Sept. 15, 1959 R. L. RICH 2,904,249

ADDING AND SUBTRACTING MACHINE

Filed July 19, 1957 2 Sheets-Sheet 1

FIG. 1.

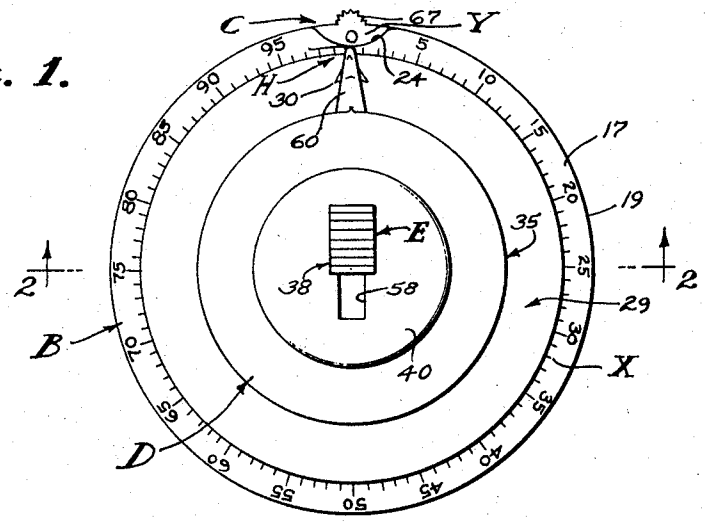


FIG. 2.

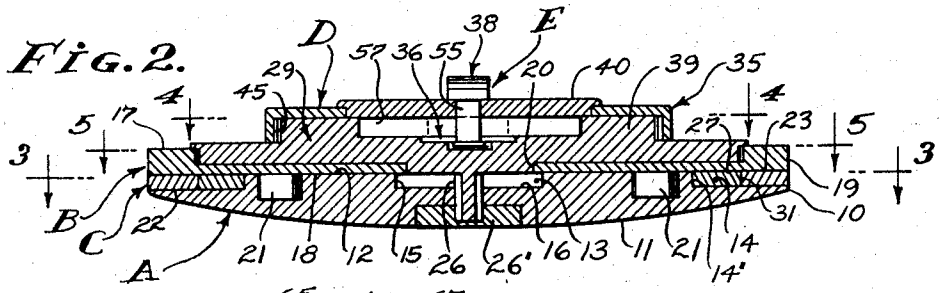
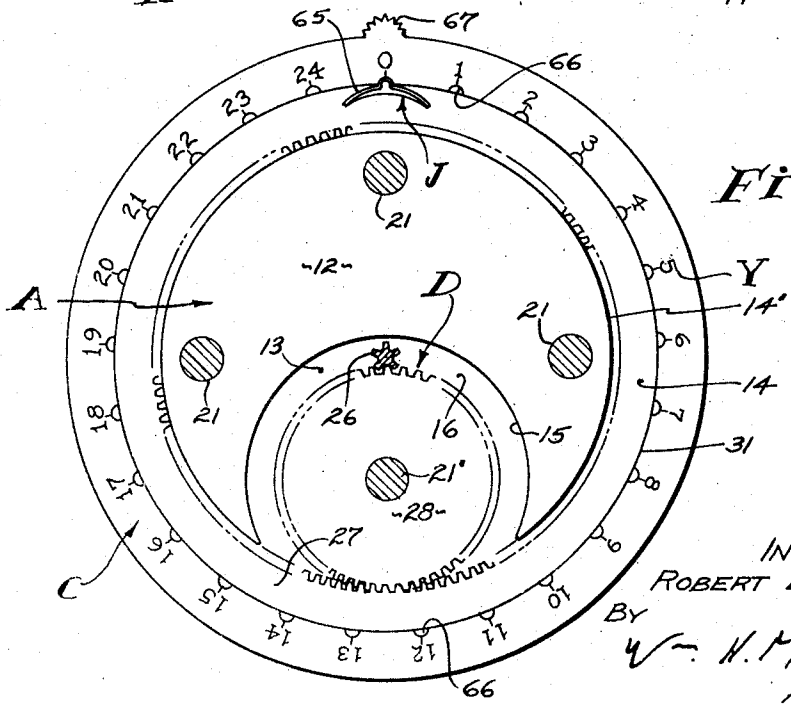


FIG. 3.



