Feb. 7, 1967 J. FOX 3,302,876

COMPACT CALCULATING MACHINE

Filed Sept. 3, 1965 2 Sheets-Sheet 1

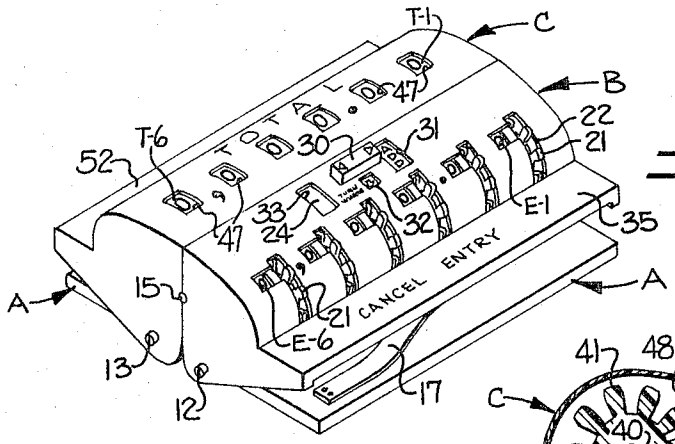


Fig-1

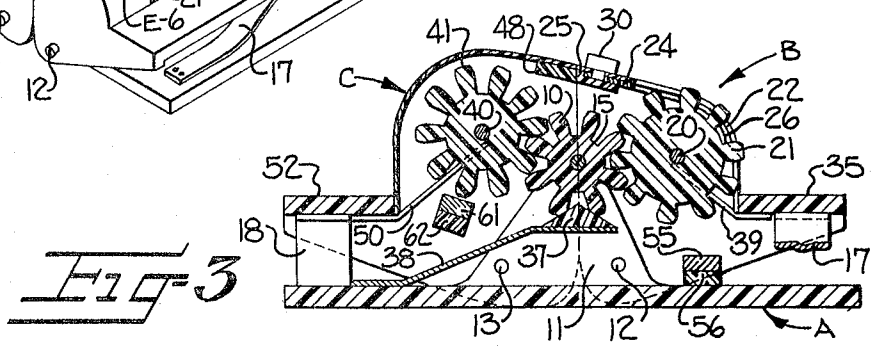


Fig-3

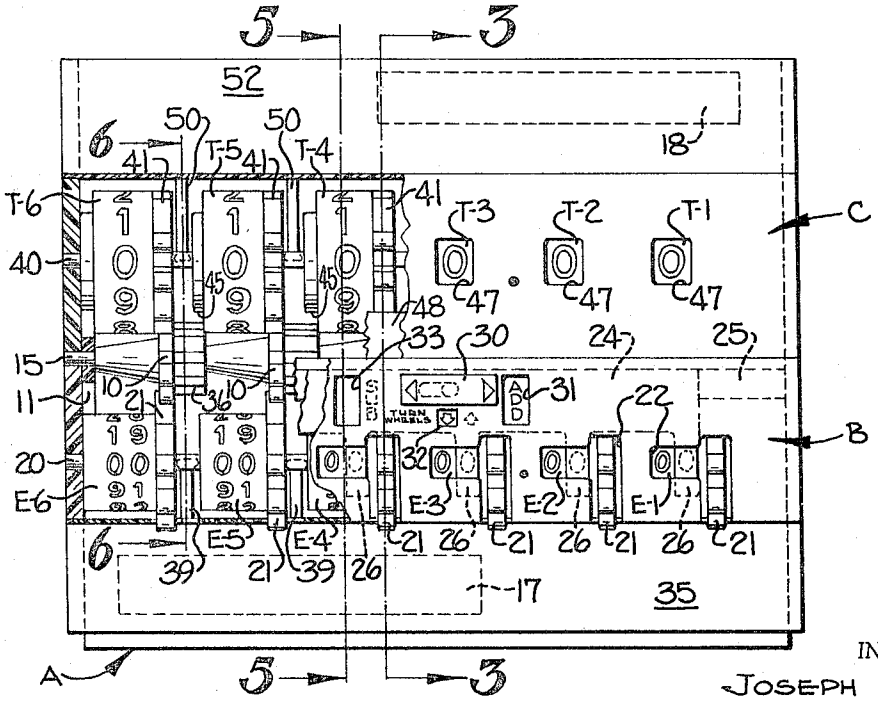


Fig-2

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COMPACT CALCULATING MACHINE

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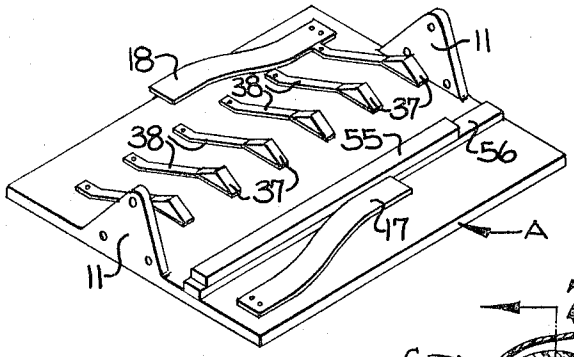


Fig-4

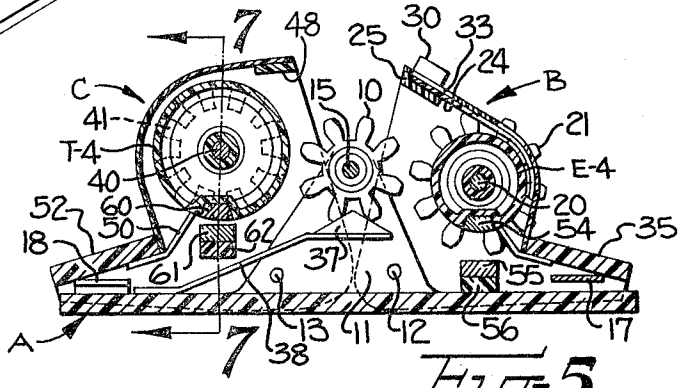


Fig-5

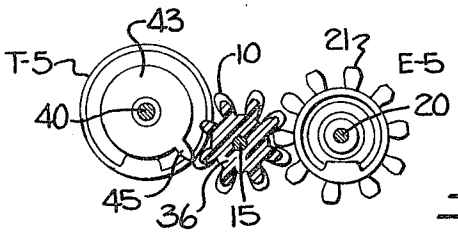


Fig-6

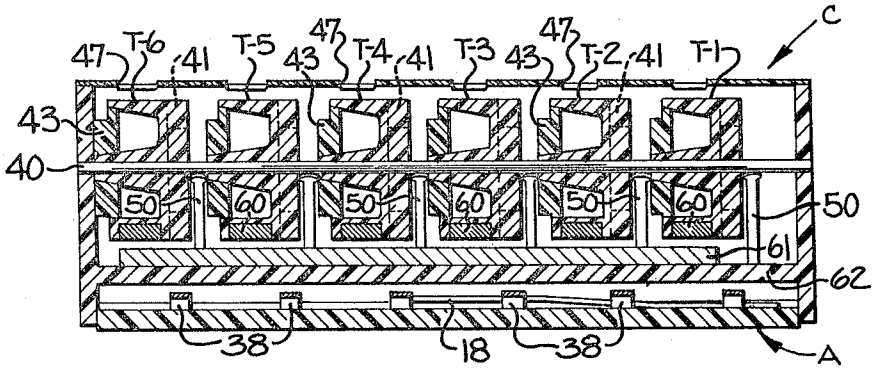


Fig-7

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COMPACT CALCULATING MACHINE

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15 Claims. (Cl. 235—80)

This invention relates generally to calculating machines and more particularly to a compact calculating machine which may be used to carry out mathematical operations in the home or office.

There are many different types of complex and expensive calculating machines presently available. However, these complex calculating machines are not in wide use in homes and small offices because their infrequent use does not justify the relatively high purchase price.

With the foregoing in mind, it is a primary object of this invention to provide a compact calculating machine which is of extremely simple design and construction and which can be manufactured economically so that it may be sold for a price that is economically justifiable to permit its purchase and wide use by housewives and small businesses where accurate mathematical operations are necessary on certain occasions.

