W. J. CRUMPTON.

REGISTER.

APPLICATION FILED OCT. 31, 1913. RENEWED DEC. 26, 1919.

1,349,049. **Patented Aug. 10, 1920.**

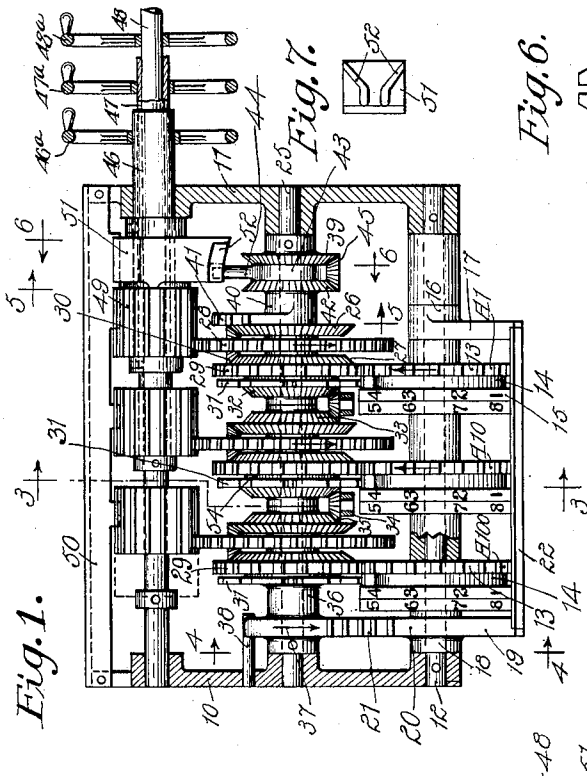


Fig. 1.

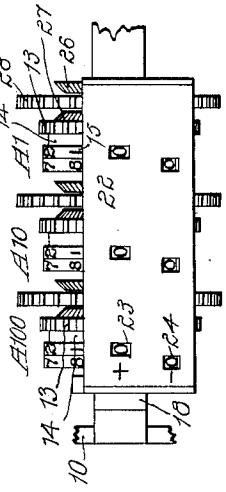


Fig. 2.

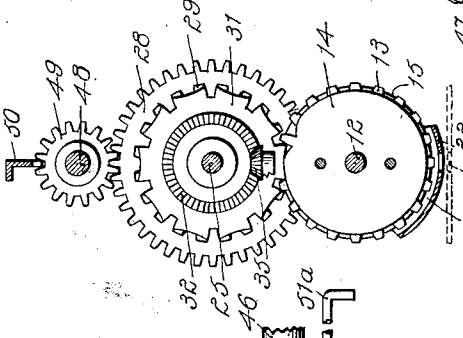


Fig. 3.

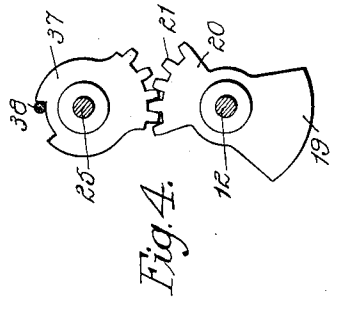


Fig. 4.

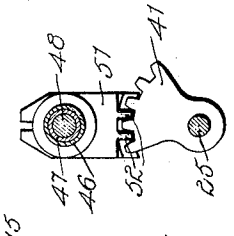


Fig. 5.

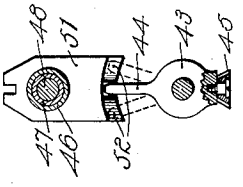


Fig. 6.

Fig. 7.

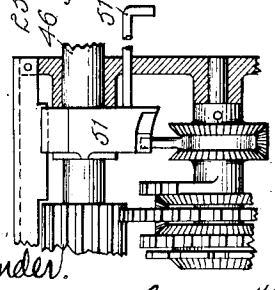


Fig. 8.

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UNITED STATES PATENT OFFICE.

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REGISTER.