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FIG. 4.

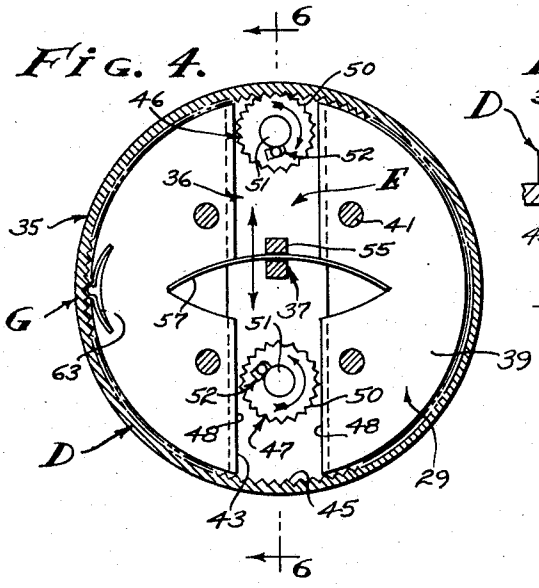


FIG. 6.

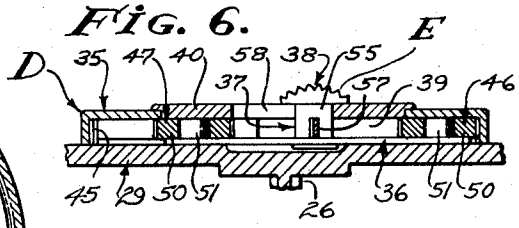


FIG. 7.

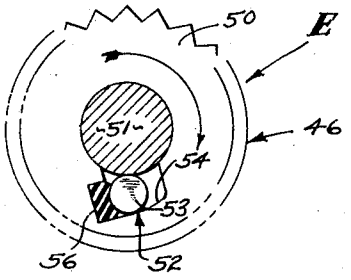


FIG. 8.

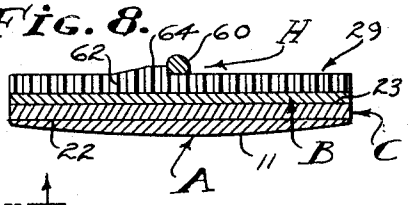
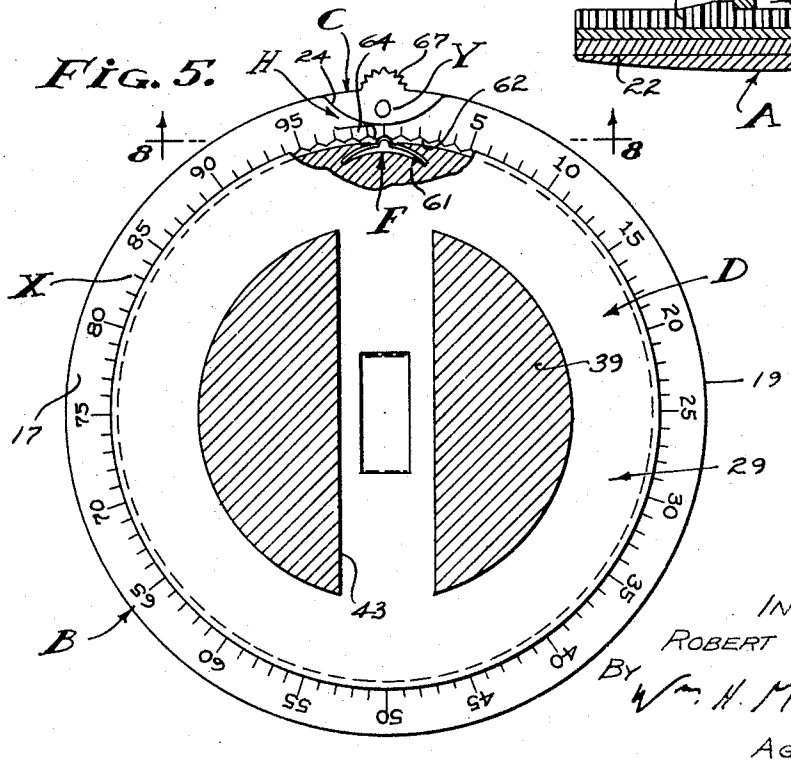


FIG. 5.



