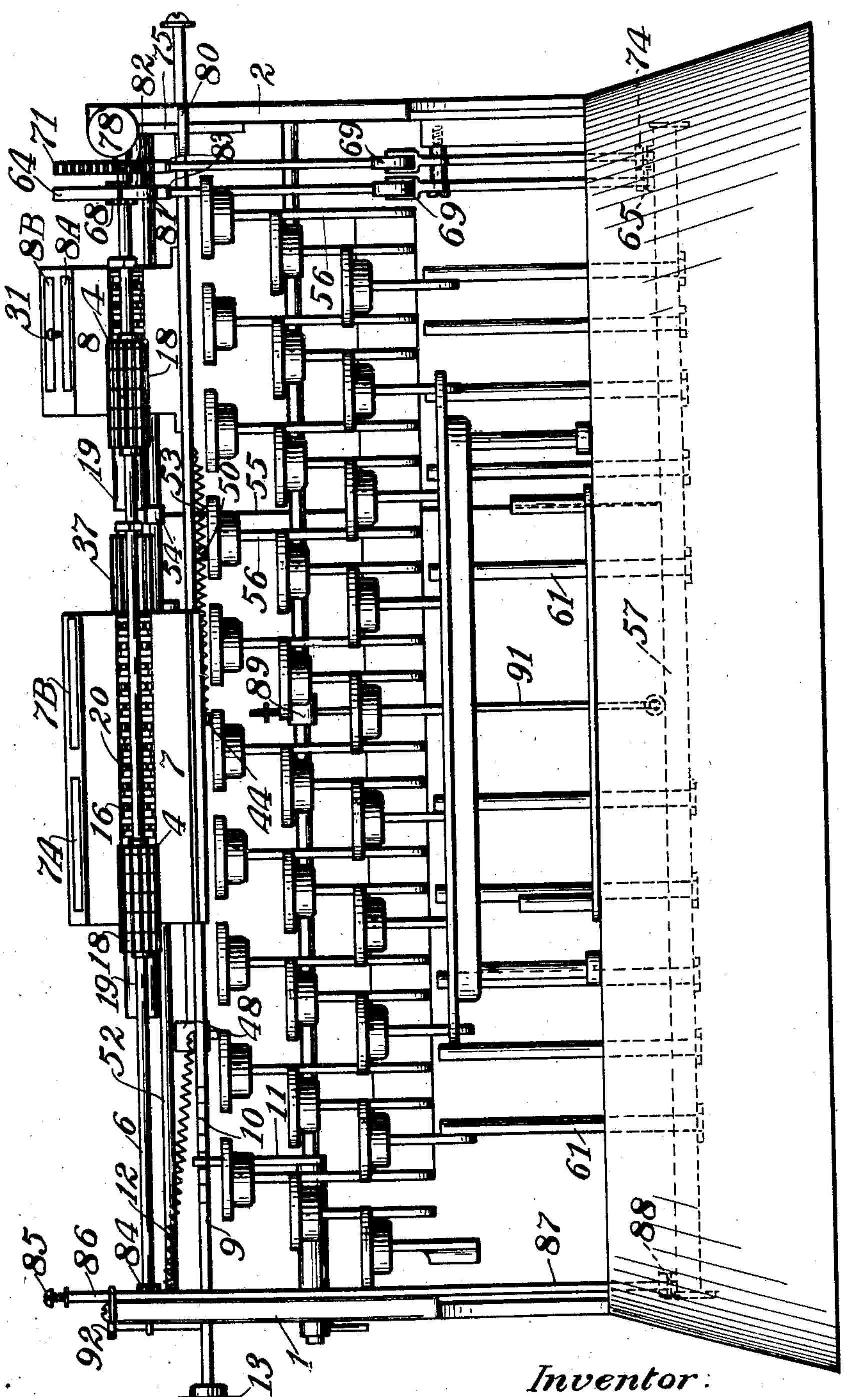
4 SHEETS—SHEET 4.

Fig. 15



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UNITED STATES PATENT OFFICE.

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COMPUTING ATTACHMENT FOR TYPE-WRITERS.

1,228,107. Specification of Letters Patent. **Patented May 29, 1917.**

Application filed May 15, 1909. Serial No. 496,130.

To all whom it may concern:

Be it known that I, CHARLES H. GILL, a citizen of the United States of America, and a resident of Chicago, county of Cook, State of Illinois, have invented certain new and useful Improvements in Computing Attachments for Type-Writers, of which the following is a specification.

The main features of this invention include an improved construction for adding machines whereby the same will be particularly suited for totalizing a plurality of columns of numbers and mechanically carrying forward both line and column totals and also the grand total; a construction of this class whereby the writing of the totals and grand total will automatically clear the various totalizers so as to avoid the necessity of re-setting the same by hand; an improved arrangement of master and transfer gears for operating computing devices whereby the count of any computing wheel will be automatically transferred to the wheels of higher denomination, but whereby the possibility of the operation of one wheel affecting a wheel of lower denomination is prevented; an improved arrangement of the transfer gears whereby said transfer gears will be advanced with the master gear to successive engagement with different computing wheel gear sets; improved means for guiding the transfer gears while disengaged from the computing wheels; an improved construction whereby a single master mechanism and its set of transfer gears will be automatically advanced relatively of the computing wheels after operating one set of computing wheels and be brought into operative relation with a different set of computing wheels; an improved arrangement of settlers or justifying detents, whereby the operation of the master mechanism will simultaneously cause the retraction of the detents and thereby relieve the master operating mechanism of the strain of overcoming the resistance offered by such detents to rotation of the computing wheels; improved means for indicating directly the total of a series of deductions or amounts subtracted; and an improved form of rack and pinion mechanism for operating the master mechanism of adding machines, and adapted to keep the rack and pinion out of mesh with each other during a certain part of the stroke of the rack and then cause them to positively enter meshing relation.

Other features and advantages will hereinafter appear.

A specific embodiment of this invention is shown in the accompanying drawings, in which—

Figure 1 is a top plan of an adding attachment for typewriters, omitting all parts of the typewriter that are not necessary for a clear disclosure of this invention,

Fig. 2 is a section of the same on the line A—A of Fig. 1, and showing also one of the key levers and the mechanism whereby motion is transmitted from the key levers to the adding mechanism;

Fig. 3 is a section of one of the column totalizers on the line B—B of Fig. 1;

Fig. 4 is a detail showing, in rear elevation, the relative arrangement of the settler retracting shaft and the transfer gears;

Fig. 5 is a fragmentary front elevation illustrating in detail the relation of the master gear and transfer gears with respect to the operating gear sets of the computing wheels;

Fig. 6 is a diagrammatic side elevation of the same viewed from the right of Fig. 5;

Fig. 7 is a detail showing the method of guiding the transfer wheels when they are out of mesh with the operating gears;

Fig. 8 is an enlarged detail showing the arrangement of the ratchet pawls which control the movement of the column totalizers with respect to the adder carriage;

Fig. 9 is an elevation of the same viewed from the right of Fig. 8;

Fig. 10 is an enlarged side elevation of the line totalizer;

Fig. 11 is an enlarged section of the same on the line C—C of Fig. 1;

Fig. 12 is an enlarged fragmentary front elevation of the same;

Fig. 13 is an enlarged detail, partly sectional and partly broken away, of the mechanism which transmits motion from the key levers to the master mechanisms for operating the computing devices, the section being taken on line D—D of Fig. 1;

Fig. 14 is a front elevation of the same.

Fig. 15 shows a front elevation of a typewriter keyboard and base with the computing attachment mounted in position thereon, the type-bars and platen carriage being omitted from the background.

In the construction shown in the drawings, the adding devices and the mechanism for operating them are of a form which is suitable for use as an attachment to typewriters. The keys, which are indicated in Figs. 2, 13 and 14, represent the numeral keys of the typewriter, and for the purpose of disclosing this invention, the illustration of said keys and their relation to the various parts of the mechanism are assumed to be sufficient to convey to those skilled in this art a clear understanding of the operative relationship between the adding attachment and the remaining parts of the typewriter mechanism, which are not shown.

In the construction shown, the adding devices extend across the typewriter frame above and immediately back of the keyboard. The supporting frame of the adding attachment comprises end parts 1 and 2, and a bar 3 connecting them. Said frame parts may be integral with the main typewriter frame or may be separably attached thereto. In the form shown two master operating elements or gears, 4 and 5, are mounted in fixed relation to each other on the shaft 6, which is journaled in the end parts 1 and 2 of the supporting frame. There are also two computing devices 7 and 8, each of which is provided with computing wheels and gear trains and arranged to be shiftable in the frame so as to successively bring different computing wheel gear trains into mesh with the master gears. The extent of rotation of the master gears determines the extent of rotation of the computing wheels, as is usual in devices of this class, and is brought about by the movement of the numeral keys of the typewriter, in each case the extent of movement of the master mechanism being proportionate to the digit to which the respective key corresponds.

