June 25, 1946. O. R. HARTOM 2,402,549

ADDING MACHINE

Original Filed Dec. 7, 1942 3 Sheets-Sheet 1

Fig. 1.

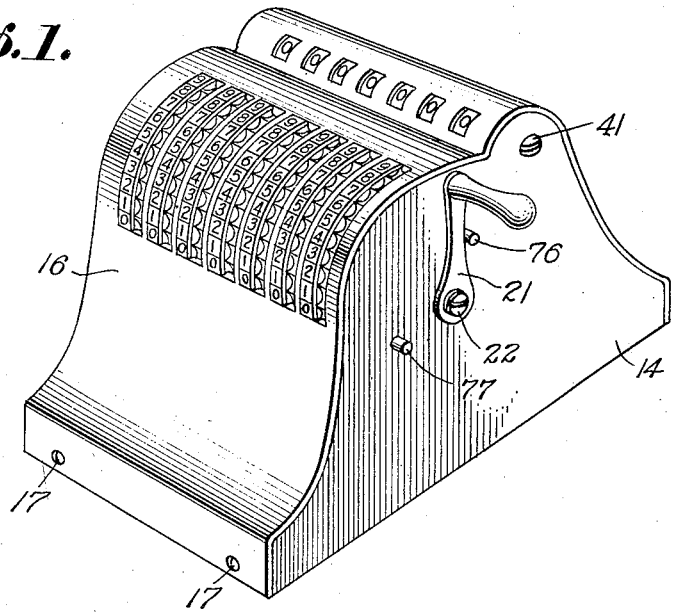
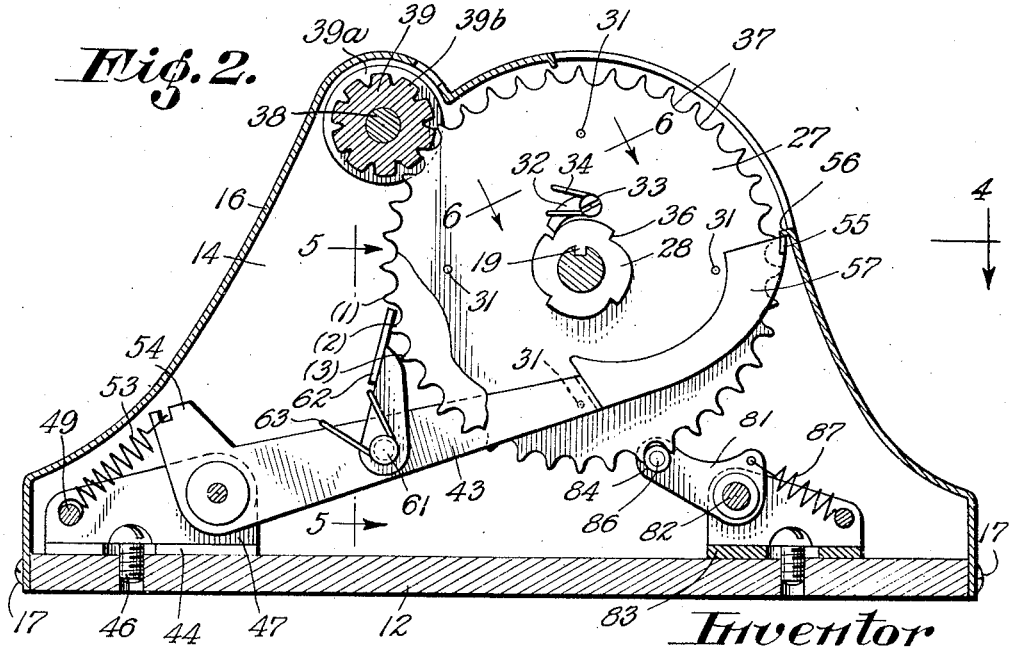


Fig. 2.