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ADDING AND SUBTRACTING MACHINE

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Application July 19, 1957, Serial No. 673,000

8 Claims. (Cl. 235—83)

This invention relates to an improved adding and subtracting machine and particularly to a compact pocket sized mechanism for use by persons in keeping a tally of figures such as expenditures, especially when such expenditures are small and numerous and must be rapidly and accurately recorded and related to a total figure representing the sum of said expenditures. It is a general object of this invention to provide and improved more accurate and more easily operated adding mechanism of the type set forth and claimed in my United States Patent No. 2,779,541, entitled Adding Machine issued January 29, 1957.

Many situations and circumstances require simple adding and subtracting of figures, such, for example, as the compiling of expenditures or possibly the compiling of other quantities of various kinds. That is, it is desirable to budget the handling of expenditures and other quantities in order to keep accurate account of them, a typical example of such a situation being that of shopping within a predetermined budget during which a large number of inexpensive items of varying costs are purchased. A person shopping, however, cannot be expected to carry along a large complicated device for adding figures, and, therefore, I have provided the improved pocket sized, or miniature, adding machine of the present invention which is small, compact, easy to operate, and reliably accurate in its compilations.

An object of this invention is to provide an improved pocket sized adding machine that accumulatively adds and/or subtracts figures or quantities.

It is another object of this invention to provide an adding machine with an improved control to determine the action of the machine to the end that it either adds or subtracts when operated.

Another object of this invention is to provide a machine of the character above referred to which is easily reset to a normal zero position by simple manual operations.

It is still another object of this invention to provide a mechanism of the character thus far referred to which can be set to begin adding or subtracting from any desired number of dollars, or quantity, within the range of the mechanism.

Further, it is an object of this invention to provide a more simple and less expensive mechanism for adding and subtracting than heretofore provided by the prior art, and which mechanism is more easily manufactured and which is accurate and reliable in its operation.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of my invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a plan view of the adding machine that I have provided. Fig. 2 is an elevational sectional view taken substantially as indicated by line 2—2 on Fig. 1. Fig. 3 is a plan sectional view taken substantially as indicated by line 3—3 on Fig. 2. Fig. 4 is a sectional view of a portion of the machine taken as indicated by line

4—4 on Fig. 2. Fig. 5 is a plan sectional view taken as indicated by line 5—5 on Fig. 2. Fig. 6 is a sectional view of a portion of the structure taken as indicated by line 6—6 on Fig. 4. Fig. 7 is an enlarged detailed view of a part of the structure, and Fig. 8 is an enlarged sectional view of a portion of the structure taken as indicated by line 8—8 on Fig. 5.

As shown in the drawings, the structure of the present invention is embodied in a hand operated pocket sized unit adapted to handle and compile dollar and cent figures or like quantities and may be a simple round substantially flat device as clearly illustrated in Figs. 1 and 2 of the drawings. In the preferred form of the invention, the adding and subtracting machine involves, generally, a case or frame A that forms a housing or base for the mechanism, a cover or plate B for enclosing and retaining parts of the mechanism within and to the frame A, a sum indicator ring C, a drive means D having a manually operable element related thereto and driving the sum indicator ring C, control means E for the drive means D to determine the direction of rotation thereof, a detent means F for the drive means D, a detent means G for the control means E, a ratchet stop H for the drive D, and clutch means J acting between the drive means D and the sum indicator ring C.

The frame A of the machine is of a small size to be conveniently carried in the palm of a person's hand and is preferably a round or circular part of shallow depth and shaped in order to house and retain the various parts of the mechanism in working position as hereinafter described. The frame A may be conveniently molded of any suitable material and is characterized by a round outer periphery 10, a substantially flat bottom 11, and a flat top 12. A chamber 13 is provided accommodating parts of the drive D and there is a peripheral recess 14 for receiving parts of the drive D and the indicator ring C. The chamber 13 and recess 14 enter the top of the frame A, the recess 14 being formed concentric therewith to rotatably receive the indicator ring C, and the chamber 13 being formed in the frame on a vertical axis offset from the central vertical axis of the structure. The chamber 13 is formed by a circular wall 15 and a flat bottom 16 and overlies the central axis and opens into the recess 14 at one side of the frame A (see Fig. 3).