The computing devices 7 and 8 are mounted upon and carried by an adder carriage 9, separate from and independent of the typewriter carriage which is not shown. In the form shown, the carriage 9 is in the form of a bar extending parallel with the shaft 6 and mounted to travel endwise in the frame parts 1 and 2. Ratchet teeth 10 on the carriage coöperate with an escapement pawl 11 so as to cause an advance of the carriage 9 between successive operations of the master mechanisms. Owing to the independent advance of typewriter carriage and computer carriage, the feed of the latter may be equal to, or greater or less than the letter feed of the typewriter carriage, in this way enabling the elements of the computer to be of the size most advantageous for the work at hand, without requiring an exact correspondence between the axial spacing of digit wheels and the letter feed of the typewriter carriage. The carriage 9 in two steps is normally urged to the left hand limit of its movement by a spring 12 and is returned manually to its initial position at the right hand limit of its movement by the operator pushing inward upon the button 13.

Each computing device comprises a series of computing wheels 14, arranged in axial alinement with each other and separately rotatable about their common axis, which is parallel with that of the shaft 6. Each of the computing wheels 14 is rotated by means of an individual gear train, comprising a gear 15 secured directly to the computing wheel and a gear 16 meshing with the gear 15 and adapted to mesh with the master wheel when registering therewith. Each of the gears 16 is of substantially the same width as the master gears 4 and 5, and secured to the left hand side of each gear 16 is a mutilated gear 17 which, in the form shown, has but a single tooth. Mounted on the shaft 6, adjacent to each master gear, is a series of transfer or carry-over gears 18 which are of such width as to simultaneously mesh with the mutilated gear 17 of one gear set and with the complete gear 16 of the gear set of next higher denomination. The transfer gears 18 are independently rotatable on the shaft 6 and are arranged at the left of the master gears in such positions as to connect in train all of the gear sets of higher denomination than those which are connected with the master gears. At the left hand end of each computing device there is a fixed guide 19, which is adapted to prevent accidental rotation of the transfer gears 18 and insure that they pass properly into mesh with the computing wheel gear sets as the adder carriage is advanced. In order to provide an arrangement of the guiding devices which will permit the master pinion to rotate freely when it occupies a position at the left of the computing wheel of highest denomination, there is provided in each computing device a rotatable guiding pinion 20. This is shown in Fig. 1 where the adjacent parts of the transfer gears are broken away.

The escapement mechanism of the adder carriage is arranged to advance the carriage by a step by step movement, comprising two steps for each complete computing stroke of a numeral key, the successive positions of rest of the carriage with the keys at rest corresponding to the spacing between the adjacent computing wheel gear trains. It will be seen from Fig. 1 that the width of the master pinions 4 and 5 is substantially the same as that of the gears 16, while the width of the transfer gears 18 is substantially equal to the "spacing" interval of the movement of the adder carriage. During each spacing movement of the adder carriage, the transfer gears 18 therefore pass into mesh with the respective gears 16 before the preceding transfer or master gear has passed out of mesh therewith, and the guiding pinions 20 are so placed between the fixed guide 19 and the gear 16 of the train of highest denomination that there is no chance for the transfer gears 18 to accidentally rotate during such spacing movement.

For the purpose of enabling the simultaneous carrying forward of a plurality of column totals, and at the same time conveniently carrying out the line totals, when tabulating, the device should preferably be provided with a separate set of computing wheels for each column of numbers. In the form shown in the drawings the relatively movable computing device 7 contains two independent totalizers, or sets of computing wheels, and the computing device 8 (fixed on the carriage) also contains two totalizers, but in the latter case they are not independent but are operated simultaneously and have the numerals on their computing wheels arranged in inverse order with respect to each other. The object of this arrangement of the computing device 8 is to permit the direct reading of amounts added, regardless of whether the master mechanism is operating in the normal direction for performing additions or in the reverse direction for performing subtractions. The arrangement of the computing wheels of the computing device 8 is illustrated in Fig. 11, where it will be seen that there are two sets of computing wheels 14 arranged one behind the other, corresponding wheels of each set being connected by one or more intermediate wheels 21 so as to be operated simultaneously by a single operating gear 16. In this case also the gears 16 are mounted on a swinging shaft 22, which is hung in arms 23 loosely journaled on the shaft 24 of the front computing wheels 14. The arms 23 are arranged to be swung backward by a lever 25 pivoted at 26 on the outside of the casing of the computing device 8 and connected by a stud 27 with one of the arms 23. The stud 27 operates in a slot 28 in the end of the casing. The lever 25 may be made of resilient material or otherwise arranged so that the detent 29 carried by it may be sprung into and out of recesses or stops 30 to secure the lever in either of its limiting positions. This arrangement permits the computing device 8 to be temporarily thrown out of service while the device 7 is being operated, which arrangement is desirable under certain circumstances.

For convenience of reference, the two totalizers of the computing device or carriage 7 will be hereinafter designated 7A and 7B, and the two totalizers of the computing device 8 will be designated 8A and 8B, as a whole. As it is never desirable to read both of the totalizers 8A and 8B at the same time, a shutter 31 is mounted in the casing thereof and is of such shape as to hide one of the totalizers whenever the other is visible. This shutter is arranged to be operated manually by means of a knob 32, and is held in the position shown in Fig. 11 by means of a spring detent 33. For certain classes of work it may be desirable to have all of the totalizers of the double form as in the computing device 8.

The computing device or carriage 7 is slidable on the carriage 9 and is normally urged toward its extreme right hand position upon the carriage 9 by means of a spring 34, but is secured in a plurality of different positions toward the left of such extreme right hand position by means of a pawl 35, which is pivotally mounted on the under side of a rearward extension of the casing 7 and arranged to engage ratchet shoulders 36A, 36B and 36C, on the carriage 9. These shoulders are spaced apart to correspond with the spacing of computing wheels of the same denomination of the totalizers 7A and 7B and so located that when the pawl 35 engages the shoulder 36A the master gear 4 will actuate the totalizer 7A; when the pawl 35 engages the shoulder 36B the master gear 4 will operate totalizer 7B; and when the pawl 35 engages the shoulder 36C both totalizers 7A and 7B will be held at the left of the master gear 4 and will, therefore, not be actuated thereby. In order to accomplish the accurate guiding of the transfer gears 18, when they are beyond the right hand end of the computing device 7, there is journaled on said right hand end a guide wheel 37 which performs the guiding function without interfering with the rotation of the master wheel 4.

In order to accomplish the advance of the computing device 7 along the main carriage 9, there is provided a second ratchet pawl 38 which engages shoulders 39 on the bar 3 of the frame. These shoulders 39 are so placed that the pawl 38 will engage one of them after the spacing interval of the carriage 9 which immediately follows the operation of the computing wheel of lowest denomination of one of the totalizers 7A or 7B, so that when the carriage 9 is returned to its initial position for adding the next number on the totalizer 8 the computing device 7 will remain stationary and therefore cause the totalizers 7A and 7B to be operated in succession through repeated operations of the totalizer 8A. The last shoulder 39 is provided for the purpose of holding both of the totalizers 7A and 7B clear of the master gear 4 during the operation of writing the total which is registered by the totalizer 8A or 8B without interfering with the accurate carrying of column totals by the totalizers 7A and 7B.

As shown in Figs. 8 and 9, the pawls 35 and 38 are loosely pivoted on studs 40, and there are separately pivoted upon the same studs a pair of intermeshing gears 41. Each of these gears has a shoulder 42 located so as to abut against the respective pawl 35 or 38 and also has rigidly connected therewith an arm 43 and 44 respectively. Springs 45 urge the pawls into their engaged positions and when either of the arms 43 and 44 are shifted to the position shown by dotted lines the gears 41 will both rotate and cause the shoulders 42 to retract the pawls, as indicated by dotted lines. A spring-pressed detent pawl 46 is located so as to engage a shoulder 47 on one of the gears 41 and thereby hold both of the pawls 35 and 38 in their retracted position. The retracting of the pawls is accomplished either through the engagement of the arm 43 with a shoulder 48 on the frame, or through the manual shifting of the arm 44. The shoulder 48 is preferably made adjustable along the bar to positions at the left of either of the column totalizers 7A or 7B. As shown, this is accomplished by mounting the shoulder 48 on a sleeve slidable on the bar 3 and securing the sleeve by means of a spring pressed detent 48A adapted to engage notches 48B on the bar 3. When the pawls are in their released position the spring 34 pulls the computing device 7 to its extreme right hand position on the carriage 9 and the detent 46 is then released from engagement with the shoulder 47 through the fact that the hinged extension 49 engages a shoulder 50 on the frame in this position. The release of the detent 46 allows the springs 45 to return the pawls to their operative positions. The extension 49 is suitably guided to prevent it from swinging out of place.