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ADDING MACHINE

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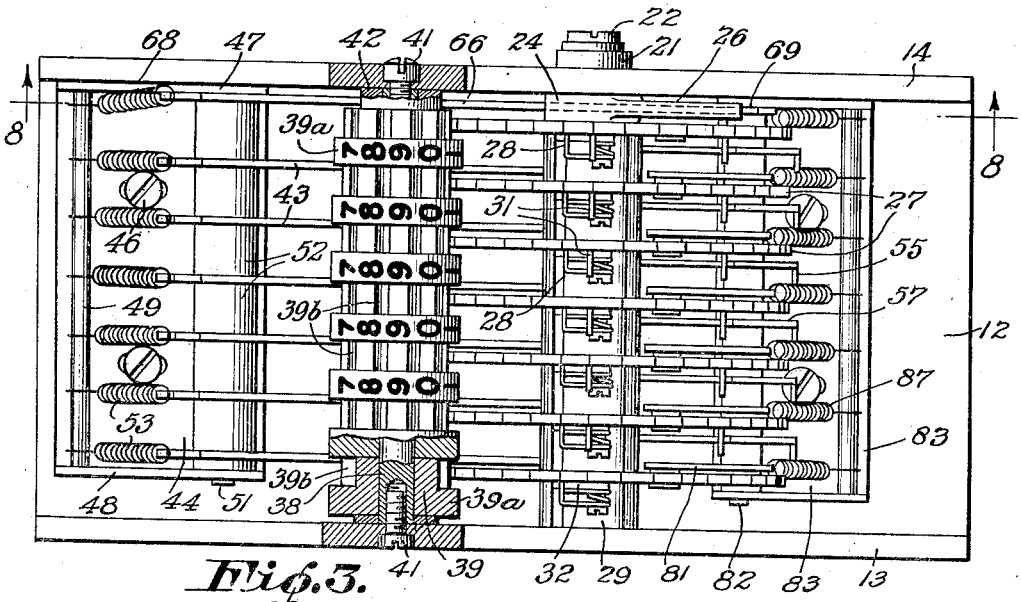

Fig. 3.

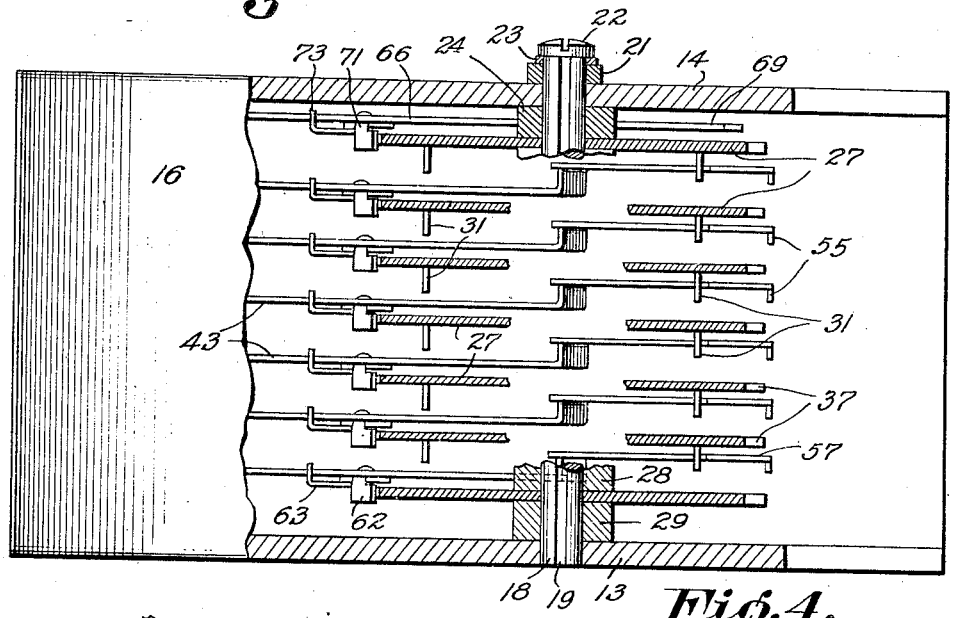

Fig. 4.

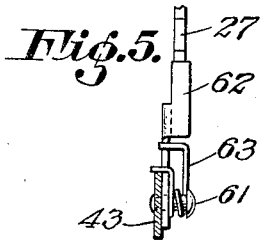

Fig. 5.

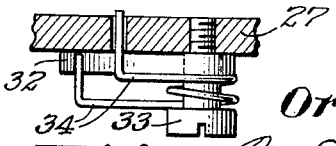

Fig. 6

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ADDING MACHINE

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Fig. 7.