It is a more specific object of this invention to provide a small calculating machine of the type described which includes a series of numbered entry wheels that may be rotated to enter a set of digits and to provide a visual indication of each set of digits entered, a series of numbered total wheels that are rotated in response to rotation of the entry wheels and which also provide a visual indication of the accumulated total following the entry of each set of digits, a series of transfer pinions positioned between the entry wheels and the total wheels and normally providing a driving connection therebetween, and simple means associated with the entry wheels and the total wheels for returning the entry wheels to the zero position following each entry without affecting the position of the total wheels and for returning the total wheels to the zero position following the completion of each mathematical operation.

It is another object of this invention to provide a compact calculating machine of the type described wherein the cancellation of each entry, as well as the cancellation of the total, is automatically carried out by movement of the respective entry wheels and total wheels away from the transfer pinions, the cancellation operation being automatically effected to return both the total wheels and the entry wheels to the zero position by means of magnetic forces acting to rotate the wheels to the zero position.

It is still another object of the present invention to provide a compact calculating machine of the type described wherein special spacer plates or fingers are provided to maintain the proper spacing between the entry wheels and the total wheels while reducing friction to a minimum as the wheels are rotated on their respective common shafts.

It is yet another object of the present invention to provide simplified means whereby the present calculating machine may be used in either addition or subtraction operations, said means including two sets of digits arranged in reverse order from zero to nine on each of the entry wheels, and a sliding shutter arrangement for selectively exposing the sets of digits on the entry wheels.

It is an additional object of the present invention to provide a compact calculating machine of the type described which includes a simplified carry-over device that reduces to a minimum the force necessary to effect a relatively large carry-over of the total wheels. In the present machine the size of the carry-over pinion relative to the transfer pinion and to the single carry-over tooth on each total wheel is such that a small force is required to move the next succeeding total wheel one step in rotation when the preceding total wheel moves from the nine position to the zero position during an addition operation or from the zero position to the nine position in a subtraction operation.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which—

FIGURE 1 is an isometric view of the compact calculating machine of the present invention;

FIGURE 2 is a top plan view of the calculating machine shown in FIGURE 1, with parts broken away to illustrate the intermeshing relationship of the entry wheels, the total wheels and the transfer pinions;

FIGURE 3 is a transverse vertical sectional view taken substantially along the line **3—3** in FIGURE 2;

FIGURE 4 is an isometric view of the base of the calculating machine and illustrating some of the parts attached thereto;

FIGURE 5 is a transverse vertical sectional view taken substantially along the line **5—5** in FIGURE 2, but illustrating the entry wheels and total wheels moved outwardly away from the transfer pinions, as would occur during a cancellation operation of both sets of wheels;

FIGURE 6 is a fragmentary transverse sectional view taken substantially along the line **6—6** in FIGURE 2 and illustrating the manner in which the single carry-over tooth on one of the total wheels engages the carry-over pinion; and

FIGURE 7 is a longitudinal vertical sectional view taken substantially along the line **7—7** in FIGURE 5, and illustrating the manner in which the total wheels are supported for rotation in the calculating machine.

Referring particularly to the drawings, a preferred embodiment of the present calculating machine is illustrated and generally includes a base A having an entry housing B and a total housing C (FIGURE 1) supported for pivotal movement thereon. A series of rotatable numbered entry wheels E–**1** through E–**6** is supported within the entry housing B and a corresponding series of rotatable numbered total wheels T–**1** through T–**6** is supported within the total housing C. A series of transfer pinions **10**, only two of which are shown in FIGURE 2, is rotatably supported on the base A and drivingly connect the entry wheels E with the corresponding total wheels T, when the entry housing B and the total housing C are in the positions shown in FIGURES 1–3, to impart rotation to the total wheels upon movement of the entry wheels, in a manner to be described in detail presently.

As a non-limiting example of the compact nature of the present calculating machine, the base A (FIGURE 4) preferably measures less than six inches in each direction. The medial portion of each end of the base A is provided with upstanding bearing plates **11** on which the lower opposite end portions of the entry housing B and the total housing C are pivotally supported, as it **12**, **13**, respectively (FIGURES 1 and 3).

Opposite ends of a transfer pinion support shaft **15** are supported in the upper ends of the bearing plates **11**. As shown in FIGURE 2, the ends of the shaft **15** extend outwardly beyond the bearing plates **11** and provide a stop against which the inner edge portions of each end of the housings B and C engage (FIGURE 1). The entry housing B and the total housing C are normally resiliently urged to the inner positions shown in FIGURES 1 and 3, with their adjacent inner edges in abutting relationship, by means of respective leaf spring members **17** and **18** (FIGURE 4). The spring members **17**, **18** are suitably secured at one end to the base A and the other ends engage the outer portions of the respective entry housing B and total housing C to normally move the same together, as shown in FIGURES 1–3.