The operating gear train of each computing wheel is provided with a settler or justifying detent or dog 51. In the form shown these engage the gears 16 and are spring-pressed, as usual. There are also detents 51 on the idle guiding wheels 20 and 37. All of these detents are preferably pivotally mounted in axial alinement with each other, and in order to relieve the type keys of the typewriter of the added strain which would be caused by these detents on account of their resistance to the rotation of the computing wheels, means are provided for retracting from engagement with the respective gear trains all of the detents or locks which correspond to the computing wheels which are being turned by the master mechanisms as well as those corresponding to computing wheels of higher denomination which are likely to be also turned through the action of the transfer gears. These means comprise a rock-shaft 52 extending in parallel relation to the master shaft 6 and adjacent to the series of detents 51. The shaft 52 has a radially disposed web or projection 53, which is of a length co-extensive with the respective master gear 4 or 5 and its series of transfer gears 18. Thus, as one of the master gears passes into position for operating a certain gear train, the corresponding web 53 also comes into position for retracting the corresponding detent 51. This arrangement is most clearly shown in Figs. 1 to 4 inclusive, from which it will be seen that the oscillation of the shaft 52 will cause the retracting of the detents 51. This is accomplished by the arm 54, which is fixed on the shaft 52 and is operated by a link 55.

The mechanism which actuates the adding devices through the operation of the numeral key levers 56 of the typewriter, is illustrated in Figs. 1, 2, 13 and 14. Below the keyboard of the typewriter, and extending transversely across all of the numeral key levers, is a pair of bars 57 and 58, which are carried by separate arms 59 from a parallel shaft 60. Each of these bars 57 and 58 has, extending upwardly therefrom and rigidly attached thereto, a series of rods 61 and 62 respectively, there being one rod 61 for each numeral key lever and one rod 62 for each numeral key lever, except the zero key. The mechanisms for accomplishing the spacing advance of the adder carriage, the releasing of the detents, and the other operations which are the same in all instances, are connected with the bar 57 which carries the rods 61 of equal length. The mechanisms which control the rotary movements of the computing wheels, and which operate differently for different levers, are actuated by the bar 58. In this case the lengths of the rods 62 determine the throw of the bar 58 which corresponds to each key lever. Each of said rods 62 is engaged with its respective key lever during the latter part of the downward movement of said key lever, and the angular movement of the key lever after it engages the corresponding pin 62 determines the extent of movement of the computing wheel which is being operated. The rods 62 are, of course, adjusted to such lengths that the operation of any numeral key will rotate the computing wheel through as many unit angular intervals as there are units in the digit to which such key corresponds. This relationship is well known in this art and need not, therefore, be more fully explained. The bars 57 and 58 are normally urged to their upper limits of movement by suitable springs, indicated at 63 in Fig. 2.

The master shaft 6 is operated by a rack bar 64, which is connected by an arm 65 with the bar 58 and which has two racks 66 and 67 of suitable length and located to engage opposite sides of a pinion 68 rigidly mounted on the shaft 6. Racks 66 and 67 are spaced apart so that when the bar 64 is in a middle position neither of said racks will mesh with the pinion 68. The bar 64 is normally held in such middle position by means of a pair of spring-pressed centering rollers 69. Stationary stops 70 prevent either roller 69 from urging the bar 64 beyond such middle position. There is a second bar 71, somewhat similar in form to the bar 64, but provided with racks 72 and 73 of suitable length on its opposite outer edges and having smooth inner edges. The bar 71 is connected by an arm 74 with the bar 57. As the pins 61 are longer than any of the pins 62, there will always be a certain amount of movement of the bar 71 in advance of each movement of the bar 64, and this advance movement is utilized for the purpose of shifting one of the racks of the bar 64 into mesh with the pinion 68. Which rack shall be so shifted is determined by a guide 75 which carries a pair of studs 76 at opposite sides of the rack bars. The guide 75 is normally urged into the position shown in Fig. 13 by means of the spring 77, but may be pushed back against the action of the spring 77 by pressure on the button 78, and will be held in such rearward position by the spring-pressed catch 79, which may in turn be released by a downward pressure upon the button 80. Each of the studs 76 carries a cam 81 located in the plane of the bar 64, and a toothed sector 82 in the plane of the bar 71. The cams 81 are in the form of sectors, having smooth circular peripheries and one flat side. Near the lower ends of the racks on the bar 64 are projections 83 which coact with the flat sides of the cams 81 so as to insure that the toothed sectors 82 occupy positions for meshing with the racks 72 and 73 when the bar 64 is at the upper limit of its movement. This relation is shown in Figs. 1, 13 and 14, from which it will be seen that as the rack bar 64 descends the rack 72 will engage the teeth of the toothed sector 82 and will then cause the two sectors to rotate together. The periphery of the sector 81, engaging the side of the rack bar, will then push the rack 66 into mesh with the pinion 68 when the bar 71 has completed a certain portion of its downward stroke. During the remaining portion of such downward stroke, the continued rotation of the toothed sector 82 and cam 81 serves merely to retain the rack 66 in mesh with the pinion 68. The first portion of the downward stroke of the bar 71, which accomplishes the throwing into mesh of the racks 66 with the pinion 68, is completed before the numeral key 56 engages the upper end of the respective rod 62. When such engagement takes place the bar 58 is pushed downward and pulls the rack bar 64 with it throughout the remainder of the stroke of the key bar 56. The extent of this latter part of the stroke is, of course, determined by the height of the respective rod 62, and this length is such that the rotation of the pinion 68 will cause the master pinions to rotate sufficiently to register the amount of the digit which corresponds to the respective key bar 56.

At the end of its downward movement, the rack bar 72 has rotated the toothed segment 82 and the cam 81 until the teeth of said segment no longer mesh with the teeth of the rack bar 72. This permits the valuating rack bar 64 to be swung clear of the drive pinion 68 by the spring-pressed roller 69, because the round surface of the cam 81 is cut away at the point corresponding to this; then by a camming action, the flat outside edge of the valuating rack bar 64 turns the cam 81 and segment 82 until their flat sides face the rack bars 71 and 64. Since this breaking of the meshing of rack bar 72 and segment 82 occurs at the bottom of the key stroke, the master wheel is free of the numeral keys until another downward key stroke is begun, because the flat side of the cam 81 holds the segment 82 so that it is impossible for said segment 82 to mesh with the rack bar 72 during the up-stroke of the key. It will be noted that the master wheel shaft 6 to which the pinion 68 is fast is thus free from the numeral keys when the computing carriage 9 feeds at the end of the down and beginning of the up-stroke of the numeral keys.

In Fig. 13 the parts are in position ready for performing the operation of addition. When it is desired to subtract a quantity from either of the calculators, the button 78 is pushed rearward, and this brings the front sector and cam into position for causing the rack 67 to mesh with the pinion 68.

In order to prevent overthrow of the master gears, the shaft 6 is provided with a stop wheel 84, similar to the pinion 68 but at the opposite end of said shaft. The wheel 84 has the same number of tooth spaces as the pinion 68, and a pin 85, (Figs. 1 and 2), is arranged to engage the wheel 84 and stop the rotation of the shaft 6 at a predetermined instant. The pin 85 is adjustably mounted in a yoke 86, carried by a bar 87, which is connected to the oscillating bar 57 by an arm 88.

The escapement pawl 11 is carried by a pivot shaft 89, which has an arm 90 connected by a slidable link 91 with the oscillating bar 57. Similarly the arm 54, which oscillates the shaft 52 for retracting the computing wheel detents, is connected with the oscillating bar 57 by the link 55.

The operation of the device shown is as follows:

Assume, for example, that it is desired to write the following table of numbers and perform both line and column additions, and also carry out the grand total:

Department.	Checks.	Currency.	Totals.
No. 1	1687.24	1348.76	3036.00
No. 2	1934.17	1006.41	2940.58
No. 3	1097.78	2131.41	3229.19
Totals	4719.19	4486.58	9205.77