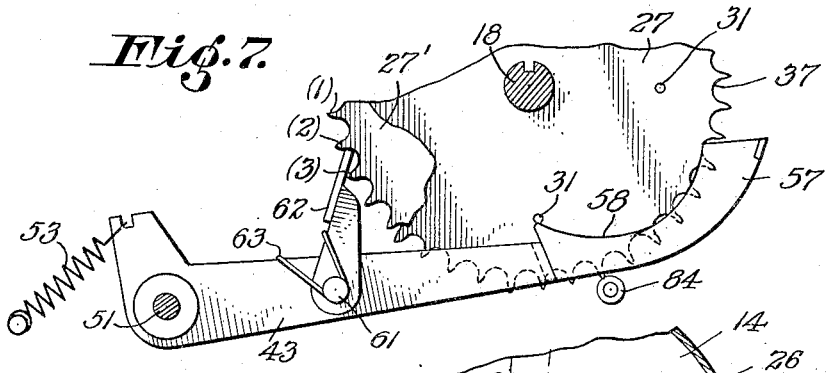


Fig. 8.

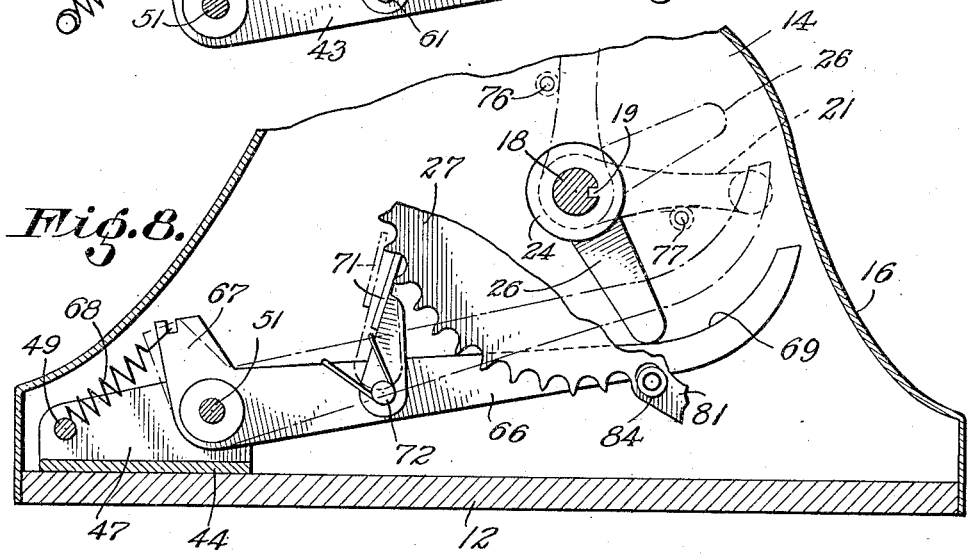


Fig. 9.

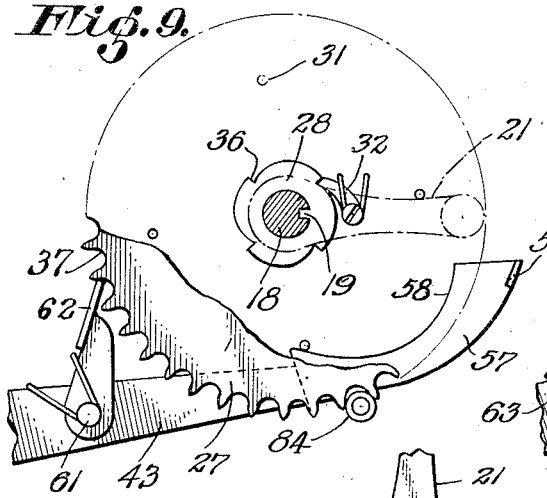


Fig. 10.

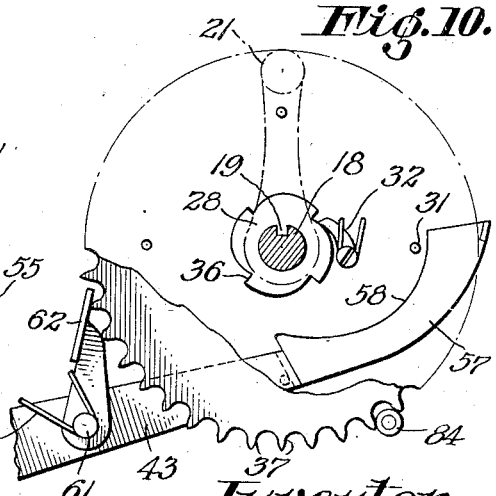
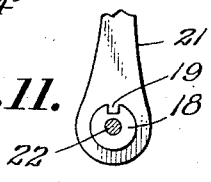


Fig. 11.



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Patented June 25, 1946 2,402,549

UNITED STATES PATENT OFFICE

2,402,549

ADDING MACHINE

Ora R. Hartom, Chicago, Ill.