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To all whom it may concern:

Be it known that I, WILLIAM J. CRUMPTON, a citizen of the United States, residing at Evanston, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Registers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to registers or totalizers, particularly registers or totalizers capable of algebraic summation, and its object is to provide a simplified and generally improved mechanism of this class. The specific register hereinafter described and subsequently claimed is adaptable for association with calculating machines and systems and calculating machine attachments for billing machines, typewriters, etc.

Broadly, the register of my invention comprises a plurality of figure wheels, each having two sets of figures thereon running in opposite directions, and mechanism for moving the units figure wheel at the proper times to cause the indicated resultant to be true and final.

These and other features of my invention are illustrated in the drawings, in which—

Figure 1 is a plan view of a register of my invention, a part of the supporting frame thereof being shown in section;

Fig. 2 is a front view thereof;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 1;

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 1;

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 1;

Fig. 7 is an isolated end view of one of the parts provided for carrying into the units order, as will be hereinafter explained; and

Fig. 8 is a fragmentary view, similar to Fig. 1, of a modified form of register.

The register illustrated in Figs. 1 to 7, inclusive, comprises side walls 10 and 11 in which is pinned a shaft 12 arranged to carry the order indicating sets A′, A^{10}, A^{100}. Each one of the order sets comprises a spur gear 13, a carrying gear 14 and a numeral wheel 15, the numeral wheel having two sets of figures thereon running in opposite directions. The members of each set are secured together and are rotatably mounted upon shaft 12. At the right end of shaft 12 is mounted a hub 16, from which a segment plate 17 extends forwardly. At the left end of the shaft is mounted a hub 18, from which the segment plate 19 extends forwardly, and which has the rear segmental extension 20 provided with gear teeth 21. Suitable spacing collars separate the hub 16 from plate 11, and the numeral wheels from said hubs and from each other, as shown. The segmental plates 17 and 19 carry at their forward edges the shutter 22, having a positive set of sight openings 23 and a negative set of sight openings 24. On a shaft 25, journaled in plates 10 and 11, are as many sets of driving and carry-over mechanism as are necessary, the number of said sets being determined by the number of order sets.

Each set of driving and carry-over mechanisms comprises a differential gear 26 loosely mounted upon the shaft 25, a companion differential gear 27 also loosely mounted on the shaft, an order driving wheel 28 located between the gears 26 and 27, an intermediate transmission gear 29 fixed relatively to the differential gear 27, and a differential pinion 30 pivoted in an opening through the gear 28 and engaging with the differential gears 26 and 27. Each driving and carry-over set also comprises a loosely mounted female Geneva carry-over and locking gear 31 which alternately locks against and meshes with the male Geneva carrying gear 14 of the corresponding order set. Disposed adjacent and fixed relatively to each one of the Geneva gears 31, except the one for the highest order, is a bevel gear 32 forming part of the carry-over train. Fixed relatively to each one of the bevel gears 26, except the one associated with the carry-over set of lowest order, is a differential gear 33, which forms a mate for the gear 32 of the preceding sets.

Supported from the frame of the register are suitable bearings 34, each of which journals a pinion 35 engaging the adjacent bevel gears 32 and 33. There can, of course, be any number of order sets and driving and carry-over sets.

Fixed relatively to the Geneva gear 31, co-acting with the carrying gear 14 of the highest order set, is a hub 36 which is formed integral therewith and a gear plate 37 provided with teeth meshing with the teeth of the segment 20. The hub 36 is pinned to shaft 25, as shown. A pin 38, carried by plate 10, limits the movement of gear plate 37 in either direction. Located at the right end of shaft 25, and having a hub pinned to the shaft, is a differential gear 39. As shown, the gear 26 of the units carry-over set is provided with an integral hub 40, having a rearwardly extending gear sector 41 and a companion gear 42 for the differential gear 39, the sector 41 and gear 42 being preferably formed integral with the hub 40. Loosely mounted on shaft 25, between gears 39 and 42, is a plate 43 having a rearwardly extending arm 44 and a pinion 45 pivoted thereto on the forward edge thereof, said pinion meshing with gears 39 and 42.