The characters which make up this total are written upon the typewriter in the usual manner, one line at a time. To write the line of figures which follows the words, "No. 1," the operator first pushes the carriage 9 to the extreme right hand limit of its movement and also trips the pawls 35 and 38 and allows the calculator 7 to return to the extreme right hand limit of its movement on the carriage 9. This brings the calculators in such position that the master gears 4 and 5 will be in mesh with the guide wheels 20, which are at the left hand ends of the totalizers 7A and 8A respectively. If the carriage 9 is locked against shifting, by any suitable means, as, for instance, a movable detent 92 mounted on the frame and adapted to be shifted into and out of engagement with a notch in the carriage 9, then any numbers may be written without affecting the calculators. When it is desired to write the first number, 1687.24, the operator releases the detent 92 and thereby allows the carriage to advance until the first of the shoulders 10 engages the adder carriage escapement 11. This brings the master gears 4 and 5 into position for writing the first number. In the device shown, the totalizers are indicated as having six wheels each, and the first digit would, therefore, be registered upon the wheel of highest denomination of the totalizers 7A and 8B when the operator depresses that key which is used for writing the numeral 1. Similarly the digits 6, 8, 7 are written and registered by depressing the corresponding keys, and the step by step advance of the adder carriage causes each digit to be registered upon its proper computing wheel. The decimal point is then written, but as the typewriter key lever which writes the decimal point has no connection with the swinging bar 57, the writing of the decimal point will not advance the adder carriage, but will advance the typewriter carriage so that the typewriter carriage will advance properly to provide space for the decimal point while the adder carriage will remain in proper position for registering the next digit "2" on the proper computing wheel. After writing the last digit "4" the operator again pushes the adder carriage to its extreme right hand position. This returns the computing device 8 to its initial position with the idle wheel 20 in mesh with the master gear 5, but does not return the computing device 7 for the reason that during the previous advance movement the pawl 38 was carried into position for engaging the shoulder 39 and therefore prevents such return movement of the computing device 7. This leaves the guide wheel 20, which is at the left of the calculator 7B, in mesh with the master gear 4, where it was after the spacing movement of the carriage which followed the writing of the last digit of the number 1687.24. The second number, 1348.76, is now written in the same manner and is registered upon the totalizers 7B and 8A. The writing of the last digit "6" of this number causes the computing device 7 to advance so that the pawl 38 is brought into engagement with the second shoulder 39. When the adder carriage is next returned to its initial right hand position, for the purpose of writing the line total, the computing device 7 will be held by the ratchet mechanism in such position that the master gear 4 will be at the right of the calculator 7B and in mesh with the right hand guide wheel 20. When the operator writes the line total, 3036.00, the slide 75 is first pushed rearward by means of the button 78 so that when a numeral key is depressed the substracting rack 67 will operate the master wheels. As the line total is the total of the numbers previously written, the act of writing this number while the subtracting rack is in mesh with the pinion 68 will cause this number to be subtracted from the totalizer 8A, which will, therefore, be cleared so as to indicate 0 (zero) on each of its wheels. The column numbers will, however, remain registered upon the calculators 7A and 7B for the reason that during this subtracting operation the computing device 7 was held clear of its master gear 4. The act of writing the last digit of the line total carries the computing device 7 to such position that the arm 43 will be pushed to the right by the shoulder 48 on the frame and will thereby cause both of the pawls 38 and 35 to be retracted, allowing the computing device 7 to shift to its extreme right hand position on the carriage 9. The operator now returns the carriage to its extreme right hand position and locks it there by means of the detent 92. The engagement of the rod 49 with the shoulder 50 will have released the detent pawl 46 and allowed the pawls 38 and 35 to be forced toward their engaged positions by their springs. The computing devices 7 and 8 will now occupy positions where the master gears will be in mesh with the left hand guide wheels 20, and as the carriage is locked against spacing by the detent 92, the operator will be free to write any numbers which may appear in non-computing column or columns without operating the totalizers. After the characters in the non-computing column are written and the typewriter carriage is brought into position for writing the first digit of the number in the first computing column, the operator releases the carriage 9 from the detent 92 whereupon said adder carriage advances until the master gears are brought into mesh with the computing wheels of highest denomination. The remainder of the line is written in a manner similar to that in which the first line is written, and so on throughout the remaining lines. In writing the line total of the last line preceding the line of column totals, the subtracting rack will be in position for meshing with the pinion 68. This is allowed to remain after writing this line total, so that when the column totals are written the act of writing them will clear the calculators 7A and 7B; that is, it will reset them to zero. The line total which now appears on the totalizer 8A will not be the true total, but will be zero minus the true total, as this totalizer was turned backward. However, by shifting the knob 32 so as to shift the shutter 31 and display the totalizer 8B, the true total may be read from that totalizer, since, as has been hereinbefore described, the arrangement of the numerals on the wheels of the totalizer 8B is in the reverse order with respect to its direction of rotation. In reading the totalizer 8B, allowance is to be made for the plus or minus error in the unit numeral, as is usual in this art. The operator now pushes down the button 80 and thereby allows the slide 75 to shift forward and carry the adding rack 66 into position for engaging the pinion 68, and when the grand total is now written, as it appears on the totalizer 8B, the act of writing it will clear the computing device 8 and bring both of the totalizers 8A and 8B to zero reading.

During the downward stroke of either of the numeral keys 56, the bar 57 is depressed, and this, through the action of the link 55 and arm 54, swings the shaft 52 and causes the projection 53 to release the detents 51. The same movement of the bar 57 acts upon the link 91, and as it approaches the end of its downward stroke the upper shoulder on said link engages the arm 90 and swings the escapement pawl 11, causing the carriage 9 to advance through the distance between a tooth 10 on one side of the bar 9 and the next tooth 10 on the other side of this bar. During the upward or return movement of the key the lower shoulder of the link 91 oscillates the escapement pawl 11 back to its initial position and completes the unit spacing movement of the carriage 9.

The single tooth of the mutilated gear 17 is located in such position with respect to the gear train of its respective computing wheel that it will come into position for meshing with the transfer gear 18 when the numeral 9 is indicated on the respective computing wheel, so that when said computing wheel advances one more unit interval the single toothed gear will rotate the transfer gear and increase the count of the computing wheel of next higher denomination by unity, as is usual in other forms of transfer mechanisms. An important advantage of this arrangement of transfer gears is the fact that there is no connection whatever between the computing wheel which is being operated by the master gear and the other computing wheels of lower denomination and, therefore, no possibility of accidentally transferring movement from one wheel to another of lower denomination.

Although but one specific embodiment of this invention has been herein shown and described, it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention.

I claim:

1. In a computing machine, the combination of a frame, a pair of computing devices, movable relatively to each other, a pair of master mechanisms for respectively operating said computing devices and spaced apart in fixed relation to each other, means for causing simultaneous step by step advance of said computing devices with respect to their master mechanisms, and means for causing one of said computing devices to advance continuously in one direction through a repeated backward and forward movement of the other, said master mechanisms including a pair of master wheels turning on a single axis.

2. In a computing machine, the combination of a master shaft, a pair of master pinions mounted on said shaft and spaced apart in fixed relation to each other, a carriage movable in parallel relation to said shaft, a computing device comprising a series of computing wheels and operating gears mounted on said carriage in fixed relation thereto, a second computing device mounted to travel on said carriage toward and away from said first computing device and comprising a series of computing wheels and operating gears located to mesh with the respective master device, means acting between said second computing device and said carriage and adapted to cause said second computing device to advance with said carriage during a movement of the carriage in one direction and to remain station-

ary and to permit said carriage to return to a certain initial position without returning said second computing device to the corresponding initial position, means for operating said master shaft, and means for causing a step by step advance of said carriage through successive operations of said last-named means.

3. In a computing machine, the combination of a frame, a carriage mounted to travel on said frame, a line totalizer mounted on said carriage, a plurality of column totalizers secured in fixed relation to each other but mounted on said carriage to travel therewith and to be also shiftable thereon toward and away from said line totalizer, a pair of master mechanisms spaced apart and adapted to respectively operate said line and column totalizers, and mechanism controlling the movement of said carriage and adapted to cause said line and column totalizers to advance simultaneously, and means for holding said column totalizers stationary during the return movement of said carriage whereby successively different column totalizers will enter operative position adjacent to their master mechanism during successive operations of said column totalizer.

4. In a computing machine, the combination of a frame, a carriage mounted to travel on said frame, a computing device mounted on said carriage to travel therewith and to be also shiftable thereon, means for causing said computing device to travel with said carriage in one direction and to cause said computing device to remain stationary during a return movement of said carriage whereby said computing device will be advanced to successively different positions on said carriage through repeated backward and forward movements of the carriage.

5. In a computing machine, the combination of a frame, a carriage mounted to travel on said frame, a computing device mounted on said carriage to travel therewith and to be also shiftable thereon, means for causing said computing device to travel with said carriage in one direction and to cause said computing device to remain stationary during a return movement of said carriage whereby said computing device will be advanced to successively different positions on said carriage through repeated backward and forward movements of the carriage, and means for automatically returning said computing device to a certain initial position on said carriage after it has advanved to a certain position thereon.

6. In a computing machine, the combination of a frame, a carriage mounted to travel on said frame, a computing device mounted on said carriage to travel therewith and to be also shiftable thereon, means for causing said computing device to travel with said carriage in one direction and to cause said computing device to remain stationary during a return movement of said carriage whereby said computing device will be advanced to successively different positions on said carriage through repeated backward and forward movements of the carriage, and means for automatically returning said computing device to a certain initial position on said carriage after it has advanced to a certain position thereon, said last named means being adjustable so as to provide different limits for the movement of said computing device on said carriage.

7. A computing device comprising a series of computing wheels, a series of operating gears arranged for individually operating the respective computing wheels and journaled in axial alinement with each other, a master shaft extending along said series of gears, a master gear mounted on said shaft, mechanism for successively advancing said computing device with respect to said master gear to successively shift said master gear into mesh with different operating gears, and a series of transfer gears loosely journaled on said master shaft and adapted to connect the gear trains of adjacent computing wheels for transferring the count from each to the next of higher denomination.