The plate B is a disc-shaped part that overlies the top 12 of the frame A and the chamber 13 and recess 14 to extend inwardly from the periphery of the frame to overlie the chamber therein. The plate B acts to retain the parts of the drive D and the indicator ring C in operating position relative to the frame A. The plate B has flat upper and lower horizontally disposed faces 17 and 18 and an outer peripheral wall 19. The face 18 has flat engagement with the top 12 of the frame and the outer margin or peripheral portion of the plate B overlies the recess 14. The face 17 encompasses or extends around the structure and is a continuous face calibrated in equally spaced markings X. The markings shown each represent a cent, there being one hundred markings around the peripheral portion of the plate B. The plate B is provided with a central opening 20 on the vertical axis of the frame A to cooperate with a part of the drive means as hereinafter described. The plate B is secured to the frame A as by cementing or the like, and as shown, pins 21 depend from the plate B to engage in and locate with the frame A.

The sum indicator ring C is essentially a disc-shaped flat circular part round in configuration and carried in the frame A concentric with the vertical axis thereof. The ring C is rotatably carried in the recess 14 having a flat bottom face 22 engaged with the bottom 22' of the

recess 14 and top face 23 engaged with the lower face 18 of the plate B. The plate B cooperates with the frame A to define the annular channel-shaped recess 14 to rotatably receive and to retain the ring C in operating position. The indicator ring C is rotatably carried in the recess 14, and, in accordance with the invention, the face 23 of the ring is calibrated in equally spaced markings Y. The markings Y each represent a dollar, there being any suitable number of markings around the periphery of the ring C. For example, there may be twenty-five markings representing a total of twenty-five dollars. As clearly illustrated in Fig. 1 of the drawings, a peripheral opening or notch 24 is made in the plate B in order to view the markings Y, and as this ring C rotates the number of dollars added is observed by the marking Y visible at the notch 24.

The drive means D is provided to operate and rotate the sum indicator ring C relative to the frame A and is preferably a gear drive. As shown in the drawings, when there are one hundred markings X on the cover B and twenty-five markings Y on the indicator ring C the drive or gear ratio of the means D will be twenty-five to one, to the end that one revolution of the means D will advance the plate C one mark Y or one dollar at a time.

As shown, the drive means D involves, generally a drive gear 26, a drive gear 27, and an intermediate or transfer gear 28. The gear ratio between the gears 26 and 27 is twenty-five to one in order to gain the desired speed reduction, and the gear 28 operates or idles therebetween to transfer motion from the gear 26 to the gear 27. The drive means D further includes a drive element 29 with a pointer 30, and in accordance with the invention, the element 29 and gear 26 operate on the central vertical axis of the frame A, the gear 26 having driving connection with the transfer gear 28.

As shown, the central bearing opening 20 in the plate B rotatably receives a bearing boss that depends from the element 29 to the end that the element 29 is rotatably carried. The element 29 is a sum indicating element, like the ring C, and is a disc-shaped part that overlies the upper face 17 leaving the indexed peripheral portion thereof exposed. In the preferred form of the invention the plate B is of substantial thickness and has a central upwardly opening recess therein to rotatably accommodate the said disc-shaped element 29. The pointer 30 may be any suitable marking at the periphery of the element 29 to cooperate with the markings X in order to indicate the number of cents accumulatively added.

The drive gear 26 is carried by and depends from the element 29 to enter the chamber 13 on the center axis of the structure. As shown, the element 29 and related parts are secured to the frame A by a nut 26' cemented, or otherwise secured, to the lower end part of the gear 26. The driven gear 27 is in the form of an internal ring gear concentric with the ring C and carried in the recess 14 to occupy the channel formed at the periphery of the structure. The transfer gear 28 is rotatably carried in the chamber 13 on a bearing 21' that depends from the plate B on an axis offset from the central vertical axis of the frame A. It will be apparent from the foregoing that when the element 29 is rotated, the gear 26 operates the gear 27 through the transfer gear 28.