Each of the entry wheels E is provided with two side-by-side sets of digits from zero to nine, arranged in reverse order (FIGURE 2). The sets of digits are preferably different colors and the entry wheels E are each supported for free rotation on a shaft 20. Opposite ends of the shaft 20 are suitably supported in opposite end portions of the entry housing B. Each of the entry wheels E includes an entry wheel gear 21 which is preferably formed integrally therewith. The entry wheel gears 21 have outwardly extending teeth that correspond in number to the digits on the entry wheels E. The medial curved portion of the housing B is provided with a cutout 22 at each of the entry wheels E to provide a window or viewing opening through which a selected digit on the corresponding entry wheel is visible and to also provide an opening through which the uppermost teeth of the gears 21 protrude so that manual rotation may be imparted to the entry wheels E.

A shutter plate 24 (FIGURE 2) is supported in a slide 25 for longitudinal shifting movement in the housing B. The shutter plate 24 is provided with spaced apart cover extensions 26 that extend down and cover one set of digits on the entry wheels E, for purposes to be presently described. The shutter plate 24 may be shifted to the position shown in FIGURE 2 to cover the right-hand set of digits by means of a control knob 30 that is preferably provided with indicator arrows at opposite ends.

Viewing windows 31 and 32 are also provided in the entry housing B (FIGURE 2) to expose certain instructions and when the shutter plate 24 is shifted to the position shown in FIGURE 2, the word "ADD" appears in the window 31 to indicate the type of mathematical operation which is to take place while a downwardly pointing arrow appears in the window 32 to indicate the direction in which the gears 21 of the entry wheels E should be turned to set each digit of each number to be added.

An additional viewing window 33 is provided in the housing B so that when the shutter plate 24 is shifted to the left of the position shown in FIGURE 2, to cause the extensions 26 to cover the left-hand set of digits on the entry wheels E, the word "SUB" will appear therein and indicate that a subtracting operation is being carried out. As the shutter plate 24 is shifted to the left from the position shown in FIGURE 2, the word "SUB" will appear in the window 33, the word "ADD" will move out of the window 31, and the wheel turning indicator that points upwardly, indicated in dotted lines in FIGURE 2, will move into the window 32 to indicate that the gears 21 of the entry wheels E should be moved upwardly during a subtracting operation.

As best shown in FIGURE 1, the outer portion of the housing B is provided with a flat shelf portion or cancel plate 35. Depressing this cancel plate 35 with the fingers will cause the entry housing B to swing on its pivot points 12 and move to the "cancel" position shown in FIGURE 5, for purposes to be presently described. As soon as pressure on the cancel plate 35 is released, the leaf spring 17 will move the entry housing B back to the position shown in FIGURE 3 and resiliently maintain the same in this position.

The left-hand side of each of the transfer pinions 10 (FIGURE 2) is formed with a tapered hub portion which act as spacers between the pinions 10. The right-hand side of each transfer pinion 10 has a carry-over pinion 36 that is preferably formed integral therewith. It will be noted in FIGURE 6 that both the transfer pinion 10 and the carry-over pinion 36 have the same number of teeth and that the carry-over pinion 36 has a smaller diameter than the transfer pinion 10 to aid in overcoming the mechanical disadvantage occurring in a carry-over operation, in a manner to be presently described.

As best shown in FIGURE 3, when the entry housing B is in the uppermost or "operative" position, the entry wheel gear teeth 21 are in engagement with the teeth of the transfer pinion 10 and a cam 37 resiliently engages adjacent teeth of the transfer pinion 10. The cam 37 is supported on one end of a leaf spring 38, the opposite end of which is suitably secured on the base A. The cam 37 resiliently maintains the transfer pinion 10 and the entry wheel E in the desired position after entry of each number and also aids in the proper positioning of the digits on the entry wheel E in the windows 22 as they are manually rotated. The entry wheels E are maintained in properly spaced relationship on the shaft 20 by means of spacer fingers 39, only two of which are shown in FIGURE 2, that are connected at their outer ends to the entry housing B.