8. A computing device comprising a series of computing wheels, a series of operating gears arranged for individually operating the respective computing wheels and journaled in axial alinement with each other, a master shaft extending along said series of gears, a master gear mounted on said shaft, mechanism for successively advancing said computing device with respect to said master gear to successively shift said master gear into mesh with different operating gears, a series of transfer gears loosely journaled on said master shaft and adapted to connect the gear trains of adjacent computing wheels for transferring the count from each to the next of higher denomination, and means for guiding said transfer gears to insure that they pass endwise into mesh with the respective operating gears through the relative advancing of said computing device and master gear.

9. In a computing device, the combination of a series of computing wheels, a series of gear sets for individually operating said computing wheels, each of said gear sets comprising a complete gear and a mutilated gear secured in fixed relation to each other, and all of said gear sets being mounted in axial alinement with each other, a master shaft journaled in parallel relation to the common axis of said gear sets, a master gear mounted on said shaft and rotatable therewith, mechanism for causing said master gear to successively mesh with the complete gears of adjacent gear sets and to succes-

sively advance from the gear set corresponding to the computing wheel of highest denomination toward that which corresponds with the computing wheel of lowest denomination, and a series of transfer gears rotatably mounted on said master shaft and so located with respect to said master gear as to respectively connect each of the mutilated gears of said operating sets with the complete gear of the set of next higher denomination.

10. A computing mechanism comprising a series of computing wheels, a series of pairs of operating gears, one pair being connected to each computing wheel and each pair comprising a mutilated gear and a complete gear secured against relative rotation, a series of transfer gears journaled to mesh with said gears, each being of a width sufficient to be in mesh with the mutilated gear connected to one computing wheel and the complete gear connected to the adjacent computing wheel, mechanism for individually rotating said computing wheels, separate supports for said computing wheels and transfer gears, said supports being relatively movable in a longitudinal direction, and means for causing a step by step advance of one of said supports with respect to the other for shifting said series of transfer gears endwise into mesh with the successive pairs of operating gears.

11. A computing device, comprising a series of computing wheels, a series of gear sets for individually operating said computing wheels, each of said gear sets comprising a complete gear and a mutilated gear secured in fixed relation to each other, all of said complete and mutilated gears being mounted in axial alinement with each other, a master shaft journaled in parallel relation to the axis of said gears, a master gear mounted on said shaft and adapted to operate said gear sets individually, means for rotating said master gear for causing relative shifting of said computing wheels and master gear to carry said master gear successively into mesh with different gear sets, the direction of movement being such as to advance the master gear from a wheel of one denomination to the one of next lower denomination, a series of transfer gears mounted to rotate separately on an axis parallel with that of said gear sets, said transfer wheels being arranged in a series on the side of said master gear which is in the direction of the computing wheel of highest denomination, said transfer gears being arranged to connect the successive gear sets which are of higher denomination than that with which said master gear is in mesh and being arranged to connect the mutilated gear of one set with the complete gear of the adjacent set, said transfer gears being mounted in fixed axial positions with respect to said master gear, and means for guiding said transfer gears so as to cause them to pass into mesh with the successive gear sets during each advancing movement.

12. A computing device, comprising a series of computing wheels, a series of gear sets for individually operating said computing wheels, each of said gear sets comprising a complete gear and a mutilated gear secured in fixed relation to each other, all of said complete and mutilated gears being mounted in axial alinement with each other, a master shaft journaled in parallel relation to the axis of said gears, a master gear mounted on said shaft and adapted to operate said gear sets individually, means for rotating said master gear for causing relative shifting of said computing wheels and master gear to carry said master gear successively into mesh with different gear sets, a series of transfer gears mounted to rotate separately on an axis parallel with that of said gear sets and mounted in fixed positions with respect to the plane of rotation of said master gear, said transfer gears being arranged to connect operatively all of said gear sets which are on one side of said master gear, and means for guiding said transfer gears into mesh with said gear sets during said relative shifting, said guiding means comprising an idle gear journaled at one end of the series of gear sets.

13. A computing device, comprising a series of computing wheels, a series of gear sets for individually operating said computing wheels, each of said gear sets comprising a complete gear and a mutilated gear secured in fixed relation to each other, all of said complete and mutilated gears being mounted in axial alinement with each other, a master shaft journaled in parallel relation to the axis of said gears, a master gear mounted on said shaft and adapted to operate said gear sets individually, means for rotating said master gear for causing relative shifting of said computing wheels and master gear to carry said master gear successively into mesh with different gear sets, a series of transfer gears mounted to rotate separately on an axis parallel with that of said gear sets and mounted in fixed positions with respect to the plane of rotation of said master gear, said transfer gears being arranged to connect operatively all of said gear sets which are on one side of said master gear, and means for guiding said transfer gears into mesh with said gear sets during said relative shifting, said guiding means comprising a stationary guide located beyond one end of said series of gear sets and spaced away from the nearest of said gear sets a distance greater than the thickness of said transfer gears, and an idle gear journaled between said fixed guide and the adjacent gear set.

14. In a computing device, the combination of a series of computing wheels, a series of operating gear sets for individually rotating said computing wheels, each of said gear sets comprising a complete gear and a mutilated gear secured in fixed relation to each other, a master mechanism for individually operating said gear sets, a carriage supporting said computing wheels and gear sets and movably mounted with respect to said master mechanism for shifting the same into operative relation with different gear sets, a shaft disposed in parallel relation with the path of said carriage and secured against shifting axially with respect to said master mechanism, a series of transfer gears separately journaled on said shaft each being adapted to simultaneously mesh with the complete gear of one of said operating gear sets and the mutilated gear of the gear set of next lower denomination, and being spaced with respect to each other to correspond with the spacing of said gear sets, said carriage and shaft being arranged to advance said master mechanism and transfer gears with respect to said operating gears through the movement of said carriage.

15. In a computing device, the combination of a series of computing wheel gear sets, individual detent devices for said sets, a master gear arranged to individually operate said gear sets, means for shifting said series of gear sets and master gear relatively to each other to bring said master gear successively into mesh with different gear sets, a series of transfer gears arranged adjacent to said master gear and adapted to operatively connect the adjacent gear sets which correspond to the computing wheels of higher denomination than the one which is in operative connection with said master gear, said transfer gears being secured in fixed axial relation with respect to said master gear, a series of detent devices for individually preventing accidental rotation of said gear sets, movable means arranged in substantially parallel relation to said master and transfer gears and coextensive therewith and adapted to be moved into and out of position for retracting the detent devices which correspond to the gear sets which are in mesh with said master and transfer gears.

16. In a computing device, the combination of a series of computing wheel gear sets, individual detent devices for said sets, a master gear arranged to individually operate said gear sets, means for shifting said series of gear sets and master gear relatively to each other to bring said master gear successively into mesh with different gear sets, a series of transfer gears arranged adjacent to said master gear and adapted to operatively connect the adjacent gear sets which correspond to the computing wheels of higher denomination than the one which is in operative connection with said master gear, said transfer gears being secured in fixed axial relation with respect to said master gear, a series of detent devices for individually preventing accidental rotation of said gear sets, movable means arranged in substantially parallel relation to said master and transfer gears and coextensive therewith and adapted to be moved into and out of position for retracting the detent devices which correspond to the gear sets which are in mesh with said master and transfer gears, and means for automatically shifting said releasing devices through the act of operating said master gear.

17. In a computing device, the combination of a series of computing wheels, a series of gear sets for individually operating said computing wheels, a series of detents arranged in a row and adapted to prevent extensive rotation of the corresponding gear sets, a shaft extending in parallel relation to said series of gear sets and having thereon a master gear, means for shifting said master gear and series of gear sets relatively to each other for bringing said master gear successively into mesh with different gear sets, a series of transfer wheels arranged on said shaft at one side of said master gear, being separately rotatable and adapted to connect the adjacent gear sets which are located at said one side of said master gear, a second shaft parallel with said first shaft and having thereon a shoulder extending longitudinally thereof and coextensive with said master and transfer gears, said shoulder being so placed as to engage the detents which are adjacent thereto and retract said detents from engagement with their respective gear sets through the oscillation of said second shaft, means for rotating said first shaft, and means actuated by said last-named means for oscillating said second shaft.

18. In a machine of the class described, the combination of a frame, a carriage mounted to travel along said frame, a computing mechanism mounted in a relatively fixed position on said carriage, a second computing mechanism comprising a plurality of independent computing devices mounted in fixed relation to each other on said carriage, mechanism adapted to cause said second computing device to travel with said carriage in one direction, and mechanism for holding said second computing device stationary during the return movement of said carriage.