Rotatably supported by the register framework are the quill shafts 46 and 47 and the shaft 48, each one of which has rigidly secured thereto a gear 49 meshing with one of the driving gears 28. Supported by plates 10 and 11 is an aliner bar 50 which, when gears 49 are in the positions shown, prevents rotation of the same. In practice the shafts 46, 47 and 48 are so related to the keys of a typewriter or calculating machine, that normally the gears 49 are in the positions shown, but when the shafts are operated to drive said gears the shafts are shifted to the left to positions such that gears 49 still mesh with their corresponding gears 28 but clear the aliner bar 50. After the required amount of rotation of the shafts 46, 47 and 48 has been effected they are returned to their initial positions by suitable mechanism.

As shown in Fig. 1, I have provided wheels, 46^a, 47^a and 48^a, having hand pieces and secured by means of screws or other instrumentalities to the shafts 46, 47 and 48 respectively in order that they may be moved to actuate the register order sets. The wheels 46^a, 47^a and 48^a are mounted on the several shafts so that the shafts may be rotated or shifted to the right or left as desired. By grasping the hand pieces carried by the wheels and imparting rotating movement thereto any desired number may be set up in the order indicating sets. In order to set up a number for an operation in subtraction, the hand pieces are grasped and rotated in a clockwise direction, while in an operation for addition, the wheels are given a counter-clockwise direction of rotation. It will be understood that any one of the gears driving the register order sets may be operated independently by its associated hand wheel, and that these gears which are secured to the quill shafts 46 and 47 and the shaft 48 may be brought into engagement with the aliner bar 50 to prevent rotation by imparting a longitudinal movement to the hand wheels, this shifting movement of the shafts being necessary in order that the resultant indicated may be true and final when the operation performed on the machine is such as to require the additional one step movement to the units order.

Loosely mounted on quill shaft 46 is a member 51 which is provided with a slot at all times in engagement with the aliner bar. The member 51, at its forward end, is provided with cams 52 which diverge toward the plate 11. As shown in Fig. 6, the arm 44 of plate 43 projects between these cams. Suitable spacing washers 54 are disposed between the gears 29 and 31 of each driving and carry-over set.

While my mechanism is, of course, adapted to have both arithmetical and algebraic operations performed thereon, I shall merely describe the operation when a number is to be subtracted from a smaller number. Suppose we have "87" set up on the register and that "94" is to be subtracted therefrom. The actuating mechanism is now operated so that the driving gears will be rotated in the direction indicated by the arrows. When the shafts 46, 47 and 48 are shifted to the left, the cams 52 of the plate 51, which cams also serve as teeth, are brought into mesh with gear sector 41. To solve the problem mentioned, the units driving gear will be rotated 4/20ths of a revolution, resulting in 4/10ths revolution of the units order members in the reverse direction. The tens driving gear will be rotated 9/20ths of a revolution, resulting in 9/10ths of a revolution, in the reverse direction, of the tens order members. The previous indication on the tens numeral wheel was "8" and, therefore, after 9/10ths rotation in the reverse direction the zero line is passed through. The rotation of the tens carrying gear through the zero line being in the reverse direction, and the carrying tooth on said gear being just about to mesh with the tens carry-over gear, as shown in Fig. 3, the tens carry-over gear 31 will be given 1/10th of a revolution in the reverse direction, and this 1/10th revolution is transmitted through the tens transmission bevel gears to the hundreds differential gear, and the hundreds gear 29 is given 1/10th revolution in the same direction as that of the tens carry-over gear 31 through the hundreds differential gear. The rotation of the hundreds gear 29 is transmitted through the hundreds order gear 13 and carrying gear 14 to the hundreds carry-over gear 31, and the rotation is then transmitted from the plate 37, fixed relatively to gear 31, to the shutter plate 20. The various directions of rotation of the gears just traced through