Each of the total wheels T is provided with a single row of digits from zero to nine and is supported for rotation on a longitudinal shaft 40 which is supported at opposite ends in the end portions of the total housing C. Each of the total wheels T–1 through T–6 has a total wheel gear 41 on its right-hand side that is preferably formed integrally therewith (FIGURE 7). The gear 41 is drivingly engaged with the corresponding entry wheel gear 21 by means of the transfer pinion 10 when the housings B and C are maintained in the position shown in FIGURES 1–3.

The left-hand side of each of the total wheels T–1 through T–6 has a disk closure plate 43 (FIGURE 7) fixed therein and a single carry-over tooth 45 (FIGURE 6) is integrally formed on each of the closure plates 43. The single carry-over tooth 45 is positioned to engage and rotate the corresponding carry-over pinion 36 one step each time that one of the total wheels T moves from the nine position to the zero position during an addition operation, or from the zero position to the nine position during a subtraction operation. As the carry-over pinion 36 is moved one step by the carry-over tooth 45, it moves the next total wheel gear 41 and total to the next digit.

The carry-over pinion 36 is slightly smaller in diameter than the transfer pinion 10 with which it is associated. The slightly larger diameter of the latter produces a greater circumferential velocity, causing the total wheel T to rotate very slightly faster than the initially-moved wheel to which the long tooth 45 was attached. This small amount of extra velocity, transmitted to the next carry-over pinion 36 (when several total wheels are in position 9, during addition, or zero, during subtraction) is increased again by the differential between this second carry-over pinion and its associated transfer pinion. The result is that in a sequence of carry-over movements involving two or more wheels, the last wheel begins to move last, but arrives at its new position first, while the initially-moved wheel, beginning first, is the last to arrive at its new position. By such means, mechanical disadvantage, which would interfere if all pinions were of identical size, is overcome to insure that successful carry-over, even of all wheels, can in fact be accomplished.

The total housing C is provided with viewing windows 47 (FIGURE 2) through which one of the uppermost digits on each of the total wheels T may be observed. The total housing C is preferably provided with a strengthening rib 48 which extends along the lower inner edge thereof. The total wheels T are supported for free rotation on the shaft 40 and are maintained in the proper spaced apart relationship by a plurality of spacer fingers 50, only two of which are shown in FIGURE 2, that are connected at their outer ends to the total housing C. The spacer fingers 50 are wider at their inner ends so that only a small surface engages the adjacent surfaces of the gears 41 and closure plates 43 at a point closely adjacent the shaft 40 to thereby reduce the amount of friction on the total wheels T. The inner ends of the spacer fingers 39 (FIGURE 2) are also wider to reduce the friction on the entry wheels E.

The outer portion of the housing C has a flat portion forming a total canceling plate 52 that may be depressed by the fingers of the operator to swing the housing C

from the operative position shown in FIGURE 3 to the cancel position shown in FIGURE 5. When the housing C is pivoted to the cancel position, the teeth of the total gears **41** move out of engagement with the teeth of the corresponding transfer pinions **10**, as shown in FIGURE 5, so that the total wheels T are then free to return to the zero position in a manner which will now be described.

Magnetic forces are utilized to return the entry wheels E and the total wheels T to the zero position and for this reason, as well as for economy and ease of manufacture, all of the parts heretofore described are formed of non-ferrous material, such as wood, plastic, brass, aluminum, etc. It is preferred that a small magnetically attractable weight **54**, such as steel, be fixed in each of the entry wheels E and a bar type permanent magnet **55** is fixed on a spacer bar **56** to extend beneath each of the entry wheels E.

The weights **54** are positioned on the entry wheels E in the proper position so that when the housing B is moved to the cancel position the magnetic force of the bar magnet **55** will attract the weights **54** and immediately cause rotation of the entry wheels E to the position shown in FIGURE 5, so that the zero digits appear in the window openings **22** in the entry housing B. The forces of gravity acting on the weights **54** will also aid in rotating the entry wheels to the zero position.