19. In a device of the class described, the combination of a frame, a carriage movable along said frame, a pair of computing de-

vices mounted on said carriage, one being relatively fixed and the other being arranged to move along said carriage, said other computing device comprising a plurality of independent sets of computing wheels, a pair of master mechanisms mounted in said frame and spaced apart for simultaneously actuating said computing devices, means for simultaneously actuating said master mechanisms, an escapement mechanism adapted to cause a step by step advance of said carriage through successive operations of said master mechanisms, a ratchet mechanism connecting said second computing device with said carriage and adapted to normally secure said second computing device to the carriage during the movement of the carriage in one direction and adapted to permit said second computing device to remain stationary during the reverse movement of the carriage, a second ratchet mechanism acting between said second computing device and said frame and adapted to prevent the return movement of said second computing device with the carriage, said ratchet mechanisms being arranged to cause a step by step advance of said second computing device on said carriage during repeated forward and backward movements of said carriage, said last mentioned step by step advance being such as to bring said plurality of sets of computing wheels successively into position for operative engagement with said master mechanism.

20. In a device of the class described, the combination of a frame, a carriage movable along said frame, a pair of computing devices mounted on said carriage, one being relatively fixed and the other being arranged to move along said carriage, said other computing device comprising a plurality of independent sets of computing wheels, a pair of master mechanisms mounted in said frame and spaced apart for simultaneously actuating said computing devices, means for simultaneously actuating said master mechanisms, an escapement mechanism adapted to cause a step by step advance of said carriage through successive operations of said master mechanisms, a ratchet mechanism connecting said second computing device with said carriage and adapted to normally secure said second computing device to the carriage during the movement of the carriage in one direction and adapted to permit said second computing device to remain stationary during the reverse movement of the carriage, a second ratchet mechanism acting between said second computing device and said frame and adapted to prevent the return movement of said second computing device with the carriage, said ratchet mechanisms being arranged to cause a step by step advance of said second computing device on said carriage during repeated forward and backward movements of said carriage, said last mentioned step by step advance being such as to bring said plurality of sets of computing wheels successively into position for operative engagement with said master mechanism, and means for releasing said ratchet mechanisms to permit said second computing device to be freely shifted on said carriage.

21. In a device of the class described, the combination of a master mechanism, a carriage mounted to travel past said master mechanism, a computing device mounted on said carriage and comprising a plurality of independent sets of computing wheels secured in fixed position with respect to each other, a spring normally urging said computing device toward one end of said carriage, ratchet mechanism connecting said computing device and carriage and adapted to permit a step by step advance of said computing device on said carriage against the action of said spring and ratchet mechanism acting between said computing device and frame and adapted to hold said computing device stationary during the return movements of said carriage, said ratchet mechanisms being so arranged as to cause the step by step advance of said computing device on said carriage to correspond with the spaces between computing wheels of corresponding denomination of different sets of computing wheels.

22. In a device of the class described, the combination of a frame, a carriage movable along said frame, a pair of computing devices mounted to travel along the path of said carriage, one being relatively fixed with respect to said carriage, and the other being arranged to move along said carriage, said other computing device comprising a plurality of independent sets of computing wheels, a pair of master mechanisms mounted in said frame and spaced apart for simultaneously actuating said computing devices, means for simultaneously actuating said master mechanisms, an escapement mechanism adapted to cause a step by step advance of said carriage through successive operations of said master mechanisms, a ratchet mechanism connecting said second computing device to the carriage and adapted to normally secure said second computing device to the carriage during the movement of the carriage in one direction and adapted to permit said second computing device to remain stationary during the reverse movement of the carriage, a second ratchet mechanism acting between said second computing device and said frame and adapted to prevent the return movement of said second computing device with the carriage, said ratchet mechanisms being ar-

ranged to cause a step by step advance of said second computing device along said carriage during repeated forward and backward movements of said carriage, said last mentioned step by step advance being such as to bring said plurality of sets of computing wheels successively into position for operative engagement with said master mechanism.

23. In a computing device, the combination of a series of computing wheels separately journaled on a common axis, a series of operating gears journaled on a parallel axis and geared respectively to individual computing wheels, a shaft carrying said operating gears, supports for said shaft pivotally mounted to swing about the axis of said computing wheels, a master mechanism for operating said operating gears, and means for shifting said shaft to move said operating gears into and out of position for engagement with said master mechanism.

24. In a computing device, the combination of a master operating element, a series of computing wheels movable relatively to said master element for causing the individual operation of different wheels, a shaft for actuating said master element, a pinion on said shaft, a reciprocating member, a pair of racks carried by said member and adapted to mesh with respectively opposite sides of said pinion, guiding-means adapted to normally hold both of said racks out of mesh with said pinion, a key for moving said member, and means actuated by said key and adapted to carry one of said racks into mesh with said pinion during a certain initial part of the stroke of said key.

25. In a computing device, the combination of a master operating element, a series of computing wheels movable relatively to said master element for causing the individual operation of different wheels, a shaft for actuating said master element, a pinion on said shaft, a reciprocating member, a pair of racks carried by said member and adapted to mesh with respectively opposite sides of said pinion, guiding-means adapted to normally hold both of said racks out of mesh with said pinion, a key for moving said member, and means actuated by said key and adapted to carry one of said racks into mesh with said pinion during a certain initial part of the stroke of said key, said guiding means being shiftable to opposite positions for causing the engagement of either of said racks with said pinion at the will of the operator.

26. In a computing device, the combination of a master operating element, a series of computing wheels movable relatively to said master element for causing the individual operation of different wheels, a shaft for actuating said master element, a pinion on said shaft, a reciprocating member, a pair of racks carried by said member and adapted to mesh with respectively opposite sides of said pinion, means normally urging said bar to an intermediate position, with both racks clear of said pinion, a guide controlling the movement of said bar, a pair of guiding-elements movably mounted on said guide and respectively adapted for shifting said bar in opposite directions, said guiding elements being spaced apart so that but one of them can engage said bar at a time, a key-lever controlling the movement of said bar, and means actuated by said key-lever and adapted to operate each of said guiding elements for shifting the respective rack on said bar into mesh with said pinion during a certain initial part of the stroke of said key-lever.

27. In a computing device, the combination of a master operating element, a series of computing wheels movable relatively to said master element for causing the individual operation of different wheels, a shaft for actuating said master element, a pinion on said shaft, a reciprocating member, a pair of racks carried by said member and adapted to mesh with respectively opposite sides of said pinion, means normally urging said bar to an intermediate position with both racks clear of said pinion, a guide controlling the movement of said bar, a pair of cams journaled on said guide at respectively opposite sides of said rack and adapted to shift said rack bar in opposite directions when in operative relation therewith, said cams being spaced apart so that but one at a time may engage said bar, gears respectively secured in axial alinement with said cams, a second rack bar slidably mounted on said guide and having thereon two sets of rack teeth respectively located to mesh with the teeth of said gears, and a key-lever operatively related to both of said rack bars for causing them to reciprocate.

28. In a computing device, the combination of a master operating element, a series of computing wheels movable relatively to said master element for causing the individual operation of different wheels, a shaft for actuating said master element, a pinion on said shaft, a reciprocating member, a pair of racks carried by said member and adapted to mesh with respectively opposite sides of said pinion, means normally urging said bar to an intermediate position with both racks clear of said pinion, a guide controlling the movement of said bar, a pair of cams journaled on said guide at respectively opposite sides of said rack and adapted to shift said rack bar in opposite directions when in operative relation therewith, said cams being spaced apart so that but one at a time may engage said bar, gears respectively

secured in axial alinement with said cams, a second rack bar slidably mounted on said guide and having thereon two sets of rack teeth respectively located to mesh with the teeth of said gears, and a key-lever operatively related to both of said rack bars for causing them to reciprocate, said gears being mutilated, and means on said first rack adapted to co-act with said cams for tilting said mutilated gears into position for meshing with the teeth on said second rack.

29. In a computing device combined with a typewriting machine, the combination with a type-writer carriage, of two master-wheels, a shaft upon which they are mounted, means for rotating the master-wheels, two computing devices or heads associated with said master-wheels, a second carriage upon which said computing heads are mounted, and means for moving said second carriage step-by-step concomitantly with the first carriage; each computing device comprising two independent computing heads.

30. In a computing device combined with a typewriting machine, the combination with a typewriter carriage, of two master-wheels, a shaft upon which they are mounted, means for rotating the master-wheels, two computing devices associated with said master-wheels, a second carriage upon which said computing heads are mounted, means independent of the first carriage for moving said second carriage step-by-step concomitantly with the first carriage; each computing device comprising two independent computing heads; and means for moving one of said computing heads relatively to the other.

31. In a computing device, the combination with a master-wheel, of a computing head comprising a series of computing wheels, and an individual gear train for rotating each of said computing wheels, each train comprising a gear secured directly to the computing wheel, and also comprising a gear meshing with the first gear and also constructed to mesh with the master-wheel, a single tooth secured upon the side of each gear, and a series of transfer gears of such width as to simultaneously mesh with said single tooth and with the complete gear of the set of next higher denomination.

32. In a combined typewriting and adding machine, the combination with a master wheel and type-operating keys, of two racks 64 and 71, the keys operating the rack 71 ahead of the rack 64, to cause the latter to turn the master-wheel in either one direction or the other, substantially as set forth.

33. The combination with a typewriting machine including numeral type keys and also including a carriage, letter-feeding or spacing mechanism therefor, a second carriage, separate spacing mechanism therefor controlled by said numeral keys, a plurality of adding heads on said second carriage, and master-wheels mounted on the framework of the machine and controlled by said numeral keys.