In accordance with the invention, the concentric ring C and driven gear 27 are carried together in the recess 14 and normally rotate therein as a unit. However, the ring C and gear 27 are separate parts, the gear 27 being rotatably supported by the frame A on the inner wall 14' of the recess 14, the ring C being rotatably carried over the gear 27. In practice the gear 27 has a round outer wall 31 that rotatably carries the ring C. Driving connection between the gear 27 and ring C is obtained by provision of the above mentioned clutch means J hereinafter described.

The control means E is provided to determine the direction of rotation imparted by the drive means D by means to the element 29. That is, the element 29 may be made effective to advance or may be made to retract depending upon the setting of the control means E by manipulation of the person using the machine. The control means E is preferably a reversible ratchet type means carried by the element 29 and involves generally, a cap 35, a reversible driver element 36, a positioning means 37 for the driver element 36, and a controller 38 for reversing the driver 36. In practice, the element 29 is provided with a central upstanding boss 39, the cap 35 being a shell-like part that is rotatably carried over the boss 39. The boss 39 is a round part that rotatably supports the cap 35 the cap being retained in working position by a bearing element 40 secured to the uppermost face of the boss by means of pins 41 or the like. The bearing element 40 has a lip that retains the cap in operating position on the boss 39. The boss 39 has a transversely disposed guideway 43, as shown, that extends diametrically of the boss 39 to shiftably receive the reversible driver 36, and the cap 35 is characterized by a cylindrical peripheral wall 44 provided with a continuous series of teeth 45, or the like, to be engaged by the driver 36.

The driver element 36 is a reversible part shiftably carried in the guideway 43 and adapted to have driving engagement with the teeth 45 on the wall of the cap 35. The driver 36 is in the nature of a slide and in the form of an elongate bar with drivers 46 and 47 at the opposite ends thereof, respectively (see Fig. 4). The driver element 36 is shiftable transversely of the boss 39 and is retained in the guideway 43 by means of rails 48 at the sides of the guideway. As clearly shown in Fig. 4 of the drawings, the driver 36 is positioned to operate transversely of the boss 39 and it may be shifted between diametrically opposite positions as indicated by the arrow in order to operate alternately to bring the driver 46 or 47 into driving engagement with the teeth 45.

A feature of the present invention is the provision of the drivers 46 and 47, the driver 46 being adapted to operate to drive the element 29 in a clockwise direction, and the driver 47 being adapted to operate to drive the element 29 in a counterclockwise direction. Except for the direction of rotation involved, the drivers 46 and 47 are alike and each involves, generally, a gear 50 carried on a shaft 51, and means 52 controlling rotation of the gear 50. As shown, the shaft 51 projects vertically from the end portion of the driver element 36 and rotatably carries the gear 50 which is adapted to mesh with the teeth 45 on the inner face of the wall 44. The means 52 controls rotation of the gear 50 whereby the gear 50 is free to rotate in one direction and is locked against rotation in the other direction. In the preferred form of the invention the means 52 involves a friction type ratchet wherein the motion is transmitted by frictional resistance. The particular means 52, best illustrated in Fig. 7 of the drawings, involves a roller 53 operating between the gear 50 and the shaft 51. The roller 53 is carried in a pocket formed in the gear 50, said pocket having an inclined peripherally disposed face 54 causing the roller 53 to be wedged between the gear 50 and shaft 51 when the gear is turned in one direction, but free when the gear is turned in the other direction. The roller 53 is biased by means of a spring or body 56 of resilient material, such as rubber or the like, so that the gear has immediate driving engagement when turned in a driving direction. It will be apparent that manual turning of the cap 35 operates one of the drivers 46 or 47, depending upon which driver is in engagement with the teeth 45.

The positioning means 37 for shifting the driver element 36 yielding urges the driver element 36 in one direction or the other longitudinally of the guideway 43 to alternately bring the drivers 46 or 47 into engagement with the cap 35. The positioning means 37 is operatively connected with the driver element 36 through a stem 55

that projects upwardly from the driving element **36** intermediate the ends thereof. The means **37** is in the form of a spring, preferably a leaf spring **57** that extends through the stem **55** transversely of the element **36** and which is carried in a recess in the boss **39**, as shown. It will be apparent, from Fig. 4 of the drawings, how the driver element **36** is yieldingly operated from one position to the other by action of the spring **57**.