As shown in FIGURES 5 and 7, each of the total wheels T is also provided with a magnetically attractable weight **60** and a bar type permanent magnet **61** is fixed on a support bar **62** which is in turn fixed at its opposite end to opposite ends of the total housing C. The weights **60** are properly positioned in the total wheels T so that when they are aligned above the magnet **61**, as shown in FIGURE 5, the zero digits on the total wheels appear in the windows **47** in the housing C.

Each of the entry wheels E and each of the total wheels T has been described as being provided with a magnetically attractable weight and a bar type permanent magnet is positioned beneath the series of entry wheels E and the series of total wheels T. However, it is to be understood that a small magnet may be provided in each of the entry wheels E and each of the total wheels T. Similarly, individual magnets may be substituted for the bar type permanent magnets under the series of entry wheels E and total wheels T, if desired. In either case, the magnets cause a positive rotation of the total and entry wheels to return and hold them in the zero position when the corresponding housing is pivoted to effect a cancellation. When the housings are subsequently returned to the position shown in FIGURE 3, the gears of the entry and total wheels will properly mesh with the teeth of the transfer pinions **10**, the entry and total wheels being held in the zero position by the magnets.

Operation

To add a series of numbers, the machine must first be "cleared" by depressing both the plate **35** and the plate **52** to pivot both of the housings B and C outwardly to the position shown in FIGURE 5 so that the entry wheels E and the total wheels T will automatically return to the position where zeros appear in the respective windows **22, 47**. With outward pivotal movement of the housings B and C, the entry wheels E and total wheels T will automatically return to zero as their corresponding gears are disengaged from the transfer pinions **10** and the weights **54** and **60** are attracted to the respective magnets **55** and **61**.

The shutter shifting knob **30** must be moved to the position shown in FIGURE 2 so that the word "ADD" appears in the window **31** and the right-hand set of digits on the entry wheels E is covered by the shutter fingers **26**. Then, the entry wheels E are manually rotated downwardy, as indicated in the window **32**, until the digits corresponding to the digits of the first number to be added appear in the windows **22**. The total wheels T will also be automatically rotated like amounts by means of the transfer pinions **10**, so that the same digits will appear in the windows **47**.

After the first number to be added is set or entered on the wheels E, the cancel plate **35** is depressed so that the entry wheels E will automatically return to zero position as the housing B is pivoted outwardly to the position shown in FIGURE 5. However, the digits of the first number will remain on the total wheels T since the housing C remains in the positions shown in FIGURE 3 and these wheels are held in this position since the cams **37** remain in engagement with the transfer pinions **10**.

To enter the next number to be added, the gears **21** of the entry wheels E are again rotated downwardly in FIGURE 2 so that the digits of the second number to be added appear in the windows **22** of the housing B. As the entry wheels E are rotated, like rotation is imparted to the total wheels T and as soon as the entry is set on the wheels E, the sub-total of the two numbers entered will appear in the total windows **47** of the housing C. In the event one of the digits entered on one of the wheels E of this second number is sufficiently large to rotate the corresponding total wheel from nine to zero, a carry-over will occur since the carry-over tooth **45** on the corresponding total wheel T will engage and rotate the carry-over pinion **36** and thereby move the corresponding transfer pinion one step in rotation to move the next succeeding total wheel T to the next higher digit.

After completing this second entry, the plate **35** is again depressed so that the entry wheels E automatically return to the zero position, in preparation for entering the digits of the next number to be added. After the desired number of entries are made to complete the desired addition, the total may be observed in the windows **47** and noted. Then, the total plate **52** is depressed so that the total wheels T will automatically return to zero, in preparation for the next mathematical operation.

In order to subtract one or more numbers from a total, the shutter plate **24** should be in the "ADD" position, as shown in FIGURE 2, to enter the minuend (the number to be subtracted from) in the windows **47** of the housing C by downward rotation of the gears **21** on the entry wheels E. Then, before subtracting the first number from the minuend, the knob **30** should be shifted to the left in FIGURE 2 to the "SUB" position so that the right-hand series of numbers is visible on the entry wheels E and the arrow in the turn wheel direction window **32** points upwardly. The number to be subtracted is then entered on the entry wheels by movement of the gears **21** in an upward direction and any necessary carry-over will occur as the total wheels move from zero to nine to cause a movement of the next succeeding total wheel. After the first number to be subtracted has been entered, the remainder will appear in the openings **47** and the entry is canceled by depressing the plate **35** to thus pivot the housing B. As the plate **35** is depressed to pivot the housing B, and move the same to the position shown in FIGURE 5, the entry wheel gears **21** are disengaged from the transfer pinions **10** so that the entry wheels E automatically return to the zero position, due to the magnetic force of the magnet **55**. If additional numbers are to be subtracted, they are entered in like manner.