34. The combination of a system of computing wheels, each provided with a mutilated tens-carrying gear or tooth, a master wheel, means for effecting step-by-step movements between said master-wheel and said computing wheels, and a set of transfer pinions each of a width to extend from the mutilated gear of one computing wheel to the next computing wheel to couple them together, the number of transfer pinions being sufficient to enable tens to be carried concomitantly throughout the system of computing wheels, and said transfer pinions being loose on said master wheel shaft and held so that they travel with said master wheel in respect to the step-by-step movements aforesaid.

35. The combination of a plurality of systems or sets of computing wheels, a plurality of master wheels, a single shaft for all said master wheels, each computing wheel provided with a tens-carrying tooth or mutilated gear, and each master-wheel provided with a loosely-mounted set of coupling or transfer pinions on said shaft to connect the mutilated gears with the higher computing wheels, and means for effecting relative step-by-step movements between said computing wheels and said master-wheels and coupling pinions.

36. The combination with a system of computing wheels, tens-carrying mutilated gears therefor, and a master wheel, of a set of coupling pinions, means for effecting relative step-by-step movements between the computing wheels with their mutilated gears and said master-wheel and pinions, a lock for the unoccupied coupling pinions, and a supernumerary wheel at the left of the computing wheels, engageable by the master-wheel, and having a movable detent to hold it alined.

37. In a computing machine, the combination with numeral keys, a carriage and key-controlled means for effecting step-by-step movements thereof, of a plurality of jumping totalizers, movable on said carriage, a single master wheel for operating said totalizers, means for moving said totalizers automatically and simultaneously on said carriage to bring them successively into engagement with said master wheel, a second totalizer, a master wheel therefor, said second totalizer being fixed on said carriage, so that said totalizer is operated repeatedly as each jumping totalizer is operated, and mechanism extending from said keys to said master wheels to enable the operation of said wheels by said keys,

38. In a computing machine, the combination with a totalizer and a master-wheel arranged to engage computing wheels *seriatim* in said totalizer, of carry-over devices for said computing wheels, carry-over pinions loose on the shaft of said master wheel and driven by said carry-over devices, said carry-over devices being temporarily coupled by said pinions to computing wheels of higher denominations, means for alining said carry-over pinions comprising an idle guiding wheel, a detent holding said idle guiding wheel alined, and means for moving said detent free of its guiding wheel at the operation of a numeral key.

39. In a computing machine, the combination with a totalizer and a master-wheel arranged to engage computing wheels *seriatim* in said totalizer, of carry-over gears for said computing wheels, carry-over pinions, a fixed bar for holding said pinions against rotation to the left of the highest of said computing wheels, an idle wheel for holding the pinion engaged by said highest computing wheel, and a detent for holding said idle wheel alined.

40. In a computing machine, the combination with a totalizer and a master-wheel arranged to engage computing wheels *seriatim* in said totalizer, of carry-over gears for said computing wheels and arranged to be turned by said master-wheel to drive said computing wheels, carry-over pinions arranged to successively engage said gears, and means for holding said pinions alined when not engaged with carry-over gears, said alining means being arranged to permit said master-wheel to turn if engaged therewith.

41. In a computing machine, the combination with a traveling carriage, of a totalizer shiftable thereon, shoulders on said carriage whereby said totalizer may be locked to travel with said carriage, shoulders on the frame of the machine against which said totalizer may be locked, pawls linked together to engage said shoulders to control the movement of said totalizer, and an abutment on the frame of the machine to control said pawls.

42. In a computing machine, the combination with a traveling carriage, of a totalizer shiftable thereon comprising two computing heads, shoulders on said carriage spaced to conform to the distance between unit wheels in said computing heads, shoulders on the frame of the machine against which said totalizer may be locked, pawls linked together to engage said shoulders to control the movement of said totalizer, and an abutment on the frame of the machine to control said pawls.

43. In a computing machine, the combination with a numeral key, of a rack bar moved by each depression of said key, a pinion normally out of mesh with said rack bar, means for bringing said rack bar and said pinion into mesh by the depression of a numeral key, means for rotating said pinion by said rack bar by the further depression of said key, and means for carrying said rack bar and said pinion out of mesh by the still further depression of a numeral key.

44. In a computing machine, the combination with a numeral key and two rack bars moved during the depression of said key, of a pinion normally out of mesh with said rack bars, means settable to selectively cause said pinion to come into mesh with one of said rack bars by the depression of said key, and means for moving said pinion and said rack bar out of mesh by the further depression of said key.

45. In a computing machine, the combination with a numeral key and a double rack bar, of means operated by said numeral key for determining how far said rack bar shall move, a pinion normally out of mesh with said rack bars, means settable for selectively bringing into mesh said pinion and one of said rack bars, and means for moving said pinion and rack bar out of mesh when said rack bar has finished the determined turning of said pinion.

46. In a computing machine, the combination with a numeral key and a rack bar moved with each depression of said key, of a pinion normally out of mesh with said rack bar, a cam rotatable by said rack bar to move it into mesh with said pinion with each depression of said key so that said pinion is turned by the depression of said key, and means for moving said rack bar and pinion out of mesh by the further depression of a key.

47. In a computing machine, the combination with a numeral key and a double rack bar moving with each depression of said key, of a pinion normally out of mesh with both of said rack bars, cams selectively rotatable by the depression of said key for bringing one of said rack bars into mesh with said pinion, and means for moving said rack bar and pinion out of mesh by the later depression of a numeral key.

48. In a computing machine, the combination with numeral keys and a master wheel, of a pinion for turning said master wheel, a pair of racks normally out of mesh with said pinion, a universal member moved by the operation of any numeral key for bringing said pinion into mesh with one or the other of said racks, a universal member operated later by said numeral keys for moving said racks to turn said pinion, and means settable to determine which rack shall mesh with said pinion.

49. In a combined typewriting and com-

puting machine, the combination with numeral keys and a master wheel, of a pinion for turning said master wheel, racks normally out of mesh with said pinion, a universal member for bringing one of said racks into mesh with said pinion, means settable to determine which of said racks shall so mesh, a universal member for moving said racks, and means for moving the rack meshing with the pinion out of mesh when the master wheel has been turned.

50. In a computing machine, the combination with numeral keys and a master wheel, of a pinion connected to said master wheel, a rack moving with the depression of a numeral key for turning said pinion, a universal bar operated by each numeral key for bringing said pinion into mesh with said rack and for bringing it out of mesh, and a detent for positively arresting said master wheel when it is completely turned by said rack operated by the same universal bar as the rack.

51. In a computing machine, the combination with numeral keys and a master wheel, of a universal member moved to various extents by the numeral keys operated, a rack moved by said universal bar, a pinion normally out of mesh with said rack, a universal bar for bringing said pinion into mesh with said rack before said rack is moved by said first-named universal bar, means for moving said pinion and rack out of mesh by said second-named universal bar, and a lock for arresting said master wheel operated by said second universal bar.

52. In a computing machine, the combination with a numeral key and computing wheels, of a double rack bar moved by said numeral key to determine how far a computing wheel shall turn, a pinion normally out of mesh with said rack bar, means for effecting an engagement between said pinion and one of the rack bars on the depression of a numeral key, and a subtraction bar settable to cause said pinion to become engaged with the other rack bar on the depression of said key.

53. In a computing machine, the combination with a computing wheel, of a pinion for turning said wheel, a double rack bar normally out of mesh with said pinion, means for moving said rack bars to selectively bring them into mesh with said pinion, to perform either addition or subtraction, and means for moving said rack bars to bring each out of mesh with said pinion at the end of its stroke.

54. In a computing machine, the combination with a reciprocating rack bar and a pinion, of two racks on said rack bar normally out of mesh with said pinion, numeral keys, means for moving said rack bar to an extent depending on the numeral key depressed, a second rack bar operated by the depression of each key, means for moving said double rack bar into mesh by movement of said second rack bar, and means for selectively determining which of the double racks shall mesh with said pinion.

55. In a computing machine, the combination with a numeral key and a rack bar, of means whereby said numeral key determines how far said rack bar shall move, a pinion normally out of mesh with said rack bar, a rotatable cam for moving said rack bar into mesh with said pinion, and a second rack bar for rotating said cam to positively move said first rack bar into mesh with said pinion.

56. In a computing machine, the combination with a numeral key and a double rack bar, of means operated by said numeral key for determining how far said rack bar shall move, a computing pinion normally out of mesh with said rack bars, means settable for selectively bringing into mesh said pinion and one of said rack bars, and means for moving said pinion and rack bar out of mesh when said rack bar has finished the determined turning of said pinion.

57. In a computing machine, the combination with a numeral key and a double rack bar, of means operated by said numeral key for determining how far said rack bar shall move, a computing pinion lying between said rack bars and normally out of mesh with both of them, means settable for selectively bringing into mesh said pinion and one of said rack bars, means for moving said pinion and rack bar out of mesh when said rack bar has finished the determined turning of said pinion, and means for returning said double rack bar to its normal position when so out of mesh.