The controller **38** for reversing the driver element **36** may be any manually engageable part and is preferably a simple button-shaped part manually engageable at the exterior of the structure. In practice, there is an elongate opening **58** in the bearing that passes the stem **55**, and the controller **38** is carried by the stem **55**. Manual pressure exerted on the button-shaped controller **38** moves the driver element between the alternate positions where the driver element **36** is held by the positioning means **37** above described.

The detent means F, as illustrated in Fig. 5 of the drawings, is provided to position the element **29** in order to stop it at each increment or marking X on the face **17** of the plate B. In accordance with the invention, a pointer **60** projects radially from the cap **35** to cooperate with the markings X above described. In order to add or subtract, the pointer **60** is brought to the zero marking X (see Fig. 1) and is then advanced to the figure or marking to be added or subtracted after which the pointer is brought back to the zero marking. The element **29** and pointer **30**, above referred to, will advance or retract and will indicate the sum of repeated operations at the markings X. The detent means F may vary widely in form and construction and is preferably a simple spring element **61** anchored in the element **29** to revolve therewith. The spring element **61** has a projection facing radially outwardly in order to engage with indentations **62** in the peripheral wall of the recess formed in the plate B to receive the element **29**. In practice, there is one indentation **62** at or for each marking X to the end that the pointer **60** and also the pointer **30** will stop at any one of said markings X.

The detent means G for the control means E is illustrated in Fig. 4 and is provided to position the cap **35** in order to stop the pointer **60** at each increment or marking X on the face **17** of the plate B. The detent means G is preferably like the means F and involves a simple spring element **63** anchored in the boss **39** of element **29** to revolve therewith. The spring element **63** has a projection facing radially outwardly in order to engage with the teeth **45** in the peripheral wall of the cap **35**. In practice, there is one tooth **45** at or for each marking X and each tooth **45** registers with an indentation **62**, as above described, to the end that the pointer **60**, as well as the pointer **30**, will stop at any one of said markings X.

The ratchet stop H for the drive D is provided to stop the cap **35** at the zero marking X, and allows the pointer **60** to advance over said zero marking. As best illustrated in Figs. 5 and 8, the stop H involves an abutment **64** to engage and cooperate with the pointer **60**. The abutment **64** has a clockwise disposed face adapted to engage and stop the pointer **60** when it is returned to the zero marking X, and it has an inclined face adapted to allow the pointer **60** to be advanced by the said zero marking X. As shown, the abutment **64** is a simple boss projecting from the face **17**, there being resilience in the parts involved that allows for the pointer **60** to be deflected to advance over the abutment **64**.

The clutch means J acting between the drive means D and the sum indicator ring C normally provides connection between the gear **27** and the ring C, but allows slippage therebetween when it is desired to rotate the ring C independently of the gear **27**. The clutch means J, as illustrated in Fig. 3, preferably involves a simple spring element **65** anchored in the gear **27** to revolve therewith. The spring element **65** has a projection facing radially outwardly in order to engage with indentations **66** in the inner wall of the indicator ring C. In practice, there is one indentation **66** at or for each marking Y to the end that the ring C will advance or retract one step or one marking Y at a time. Turning force is easily applied to the ring C by manually engaging a radially projecting lug **67** located at the zero marking Y. It will be apparent how the spring element **65** will yield to sufficient pressure in order to allow the clutch means J to let the ring C slip relative to the gear **27**.

From the foregoing, it will be observed that I have provided an improved and very compact easily operated adding machine that is convenient to operate and which accurately compiles and accumulates figures to the end that the total sum is readily observed at any time. With the structure that I provide a minimum number of easily formed parts are involved commensurate with the functions attained, resulting in economy of manufacture. The pointer **60** is operated by manipulation of the cap **35** while the pointer **30** compiles the sum of the figures as they accumulate. Further, the sum indicator ring C is advanced or retracted as the element **29** is operated to the end that the number of dollars accumulated is also compiled as indicated by the visible marking Y. It is also a simple matter to reset the machine by simply turning the pointers **30** and **60** to the zero marking X, and by moving the ring C to a zero position by slipping the clutch means J. With the mechanism at the zero position or beginning point it is again ready to operate.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and fall within the scope of the following claims.