Original application December 7, 1942, Serial No. 468,091. Divided and this application May 20, 1944, Serial No. 536,450

8 Claims. (Cl. 235—144)

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My invention relates to adding machines. It relates more in particular to relatively small, inexpensive but quietly and accurately operable adding machines adapted to be used with a pencil or stylus.

In my copending application, Serial No. 374,171, filed January 13, 1941, now abandoned, I disclosed an adding machine of a small, relatively inexpensive type having certain advantages over similar devices of the prior art. In the specification of my copending application, I set forth certain objects which are also, in part, the objects of my present invention.

My present invention has for a further object, however, the simplification of construction, reduction in the number of parts, simplicity of fabrication and ease of assembly and adjustment, as compared with the device of my copending application.

Still a further object and advantage of my present invention resides in the fact that the carry-over function is improved by storing up, in a mechanism provided for the purpose, energy for the operation of the next unit to the left in each instance, the construction and operation being such that if there should be a repetition of the numeral "nine" across the entire adding machine, the carrying-over at a multiple of positions resulting from introduction of additional values in the units position will place substantially no more strain on the stylus than would the carrying-over at a single position.

Other objects and features of the invention will be apparent from a consideration of the following description taken with the accompanying drawings wherein—

Fig. 1 is a perspective view showing an adding machine constructed in accordance with the features of my present invention;

Fig. 2 is a longitudinal sectional view, partly in elevation and with some parts broken away;

Fig. 3 is a plan view with the cover removed, a portion of the view, however, being shown in plan section to illustrate structural features;

Fig. 4 is a plan sectional view taken on the line 4—4 of Fig. 2 looking in the direction of the arrows;

Fig. 5 is a fragmentary sectional view partly in elevation taken on the line 5—5 of Fig. 2, looking in the direction of the arrows;

Fig. 6 is a fragmentary sectional view, partly in plan, taken on the line 6—6 of Fig. 2, and showing a detail of a pawl;

Fig. 7 is a fragmentary view similar to Fig. 2

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but showing some of the parts in different positions than in Fig. 2;

Fig. 8 is a vertical sectional view taken on the line 8—8 of Fig. 3, looking in the direction of the arrows, showing a portion of the zero-setting mechanism in elevation, a portion of one stylus wheel in front of the section line being shown in order to illustrate a functional detail;

Fig. 9 is a transverse sectional view, partly in elevation and with some of the parts broken away illustrating the positions of the carry-over mechanism and stylus wheels at one point during the zero-setting operation;

Fig. 10 is a view similar to Fig. 9 but illustrating the final position after a zero-setting operation; and

Fig. 11 is a fragmentary elevational view, partly in section, showing a detail of the handle.

In carrying out my invention, I use a relatively small number of identical parts, most of which enter into the performance of more than one function as the detailed description will show. The device is of a type employing a multiple of ten positions on a stylus wheel or so-called indexing wheel, the answer being shown on a plurality of accumulator wheels, but the accumulating function being in part performed by the stylus wheels themselves. The stylus wheels are rotatable upon a transverse shaft having a continuous key-way and are separated by ratchets having a plurality of positions corresponding with the number of teeth or positions in the stylus wheel divided by ten. The ratchets are provided with keys engaging in the key-way of the transverse shaft so as to turn with the shaft and the stylus wheels have a single pawl spring-pressed to engage the ratchet, an individual pawl engaging an individual ratchet at one of the several positions thereof but one tooth position removed from a single one of a plurality of cam pins carried on the same face of the stylus wheel as the heretofore referred to pawl, although as will appear clear later, the pins and positions on the ratchet may be at the same circumferential position.

Disposed between each pair of stylus wheels is a spring returned rocking cam member with a cam surface engageable by one of said cam pins and adapted to rock a functional distance equivalent to the movement of an adjacent stylus wheel one tooth position when a carry-over pawl carried by the rocking cam is caused to engage the stylus wheel of next higher ordinal position than that carrying the cam pin in engagement with the cam surface of said rocking cam. The

movement of the rocking cam described stores up energy therein sufficient to move the stylus wheel in the next higher ordinal position one tooth position, and the cam is so constructed that the cam pin disengages the cam surface at a position just as the stylus wheel carrying the cam pin moves from the nine to zero position.