are indicated by the arrows, the shutter being rotated upwardly so that the negative sight openings will come into the line of sight at L. S. (Fig. 3). The shaft 25 is turned at the same time, the rotation of shaft 25 being transmitted to special bevel gear 39, and a 1/10th revolution will be transmitted in the reverse direction through the pinion 45 to the bevel gear 42. When the register is being operated the cams of the member 51 are, of course, in mesh with the teeth of the gear sector 41, as shown in Fig. 5. Thus, when the gear 39 is rotated, the companion gear 42 is held and the pinion meshing with said gears rolls on gear 42, thus moving the arm 44 of the plate 43 into alinement with one of the cams 52. The necessary amount of actuation of the shafts 46, 47 and 48 having now taken place, the shafts are drawn to the right to initial position, thus unlocking gear 42. On account of the shape of the cams 52, the arm 44 of plate 43 is, upon this shifting movement, swung to normal position, the pinion 45 rolling this time on gear 39 and driving gear 42 enough to effect the one-step advancement of the units numeral wheel and leaving the final indication at the sight openings "—007". If this unit had not been driven into the units numeral wheel, the closed cycle of carrying would not have been completed and the indication would have been "—006", but after this unit has so been driven in, the final reading is "—007", which is the true algebraic result of the problem performed, namely the subtraction of "94" from "87".

In the arrangement shown in Fig. 8, the position of the member 51 upon the quill shaft 46 is determined by manipulating a rod 51[a]. This arrangement permits moving the member 51 to the right or left without moving the quill shafts 46 and 47 and the shaft 48 to produce such transitory movement. The member 51 should always be in its extreme position to the right whenever a reading of the register is taken so that the indicated resultant will be true and final, but this member does not necessarily have to be shifted to its extreme position to the right after each entry but only as pointed out above when the indication on the register is to be made a matter of record. The member 51, however, should be moved into its extreme left position when the ordinal wheels are receiving a regular entry. If the member 51 is in its extreme left position so as to engage the gear sector 41 when the regular entry is being made, the closed cycle of carrying is delayed and is completed only upon the member 51 being moved to its extreme right position, as heretofore explained.

The register of my invention is, therefore, capable of carrying from first to last and last to first in an endless chain of carrying operations. The shiftable shutter with which the register is provided is shifted to disclose the proper figures to be read every time the resultant passes through zero, whether the register be operated for addition or subtraction.

While I have illustrated my invention in the particular embodiments herein shown and described, I do not limit myself to these specific constructions, but claim broadly any equivalent mechanisms coming within the terms and spirit of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A totalizer comprising figure wheels, means adapted to move the units wheel one step when the highest order wheel passes through zero, said means comprising a pair of coaxial bevel gears, a bevel pinion meshing with both of said gears, said pinion rotatable on its own axis and movable around the common axis of said gears, the first one of said gears being in driven relation to the highest order wheel and the second gear being in driving relation to the units figure wheel, and devices arranged to return the pinion to normal from any position to which it may have been moved by a force transmitted from the highest order wheel, said pinion rolling on the second gear when it is moved by a force transmitted from the highest order wheel and rolling on the first gear and driving the second gear when it is returned to normal.

2. A totalizer comprising a plurality of figure wheels and differential mechanism adapted to move the units wheel one step by a series of delayed carrying operations when the highest figure wheel crosses the zero point.

3. A totalizer comprising a plurality of figure wheels, actuating mechanism for said figure wheels, and differential mechanism adapted to move the units figure wheel one step when the highest order wheel crosses the zero point and after the operation of the figure wheels by the actuating mechanism has ceased.

4. An algebraic register comprising a plurality of order sets, carrying mechanism therefor, driving mechanism for said order sets, said driving mechanism arranged to be moved into and out of driving relation with the register order sets, and means controlled by the highest order set and actuated by the driving mechanism when the latter is moved out of driving relation with the order sets arranged to impart a one step movement to the units order set to correct the indicated resultant once and for all after a series of additions and subtractions during the course of which the indicated resultant has passed through zero an odd number of times.

5. A register of the class described comprising a plurality of digit carriers, means

for operating the register in its several orders, and mechanism arranged to impart a one step movement to the digit carrier of units order to correct the indicated resultant once and for all after a series of additions and subtractions during the course of which the digits carrier of highest order has passed the zero point an odd number of times.