It is contemplated that this compact calculating machine will be of particular value to housewives in checking their bank balance and in writing a series of checks. This can be easily accomplished by generally following the subtraction operation outlined above. By this method, the shutter plate **24** is first placed in the "ADD" position and the balance from the checkbook is entered so that it appears in the total windows **47** and then the shutter plate **24** is moved to the left to the subtract position. As each check is written, it is entered on the entry wheels E so that the new balance appears in the total windows **47**. Each entry is canceled before a new entry is made and

after the declining bank balance is noted and entered in the checkbook. Thus, a balance is given after each check is written and the remaining balance is indicated after all checks have been written.

In operation of the present calculator, the numbers to be added or subtracted must be "entered" on the entry wheels E from left to right, in the same manner as they are normally written. For example, when a number such as 395 is to be entered, the entry wheel E–3 is first turned so that the digit 3 appears in the corresponding window 22. Then, the entry wheel E–2 is turned until the digit 9 appears and finally the entry wheel E–1 is turned until the digit 5 appears.

The numerals or digits on both the entry wheels E and the total wheels T are set up to carry out mathematical operations in the American numbering system. Since the American monetary system is based on the decimal system, this calculator will add and subtract both dollars and cents as well as regular numbers. As an aid in adding and subtracting money, a decimal point is preferably printed on the entry housing B between the entry wheels E–2 and E–3 (FIGURE 1) and a comma is printed between the entry wheels E–5 and E–6. The total housing C is also provided with a comma and decimal point in the positions corresponding to those on the entry housing B. However, it is to be understood that other types or arrangement of appropriate indicia may be used on these wheels so that the present calculating machine may be used in foreign countries when other numerical systems or symbols are used. It is also to be understood that a greater or lesser number of entry and total wheels than that shown may be utilized, if desired.

Since the operation is so simple, very little practice is required to become proficient in operating the compact calculating machine of the present invention. Also, the machine can be economically produced to provide a long useful life since it requires only a few basic parts which may be easily produced to operate efficiently.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. A compact calculating machine comprising
(a) a series of rotatable entry wheels numbered from zero to nine,
(b) a series of rotatable total wheels numbered from zero to nine,
(c) a series of transfer members supported for rotation on a common shaft, said common shaft being maintained in a fixed position on the machine, and said entry wheels and said total wheels being normally positioned in driving engagement with said transfer members,
(d) means supporting said entry wheels for movement away from said transfer members whereby said entry wheels move out of driving engagement with said transfer members,
(e) means operable in response to movement of said entry wheels away from said transfer members for automatically returning said entry wheels to the zero position, and
(f) means for returning said total wheels to the zero position.

2. A compact calculating machine comprising
(a) a series of rotatable entry wheels numbered from zero to nine,
(b) a series of rotatable total wheels numbered from zero to nine,
(c) a series of transfer members supported for rotation on a common shaft, said common shaft being maintained in a fixed position on the machine, and said entry wheels and said total wheels being normally positioned in driving engagement with said transfer members,
(d) means supporting said total wheels for movement away from said transfer members whereby said total wheels move out of driving engagement with said transfer members,
(e) means operable in response to movement of said total wheels away from said transfer members for automatically returning said total wheels to the zero position, and
(f) means for returning said entry wheels to the zero position.

3. A compact calculating machine comprising
(a) spaced apart series of rotatable entry wheels and total wheels numbered from zero to nine,
(b) a series of transfer members supported for rotation on a common shaft, said common shaft being maintained in a fixed position on the machine, and said entry wheels and said total wheels being normally positioned in driving engagement therewith,
(c) means supporting said entry wheels for movement away from said transfer members whereby said entry wheels move out of driving engagement with said transfer members,
(d) means operable in response to movement of said entry wheels away from said transfer members for automatically returning said entry wheels to the zero position,
(e) means supporting said total wheels for movement away from said transfer members whereby said total wheels move out of driving engagement with said transfer members, and
(f) means operable in response to movement of said total wheels away from said transfer members for automatically returning said total wheels to the zero position.