Positioned at one side of the duplicate mechanism comprising the several ordinal positions, and preferably at the right hand side of the machine, when in normal position, is a zero-setting lever having the same general relationship to the stylus wheel in the unit position as the heretofore described rocking cams have to stylus wheels in positions of a higher order. In line with the said zero-setting lever and keyed to the heretofore referred to transverse shaft is a zero-setting arm adapted to engage a cam surface carried by the said zero-setting lever when the said transverse shaft is rocked through an angle corresponding to the radius of the circumference occupied by nine tooth positions on the stylus wheels. A handle keyed to the said transverse shaft is supported to be moved through nine tooth positions on the stylus wheels. The result of this construction is that as the zero-setting handle is operated it first moves all of the stylus wheels to the nine position which position will be shown in the accumulator, the several stylus wheels being picked up by engagement between the heretofore described ratchets and pawls as the shaft rotates the ratchets through positions of a higher and higher order. As the zero-setting handle is returned to its normal position, the zero-setting arm disengages the zero-setting rocking cam and allows the rocking cam to carry over the unit stylus wheel one tooth position. The other stylus wheels, having all been removed to the nine position, have stored partially actuated energy at several carry-over mechanisms and these now function successively to advance each stylus wheel in turn from nine to zero.

Other details, objects and features of the invention will be apparent as the description progresses. I shall refer now to the details of construction of the embodiment shown in the drawings:

All of the parts are mounted on the frame of the machine comprising a base 12 and side plates 13 and 14. A cover 16 comprises a housing secured in position by a plurality of screws 17 and having the necessary openings as shown in Fig. 1 to visualize the accumulator wheels and ten positions on the stylus wheels. The portion of the housing 16 between the stylus wheels is appropriately numbered as shown to identify the zero to nine positions on the stylus wheels.

A transverse shaft 18 having a key-way 19 is disposed between the side plates 13 and 14. This shaft may be journalled and supported in various ways but I have adapted a simplified showing in order to avoid complication. In the drawings, the parts shown are drawn to bring out clearly their essential shape and function.

On the outside of the side plate 14 is a handle 21 keyed to the shaft 18 as shown in Fig. 11 and held in position by a screw 22 threaded in the end of the shaft and held in position by a lock washer 23. Within the side plate 14 is a boss 24 comprising a part of a zero setting arm 26 (see Figs. 3 and 8). Thereafter there is arranged on the shaft, successively and alternatively, stylus wheels 27 and ratchets 28 until at the opposite side of the machine on the inside of side plate 13 there is disposed a spacer 29. As previously noted and as shown clearly in Figs. 2 and 7, the ratchets 28 have keys engaging in the key-way 19 and, therefore, are fixed on the shaft 18; while the stylus wheels 27 are not provided with keys and are free to rotate on the shaft 18.

Each stylus wheel carries a plurality of cam pins 31 and a pawl 32 supported on a stud 33 and spring pressed by a spring 34 toward the face or flat side of the stylus wheel and also toward the ratchet 28. Each ratchet wheel has a plurality of positions in the nature of teeth 36 corresponding in number to the cam pins 31. Each stylus wheel has a plurality of positions 37 comprising a multiple of ten. There should be one group of ten positions 37 for each cam pin 31 and in the drawings I show forty positions 37 with four cam pins 31 and four positions 36 on the ratchet 28.

Also disposed between the side plates 13 and 14 is a shaft 38 carrying a plurality of accumulator wheels 39 and supported in position by machine screws 41 (Fig. 3). The accumulator wheels 39 comprise a numeral bearing portion 39*a* and a tooth portion 39*b* and may be made by die casting or in any other suitable way. They may have spacers between them but for simplicity I show them mounted directly on the shaft 38 and disposed side by side so that one acts as a thrust bearing for the other. Suitable washers 42 are employed at the ends of the shaft 38 to control the positions and the clearance between the several accumulator wheels 39. As shown, particularly in Fig. 2, the accumulator wheels are in permanent mesh with the stylus wheels and while an individual accumulator wheel will make one complete revolution for each multiple of ten positions (here four) traversed during one complete revolution of its associated stylus wheel, still the ordinal position of the stylus wheel will always be affected to show the value thereof in the accumulator.