6. An algebraic totalizer comprising figure wheels, and mechanism for moving the units figure wheel one step to correct the indicated resultant once and for all after a series of positive and negative entries resulting in the figure wheel of highest order passing the zero point an odd number of times.

7. An algebraic computing mechanism having a plurality of orders, and means for actuating the mechanism one step in the units order to effect the correction of the resultant once and for all after a series of positive and negative entries during the course of which the resultant has passed through zero an odd number of times.

8. An algebraic computing mechanism having a plurality of orders, and means for actuating the mechanism in its several orders to effect positive and negative entries therein, together with devices for actuating the mechanism one step in the units order to correct the resultant once and for all after a series of positive and negative entries during the course of which the resultant has passed through zero an odd number of times.

9. An algebraic register having a plurality of digit carriers, actuating mechanism shiftable into driving relation with the digit carriers adapted to be operated to effect any number of positive and negative entries in the register, together with means operated when the actuating means is shifted out of driving relation with the digit carriers arranged to move the digit carrier of the units order one step whensoever and only when during the preceding series of entries the digit carrier of highest order has passed the zero point an uneven number of times.

10. An algebraic register comprising figure wheels, each having two sets of figures thereon running in opposite directions, an index arranged to indicate which figures are to be read, mechanism arranged to operate the index whenever the figure wheel of highest order passes the zero point, together with means for moving the figure wheel of lowest order one step whenever after a plurality of positive and negative entries have been made said index is in a different position than that occupied by it before the making of said plurality of positive and negative entries.

11. In a totalizer the combination with a plurality of numeral wheels, each having two sets of numerals on the periphery thereof progressing in opposite directions, of separate means for driving each of said numeral wheels in either direction, differential carry-over gear connections between said numeral wheels, a shutter having a set of openings for registering with one of said sets of numerals and another set of openings spaced from said first named set for registering with said second set of numerals, means for shifting said shutter relatively to said numeral wheels when the resultant passes through zero, separate means for actuating each of said driving means comprising a gear having an operative and an inoperative position, means for shifting said gears into operative and inoperative position, and means controlled by said gears when returned to inoperative position and when the resultant has passed through zero an odd number of times for moving the units numeral wheel a single step.

12. In a totalizer the combination with a plurality of numeral wheels, each having two sets of numerals on the periphery thereof progressing in opposite directions, of separate means for driving each of said numeral wheels, carry-over gear connections between said numeral wheels, a shutter having a set of openings for registering with one of said sets of numerals and another set of openings spaced from said first named set for registering with said second set of numerals, means for shifting said shutter relatively to said numeral wheels when the resultant passes through zero, separate means for actuating each of said driving means comprising a gear having an operative and an inoperative position, means for shifting said gears into operative and inoperative position, and means controlled by said gears when returned to inoperative position and when the resultant has passed through zero an odd number of times for moving the units numeral wheel a single step.

13. In a totalizer the combination with a plurality of numeral wheels, each having two sets of numerals on the periphery thereof progressing in opposite directions, of separate means for driving each of said numeral wheels, carry-over gear connections between said numeral wheels, a shutter having a set of openings for registering with one of said sets of numerals and another set of openings spaced from said first named set for registering with said second set of numerals, means for shifting said shutter relatively to said numeral wheels when the resultant passes through zero, separate means for actuating each of said driving means having an operative and inoperative position, means for shifting said actuating means into operative and inoperative position, and means controlled by said actuat-

ing means when returned to inoperative position and when the resultant has passed through zero an odd number of times for moving the units numeral wheel a single step.

14. A totalizer comprising the combination of a plurality of numeral wheels having two sets of numerals on the periphery thereof progressing in opposite directions, separate means for driving each of said numeral wheels, carry-over connections between said numeral wheels, means controlled by the movement of said numeral wheels for indicating whether the resultant is positive or negative, and means including said carry-over connections for moving the units numeral wheel a single step when the resultant has passed through zero an odd number of times.