Having described my invention I claim:

1. An adding machine of the character described including, a frame with a peripheral recess therein, a sum indicating ring rotatably carried in the recess, drive means rotating the ring and including a drive gear driven by a manually operable element and a driven gear at the inner periphery of the ring, a releasable clutch coupling the ring and driven gear, and a reversible ratchet control for the drive means determining the direction of rotation of the ring.

2. An adding machine of the character described including, a frame with a peripheral recess therein, a sum indicating ring rotatably carried in the recess, drive means rotating the ring and including a drive gear driven by a manually operable element and a driven gear rotatably carried in the recess concentric with the ring, a releasable clutch coupling the ring and driven gear, and a reversible ratchet control for the drive means determining the direction of rotation of the ring.

3. An adding machine of the character described including, a frame with a peripheral recess therein, a sum indicating ring rotatably carried in the recess, a cover overlying the frame and retaining the ring in operating position, drive means rotating the ring and including a drive gear driven by a manually operable element and a driven gear rotatably carried in the recess concentric with the ring, a detent means for incrementally positioning the manually operable element, a releasable clutch coupling the ring and driven gear, and a reversible ratchet control for the drive means determining the direction of rotation of the ring.

4. An adding machine of the character described including, a frame with a peripheral recess therein, a sum indicating ring rotatably carried in the recess, a cover overlying the frame and retaining the ring in operating position, a sum indicating drive element rotatably carried by the cover, drive means rotating the ring and including a drive gear operated by said drive element and a driven gear rotatably carried in the recess concentric with the ring, a detent means for incrementally position-

ing the drive element, a manually operable drive cap rotatably carried by the drive element, a detent means for incrementally positioning the drive cap, a releasable clutch coupling the ring and driven gear, and a reversible ratchet control for coupling the cap and drive element determining the direction of the drive.

5. An adding machine of the character described including, a frame with a peripheral recess therein, a sum indicating ring rotatably carried in the recess, drive means rotating the ring and including a drive gear driven by a manually operable element and a driven gear including, a manually shiftable driver, and a pair of gears carried by the driver and engageable with the manually operable element, said gears being ratcheted in opposite directions to determine the direction of rotation of the ring.

6. An adding machine of the character described including, a frame with a peripheral recess therein, a sum indicating ring rotatably carried in the recess, a cover overlying the frame and retaining the ring in operating position, a sum indicating drive element rotatably carried by the cover, drive means rotating the ring and including a drive gear operated by said drive element and a driven gear at the inner periphery of the ring, and a reversible ratchet control for the drive means including, a manually shiftable driver carried by the drive element, and a pair of gears carried by the driver and alternately engaged by a manually operable element, said gears being ratcheted in opposite directions to determine the direction of rotation of the ring.

7. An adding machine of the character described including, a frame with a peripheral recess therein, a sum indicating ring rotatably carried in the recess, a cover overlying the frame and retaining the ring in operating position, a sum indicating drive element rotatably carried by the cover, drive means rotating the ring and including a drive gear operated by said drive element and a driven gear at the inner periphery of the ring, and a reversible ratchet control for the drive means including, a manually positioned driver carried by the drive element to shift transversely thereof, and a pair of gears one rotatably carried at each end of the driver and alternately engaged by a manually operable element, said gears being ratcheted in opposite directions to determine the direction of rotation of the ring.

8. An adding machine of the character described including, a frame with a peripheral recess therein, a sum indicating ring rotatably carried in the recess, a cover overlying the frame and retaining the ring in operating position, a sum indicating drive element rotatably carried by the cover, drive means rotating the ring and including a drive gear operated by said drive element and a driven gear rotatably carried in the recess concentric with the ring, a detent means for incrementally positioning the drive element, a manually operable drive cap rotatably carried by the drive element, a detent means for incrementally positioning the drive cap, a releasable clutch coupling the ring and driver gear, a ratchet stop preventing the manually operable element from being retracted beyond a predetermined rotative point, and a reversible ratchet control for coupling the cap and drive element including, a manually positioned driver carried by the drive element to shift transversely thereof, and a pair of gears one rotatably carried at each end of the driver and alternately engaged by a manually operable element, said gears being ratcheted in opposite directions to determine the direction of rotation of the ring.

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