Between the units and tens stylus wheels and each successive pair up to and including the last pair is disposed a carry-over rocking lever 43. These carry-over levers 43 are supported on a bracket 44 adjustably secured on the base 12 by screws 46 and having a pair of up-turned ears 47 and 48 between which shafts 49 and 51 are extended. The carry-over levers 43 are in the nature of bell crank levers as clearly shown in Fig. 2 and they are pivoted to the shaft 51 intermediate their ends, spacers 52 being provided to maintain them in proper position. Springs 53, tensioned between the shaft 49 and an upstanding end 54 of the carry-over levers 43, urge the carry-over levers in a counter clockwise direction, when looking at Fig. 2, and cause an offset portion 55 thereof to engage a stop 56 aligned with the stylus wheels. An offset portion 57 of the carry-over lever 43 is provided with a cam face 58 adapted to be engaged by one of the pins 31. The pin 31 is adapted to ride along the face 58 until it gets to the position shown in Figure 7, at which point energy has been stored in the spring 53 sufficient to restore the carry-over lever to its normal position against the stop 56. Looking at Fig. 2, it will be noted that the cam pin 31 is some little distance away from the cam face 58. This is for the purpose of illustration, but it will be understood that this pin may be closer than shown so that during substantially its entire movement to the position shown in Fig. 7 it is operating to move the offset portion 57 downwardly. It is to be understood that the cam pin 31 could engage the cam face 58 only slightly

before it reaches the position, but the longer the travel and the more gradual the movement, the less effort is felt in moving the stylus wheel carrying the particular pin 31 under consideration.

On each carry-over lever 43 is a pin 61 on which a pawl 62 is pivoted, the pawl being urged by spring 63 in a direction toward the stylus wheels, as is clear from an inspection of Figs. 3 and 4, the latter particularly. Each pawl 62 is aligned with a stylus wheel occupying a higher ordinal position than the stylus wheel which operates the carry-over lever 43 to which the said pawl is pivoted. The pawls 62 may be termed carry-over pawls, and there is, of course, one for each carry-over mechanism including each carry-over lever 43. The movement of a carry-over lever 43 is sufficient to move its carry-over pawl one tooth position. If we look at Figures 2 and 7, we shall see that the carry-over pawl 62 is engaging between two tooth projections marked (1) and (2), respectively, but in Fig. 7, the carry-over pawl has been moved downwardly to a position between tooth projections (2) and (3). If now, the cam pin 31 in Fig. 7 moves a further distance to release the cam face 58, the spring 53 will restore the mechanism to the position shown in Fig. 2, and the stylus 27', a portion of which only appears in front of the stylus wheel 27, will be advanced one position by the carry-over pawl 62. The function is repeated as each pin 31 engages the cam face 58, and the mechanism functions the same, of course, entirely across the machine.

The zero-setting mechanism heretofore referred to includes the arm 26, already described, the handle 21, the carry-over mechanism and some of the remaining structure heretofore described, and a zero-setting lever 66 (Fig. 3). This zero-setting lever 66 is also in the shape of a bell crank lever and is pivoted to shaft 51. In Fig. 3, this zero-setting lever appears to lie against the ear 47. In practice, a relatively thin spacing washer is used, and this structure is followed to permit the zero-setting lever 66 to be relatively simply formed and still keep in turn with the zero-setting arm 26 without unnecessarily widening the machine. The zero-setting lever 66 has an upstanding portion 67 urged by spring 68 in a counterclockwise direction looking at Fig. 8. A cam surface 69 is engaged by the end of the arm 26 and intermediate the cam surface 69 and the pivot point is a zero-setting pawl 71 pivoted on a stud 72 and urged by spring 73 into contact with the stylus wheel 27 in the units position. The cam face 69 is so designed that when the arm 26 rides from the position shown in broken lines in Fig. 8 to the position shown in full lines in Fig. 8, the zero-setting pawl 71 is caused to engage in back of the next successive tooth and when the zero-setting arm 26 is now returned to the broken line position, the zero-setting lever 66 is returned to its broken line position and the units stylus member is advanced one tooth position.

On the outside of the side plate 14 are pins 76 and 77. When the handle 21 is against the pin 76, the shaft 18 is in its normal position. The views in which this shaft 18 is in its normal position show the key-way 19 on top of the shaft, while those showing the shaft in the most advanced position which it takes during a zero-setting operation show the key-way facing to the right. While the shaft may be controlled to move only nine tooth positions, I permit it to move through 90 degrees but, as appears clear from Fig. 2, the ratchets 28 do not pick up the pawls 32 until the shaft has been moved through one position. This has an advantage in operation in that all of the pawls will always be in a position to be engaged by the teeth on the ratchet whereas if the shaft were only rotated through 81 degrees, quite accurate workmanship would be necessary to assure the pawls falling into the position behind a tooth.