15. A totalizer comprising the combination of a plurality of numeral wheels having two sets of numerals on the periphery thereof, separate means for driving each of said numeral wheels, carry-over connections between said numeral wheels, means for actuating said driving means having operative and inoperative positions, and means controlled by said actuating means when moved to inoperative position for moving the units numeral wheel a single step when the resultant has passed through zero an odd number of times.

16. A totalizer comprising the combination of a plurality of numeral wheels having two sets of numerals on the periphery thereof, separate means for driving each of said numeral wheels, carry-over connections between said numeral wheels, means for actuating said driving means having operative and inoperative positions, and means for moving the units numeral wheel a single step when the resultant has passed through zero an odd number of times.

17. A totalizer comprising the combination of a plurality of numeral wheels, separate means for actuating each of said wheels to indicate a numerical resultant of a plurality of either positive or negative entries or of both positive and negative entries, means for indicating whether said resultant is positive or negative, and means controlled by said actuating means for changing the resultant when the resultant has passed through zero an odd number of times.

18. A totalizer comprising a plurality of elements having numerals thereon, means for actuating said elements to indicate a resultant of a plurality of either positive or negative entries or of both positive and negative entries, said actuating means having operative and inoperative positions and remaining in the operative position until the desired series of entries has been made, means for indicating whether the resultant is positive or negative, and means controlled by said actuating means for changing said resultant when said resultant has passed through zero an odd number of times.

19. A totalizer comprising a plurality of elements having numerals thereon, means for actuating said elements to indicate a resultant of a plurality of either positive or negative entries or of both positive and negative entries, said actuating means having operative and inoperative positions and remaining in the operative position until the desired series of entries has been made, means for indicating whether the resultant is positive or negative, and means for changing said resultant when said resultant has passed through zero an odd number of times.

20. In a structure of the class described the combination with a plurality of elements having numerals thereon arranged in progressive order, separate means for driving each of said elements to a position in which the numerals in certain positions on said numeral elements indicate a resultant which is the result of a series of positive or negative entries or of both positive and negative entries, means for indicating whether said resultant is negative or positive, and means controlled by said driving means for moving the units elements one step at the end of a series of entries when during the series of entries the resultant has passed through zero an odd number of times.

21. In a structure of the class described the combination with a plurality of elements having numerals thereon arranged in progressive order, means for driving each of said elements to a position in which the numerals in certain positions on said numeral elements indicate a resultant which is the result of a series of positive or negative entries or of both positive and negative entries, and means controlled by said driving means for moving the units elements one step at the end of a series of entries when during the series of entries the resultant has passed through zero an odd number of times.

22. In a structure of the class described the combination with a plurality of elements having numerals thereon arranged in progressive order, means for driving each of said elements to a position in which the numerals in certain positions on said numeral elements indicate a resultant which is the result of a series of positive or negative entries or of both positive and negative entries, and means for moving the units elements one step at the end of a series of entries when during the series of entries the resultant has passed through zero an odd number of times.

23. In a structure of the class described the combination of a plurality of numeral elements, means for actuating said numeral elements to make a series of entries, means for holding said actuating means in opera-

tive position with said numeral elements while said series of entries are being made, and means controlled by said actuating mechanism after a series of entries has been made for moving the units numeral element one step to close the series of entries when during the entry of said series the resultant has passed through zero an odd number of times.

24. In a structure of the class described the combination of a plurality of numeral elements, means for actuating said numeral elements to make a series of entries, means for holding said actuating means in operative position with said numeral elements while said series of entries are being made, and means for moving the units numeral element one step to close the series of entries when during the entry of said series the resultant has passed through zero an odd number of times.

25. A totalizer comprising the combination of a plurality of numeral wheels, separate means for actuating each of said wheels to indicate a numerical resultant of a plurality of either positive or negative entries or of both positive and negative entries, means for indicating whether said resultant is positive or negative, and means for changing the resultant when the resultant has passed through zero an odd number of times.

In witness whereof, I hereunto subscribe my name this 29th day of October, A. D. 1913.

WILLIAM J. CRUMPTON.

Witnesses:

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Robert F. Bracke.