58. A computing typewriter combining numeral keys, a master wheel, connections between the keys and master wheel comprising a pinion and a pair of toothed members oppositely disposed with respect to the pinion, and normally disconnected therefrom, numeral key operated means for effecting relative movement between pinion and members in the plane of the pinion, to mesh the pinion with either of said members, numeral key-operated means for effecting relative driving movement between member and pinion to transmit motion from said key to the master wheel, and means adjustable for determining the member selected.

59. A computing typewriter combining numeral keys, digit wheels, means for rotating said wheels, connections between said keys and said means comprising a pinion and a pair of racks oppositely disposed with respect to the pinion, and both normally disconnected therefrom, means for effecting a mesh between the pinion and either of said

racks, means settable for determining the rack selected, and means for effecting a relative driving movement between rack and pinion to rotate said digit wheels.

60. A computing machine combining numeral keys, a totalizer, a master wheel associated with said totalizer and operated from the numeral keys, means providing relative traverse of master wheel and totalizer, the master wheel being beyond the range of said totalizer at times, and a detent device mounted to engage said master wheel to prevent accidental rotation thereof when out of range of said totalizer; said detent device connected to maintain its location with relation to said totalizer, but permitting the operation of the master wheel at the strokes of the numeral keys.

61. A computing machine combining numeral keys, a totalizer, a master wheel associated with said totalizer and operated from the numeral keys, means providing relative traverse of master wheel and totalizer, the master wheel being beyond the range of said totalizer at times, a detent device mounted to engage said master wheel to prevent accidental rotation thereof when out of range of said totalizer; said detent device connected to maintain its location with relation to said totalizer, and mechanism universal to said numeral keys to enable any thereof to release said detent.

62. A computing machine combining a totalizer carrying from right to left, a master wheel associated therewith, means providing relative traverse between master wheel and totalizer, a carry-over device with the master wheel and extending to the left thereof, means for preventing relative axial movement of master wheel and carry-over device whereby when the master wheel is opposite the highest order of the totalizer the carry-over device extends to the left of the totalizer, a guide fixed relatively to the totalizer and extending to the left thereof to prevent rotation of the carry-over elements prior to their engagement with the totalizer wheels, and a master-wheel detent device between said fixed guide and said totalizer, permitting the master-wheel to be rotated at the numeral key operation out of the adding zone.

63. A computing typewriter combining numeral keys, a typewriter carriage providing relative traverse of keys and platen, a master wheel, a computing carriage, a totalizer mounted thereon for traverse past said master wheel, a second master wheel, a plurality of totalizers mounted on said computing carriage for successive traverse past said second master wheel at successive traverses of said computing carriage, said plurality being shiftable relatively to said computing carriage, means for locking the computing carriage and said plurality together when the master wheels are in operative relation to the respective totalizers, and means to lock said plurality against return with the computing carriage, thereby to effect relative repositioning of said plurality and said computing carriage.

64. A computing machine combining numeral keys, a plurality of column totalizers, a single master wheel for coöperating with said totalizers successively, a line totalizer, a master wheel therefor, said master wheels operating in unison, all of said totalizers moving relatively to the master wheels, means for returning the line totalizer after each item, and means for automatically returning the column totalizers with the line totalizer only after a predetermined plurality of operations of the line totalizer.

65. A computing typewriter combining numeral keys, a typewriter carriage providing relative traverse of keys and platen, a master wheel, a computing carriage, a totalizer device mounted thereon for traverse past said master wheel, a second master wheel, a second totalizer device mounted upon said computer carriage for traverse past said second master wheel, means for locking the computing carriage and second totalizer device together when the master wheels are in operative relation to the respective totalizers, means adapted to lock the second totalizing device against return with the computing carriage, and means for releasing the last-named means automatically after the second totalizer device has reached the normal limit of its travel.

66. A computing typewriter combining a typewriter carriage, typewriting numeral keys, numeral-key-controlled means for feeding said carriage step by step, a computing carriage, additional numeral-key-controlled means for feeding said computing carriage step by step, three totalizers, means connecting said totalizers to the computing carriage and to the numeral keys to add on two of said totalizers items written successively by said keys on two columns of the work-sheet at successive traverses of the computing carriage, and to show on the third totalizer cross-addition of the numbers carried into the first two totalizers; said connecting means including means for shifting the connection between said computing carriage and two of said totalizers, to bring said two totalizers alternatively into the computing zone.

67. A computing machine combining a carriage, a cross totalizer connected thereto, a series of column totalizers, means to connect said column totalizers releasably to said carriage, means for effecting step-by-step feeding movements of said carriage; said carriage being returnable independ-

ently of the column totalizers in the operation of returning the cross-totalizer, and means to re-connect the carriage to the column totalizer to continue the step-by-step advance of the latter at the succeeding step-by-step advance of the cross-totalizer.

68. In a computing machine, the combination with a series of numeral keys and computing wheels, of a master wheel for turning said computing wheels *seriatim* in a manner determined by said numeral key, a rack bar operated at each depression of any of said keys, a pinion normally out of mesh with said rack bar and connected to turn said master wheel, means for bringing said pinion and rack bar into mesh, means for turning said pinion variable distances by said rack bar according to the key depressed, and means for subsequently unmeshing said pinion from said rack bar, said meshing, turning and unmeshing means being connected to operate during the depression of any numeral key.

69. In a computing machine, the combination with a numeral key and computing wheels, of a master wheel for turning said computing wheels *seriatim* as determined by said numeral key, a double rack bar moved with each depression of said key, a pinion normally out of mesh with said rack bars and connected to turn said master wheel, means capable of meshing either of said rack bars with said pinion to determine which way said pinion shall turn, means for turning said pinion by the engaged rack bar, means for unmeshing the engaged rack bar and pinion, said meshing, turning and unmeshing means being connected to operate at the operation of the numeral key, and adjustable means for determining which rack bar shall be meshed with said pinion at the operation of the numeral key.

70. A computing machine combining numeral keys, a plurality of master wheels, a plurality of totalizing devices, a carriage providing relative traverse of a master wheel and the first of said totalizing devices, the second totalizing device being movable simultaneously with or independently of said carriage to secure relative traverse between a second master wheel and said second totalizing device, and means automatically effective for selectively preventing or permitting the return of the second totalizing device simultaneously with the return of said carriage.

71. A computing machine combining numeral keys, a plurality of master wheels, a plurality of totalizing devices, a carriage providing relative traverse of a master wheel and the first of said totalizing devices, the second of said totalizing devices being movable simultaneously with or independently of the carriage, to secure relative traverse of a second master wheel and the second totalizing device, means for causing the relative traverse of both master wheels and their respective totalizing devices in unison during computation, and automatic means for preventing the return of the carriage after certain traverses of the second totalizing device, and for causing the return of said second totalizing device after other traverses thereof.

72. A computing machine combining a key-controlled carriage, a plurality of connected totalizers shiftable relatively to said carriage, a single master wheel for said totalizers and automatic means to effect the relative shifting and connecting up of said totalizers to said carriage to coöperate therewith at different points in the length of said carriage to bring either totalizer to the same computing zone, said means comprising a single pawl and rack for said plurality.

73. In a computing machine, the combination with computing wheels and numeral keys, of a master wheel for rotating said computing wheels *seriatim*, each to an extent determined by the numeral key operated, means normally disconnected from said keys for rotating said master wheel, means dependent upon the operation of any numeral key for connecting said key to the master wheel, means effective during the initial stroke of the numeral key for breaking the connection between the key and the master wheel after the master wheel is rotated, and a lock brought into action by any key for locking the disconnected master wheel against overthrow; said keys being effective to turn said master wheel variable distances.

74. In a computing machine, the combination with computing wheels and numeral keys, of a master wheel for rotating said computing wheels *seriatim*, each to an extent determined by the numeral key operated, means normally disconnected from the keys for rotating the master wheel, means dependent upon the operation of any numeral key for connecting it to the master wheel, means for breaking such connection during the initial stroke of the numeral key, a lock operable by any numeral key for locking the disconnected master wheel against overthrow, a detent for holding each computing wheel against accidental movement, and means movable by any numeral key for releasing said detent.

75. A computing typewriter combining a typewriter carriage providing relative traverse of keys and platen, a totalizer comprising digit wheels, a master wheel, a computing carriage providing relative traverse of totalizer and master wheel and adapted for movement independently of the type-

writer carriage, means for locking said computing carriage with the master wheel out of engagement with the digit wheels, means tending to position said computing carriage, and a finger-piece for releasing said locking means to permit the computing carriage to be automatically positioned for computation, the computing carriage thereafter advancing with each letter-spacing of the typewriter carriage until computation is effected.

Signed at Chicago this 8th day of May, 1909.

CHARLES H. GILL.

Witnesses:
EUGENE A. RUMMLER,
NETTIE M. PIERCE.