In the zero-setting operation, the parts move from the broken line position to the full line position and then back to the broken line position of Fig. 8 as previously described. At the same time each of the ratchets 28 picks up its pawl and the ratchets and pawls of the several stylus wheels occupy the position shown in Fig. 9 when the zero-setting arm 26 is in the full line position of Fig. 8 and the handle 21 is against the pin 77. When the handle 21 is returned to its position against the pin 26 each of the stylus wheels is moved, the units wheel moving first and it, in turn, throws one number into the tens stylus wheel which moves to the zero position and it then carries over to the one-hundred position, etc., until all of the stylus wheels are removed from the nine position which they occupy in Fig. 9 to the zero position which they occupy in Fig. 10. It should be remembered that the movement of the parts from the position of Fig. 9 to the position of Figure 10 is brought about by two distinct movements, first, the return of the shaft 18 and ratchet 28 to normal position and the advancing of the stylus wheels one position, the former being in a counterclockwise direction, looking at Figs. 9 and 10, and the latter in a clockwise direction.

To assure centering of the stylus wheels, I provide a plurality of bell crank levers 81 pivoted on a shaft 82 carried by the bracket 83. The arms carry rollers 84 on pins 86, the rollers being engaged between tooth projections on the stylus wheels. Springs 87 carry enough tension to maintain the parts in the position shown in Fig. 2 so that any movement which is more than half way will be effective to cause a full movement of the stylus wheel due to the action of the arm 81. This arm also functions as an over-throw preventing device, although over-throw is, in part, prevented during normal adding procedure by the stylus itself. Should there be any tendency to over-throw during carry-over, this will be effectively prevented by the arm 81.

It will be understood that the adding machine of my invention may be modified while still utilizing the same general principles. I do not limit myself, therefore, to the exact structure shown and the invention is limited only by the claims.

This application is a division of my prior application, Serial No. 468,091, filed December 7, 1942.

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

1. In an adding machine of the class described, a transverse shaft, a plurality of stylus wheels rotatable thereon, each such stylus wheel having a multiple of ten tooth positions, a plurality of ratchet members rotatable with said shaft, one such ratchet member being disposed between each pair of stylus wheels, and having a ratchet tooth for each ten positions on the stylus wheels, a pawl carried by each stylus wheel adapted to engage said ratchet, carry-over mechanism effective between each stylus wheel and the stylus wheel of next higher order, means for rotating said transverse shaft through approximately the periphery of ten teeth on the stylus wheels where-

by to cause engagement between the said ratchet and pawl and move all of the stylus wheels to number nine position, and means effective upon return movement of the said shaft to cause operation of the zero setting mechanism and advance of all of the stylus wheels to zero.

2. In an adding machine of the class described, comprising a transverse shaft, a plurality of stylus wheels rotatable thereon, each such stylus wheel having a multiple of ten tooth positions, carry-over mechanism effective between each stylus wheel and the stylus wheel of next higher order, means for rotating said transverse shaft through approximately the periphery of ten teeth on the stylus wheels, means effective upon rotation of the said shaft in one direction to move all of the stylus wheels to number nine position, and means effective upon return movement of the said shaft to cause operation of the carry-over mechanisms and advance of all of the stylus wheels to zero.

3. In an adding machine of the class described, a transverse shaft, a plurality of stylus wheels rotatable thereon, each such stylus wheel having a multiple of ten tooth positions, carry-over mechanism effective between each stylus wheel and the stylus wheel of next higher order, means for rotating said transverse shaft through approximately the periphery of ten teeth on the stylus wheels, means effective upon rotation of the said shaft in one direction to move all of the stylus wheels to number nine position, and means effective upon return movement of the said shaft to add one position into the units stylus wheel to restore it to zero position and cause operation of each successive carry-over mechanism moving in the direction of a higher order and thus advance of all of the stylus wheels to zero.

4. In an adding machine of the class described, a transverse shaft, a plurality of stylus wheels rotatable thereon, each such stylus wheel having a multiple of ten tooth positions, a plurality of ratchet members rotatable with said shaft, one such ratchet member being disposed between each pair of stylus wheels, and having a ratchet tooth for each ten positions on the stylus wheels, a pawl carried by each stylus wheel adapted to engage said ratchet, carry-over mechanism effective between each stylus wheel and the stylus wheel of next higher order, means for rotating said transverse shaft through approximately the periphery of ten teeth on the stylus wheels whereby to cause engagement between the said ratchet and pawl and move all of the stylus wheels to number nine position, and means effective upon return movement of the said shaft to cause operation of the said carry-over mechanisms and advance of all of the stylus wheels to zero, said last mentioned means including means for adding one position into the units stylus wheel on return rotation of the said transverse shaft.

5. In an adding machine of the class described, a transverse shaft, a plurality of stylus wheels rotatable thereon, each such stylus wheel having a multiple of ten tooth positions, a plurality of ratchet members rotatable with said shaft, one such ratchet member being disposed between each pair of stylus wheels, and having a ratchet tooth for each ten positions on the stylus wheels, a pawl carried by each stylus wheel adapted to engage said ratchet, carry-over mechanism effective between each stylus wheel and the stylus wheel of next higher order, means for rotating said transverse shaft through approximately the periphery of ten teeth on the stylus wheels whereby to cause engagement between the said ratchet and pawl and move all of the stylus wheels to number nine position, and means effective upon return movement of the said shaft to cause operation of the zero setting mechanism and advance of all of the stylus wheels to zero, said last mentioned means including a spring pressed pivoted zero setting lever with a cam surface and spring pressed pawl and an arm engaging said cam surface to move the same against its spring and engage said pawl behind one tooth position of the units stylus wheel, return movement of the said shaft releasing said cam surface and permitting adding one position into the units column.

6. In an adding machine of the class described, a transverse shaft, a plurality of stylus wheels rotatable thereon, a plurality of pins on each stylus wheel, one for each ten tooth positions thereon, a plurality of spring pressed pivoted carry-over levers between each pair of stylus wheels, each having a cam surface engageable by said pins to urge said carry-over lever about its pivot against its said spring, a carry-over pawl pivoted to said carry-over lever and positioned to engage against the periphery of the stylus wheel of next higher order than the stylus wheel effective to move said carry-over lever, the said cam surface being shaped so that said pin will move the carry-over lever sufficiently to cause said carry-over pawl to engage behind one tooth position whereby return movement of the carry-over lever causes said stylus wheel to advance one tooth position, said cam surface being shaped to permit spring return of the carry-over lever and the performance of the carry-over function, and a zero setting mechanism including means for first setting up the numeral nine in each stylus wheel, and thereafter introducing the numeral value of one into the units stylus wheel, and restore the same to zero value, whereby the carry-over mechanism will function to restore remaining stylus wheels to zero.

7. In an adding machine of the class described, a transverse shaft, a plurality of stylus wheels rotatable on the shaft, a plurality of ratchet wheels rotatable with the shaft disposed between and spacing the stylus wheels, a zero-setting pawl carried on the face of each stylus wheel adapted to be engaged by the ratchet wheel when the shaft is rotated, a plurality of carry-over pins projecting from each stylus wheel, a shaft spaced from but parallel with said transverse shaft having a plurality of carry-over levers pivoted thereto, each said carry-over lever disposed between a pair of stylus wheels and carrying a pivoted carry-over pawl spring pressed into engagement with the stylus wheel in the direction of a higher order and a cam surface positioned to be engaged by a carry-over pin on the stylus wheel in the direction of a lower order, spring means urging each such carry-over lever to move the cam in the direction of said pins whereby said pins are effective to move said carry-over lever in one direction about its pivot and engage the carry-over pawl behind one tooth position and the springs are effective to return the carry-over lever, means for rotating said transverse shaft through approximately the angle subtended by ten tooth positions, the parts being so constructed and arranged that movement of such shaft in one direction will cause said ratchet wheel to engage said zero setting pawl and set up the numeral nine in each stylus wheel, a zero setting lever pivoted to said second mentioned shaft and having a pawl spring pressed into engagement with the periphery of the units stylus wheel, a

zero-setting arm carried by the first mentioned transverse shaft and effective to rotate said zero-setting lever a sufficient distance to engage its said pawl behind one tooth position of the unit stylus wheel, and spring return means on said zero-setting lever effective upon return movement of said first mentioned transverse shaft whereby to add the value of one into the unit stylus wheel and whereby the carry-over mechanisms will then function to successively introduce one unit value into the stylus wheels of a higher order.

8. The combination in an adding machine of

the class described comprising a transverse shaft, numeral wheels on said shaft, and carry-over mechanism between said wheels, of zero setting mechanism comprising a single control means for driving said shaft for first setting up the value nine on all said wheels, and means operated by said single control means for adding the numeral one to the lowest order numeral wheel, whereby the carry-over mechanism will function to set all of said wheels to zero.

ORA R. HARTOM.