4. A compact calculating machine comprising
(a) a series of rotatable entry wheels numbered from zero to nine and including gears rotatable therewith,
(b) a series of rotatable total wheels numbered from zero to nine, said total wheels being spaced from said entry wheels and including gears rotatable therewith,
(c) a series of transfer pinions positioned between said entry wheel gears and said total wheel gears, said transfer pinions being supported for rotation on a common shaft, and said common shaft being maintained in a fixed position on the machine,
(d) means supporting said entry wheels for movement toward and away from said transfer pinions whereby said entry wheel gears move into driving engagement with said transfer pinions with movement of said entry wheels toward said pinions and whereby said entry wheel gears move out of driving engagement with said transfer pinions with movement of said entry wheels away from said pinions, and
(e) means associated with said entry wheels and operable in response to movement of said entry wheels away from said pinions for automatically returning said entry wheels to the zero position.

5. A compact calculating machine according to claim 4 wherein said means for rotating said entry wheels to the zero position upon movement of said entry wheels away from said pinions includes magnetic means associated therewith.

6. A compact calculating machine comprising
(a) a series of rotatable entry wheels numbered from zero to nine and including gears rotatable therewith,
(b) a series of rotatable total wheels numbered from zero to nine, said total wheels being spaced from said entry wheels and including gears rotatable therewith,
(c) a series of transfer pinions positioned between said entry wheel gears and said total wheel gears, said transfer pinions being supported for rotation on a

common shaft, and said common shaft being maintained in a fixed position on the machine,

(d) means supporting said total wheels for movement toward and away from said transfer pinions whereby said total wheel gears move into driving engagement with said transfer pinions with movement of said total wheels toward said pinions and whereby said total wheel gears move out of driving engagement with said transfer pinions with movement of said total wheels away from said pinions, and

(e) means associated with said total wheels and operable in response to movement of said total wheels away from said pinions for automatically returning said total wheels to the zero position.

7. A compact calculating machine according to claim 6 wherein said means for rotating said total wheels to the zero position upon movement of said total wheels away from said pinions includes magnetic means associated therewith, said magnetic means also being operable to hold said total wheels in position to move back into driving engagement with said transfer pinions upon movement of said total wheels back toward said pinions.

8. A compact calculating machine according to claim 6 including

(f) means supporting said entry wheels for movement toward and away from said transfer pinions whereby said entry wheel gears move into driving engagement with said transfer pinions with movement of said entry wheels toward said pinions and whereby said entry wheel gears move out of driving engagement with said transfer pinions with movement of said entry wheels away from said pinions, and

(g) means associated with said entry wheels and operable in response to movement of said entry wheels away from said pinions for automatically returning said entry wheels to the zero position.

9. A compact calculating machine according to claim 8 wherein said means (g) includes magnetic means operable to rotate said entry wheels to the zero position upon movement of said entry wheels away from said pinions, and wherein said means (e) also includes magnetic means operable to rotate said total wheels to the zero position upon movement of said total wheels away from said pinions, said magnetic means also being operable to hold said entry and total wheels in position to move back into driving engagement with said transfer pinions upon movement of said entry and total wheels back toward said pinions.

10. A compact calculating machine comprising

(a) a series of rotatable entry wheels numbered from zero to nine and including gears rotatable therewith,

(b) a series of rotatable total wheels numbered from zero to nine, said total wheels being spaced from said entry wheels and including gears rotatable therewith,

(c) a series of rotatable transfer pinions positioned between said entry wheel gears and said total wheel gears,

(d) a series of carry-over pinions rotatable with said transfer pinions,

(e) means supporting said total wheels for movement toward and away from said transfer pinions whereby said total wheel gears move into driving engagement with said transfer pinions with movement of said total wheels toward said pinions and whereby said total wheel gears move out of driving engagement with said transfer pinions with movement of said total wheels away from said pinions,

(f) a single carry-over tooth carried by each of said total wheels and engageable with the corresponding carry-over pinion to impart a step in movement to the adjacent total wheel upon one complete revolution of any one of said total wheels,

(g) means associated with said total wheels and operable in response to movement of said total wheels away from said pinions for returning said total wheels to the zero position,

(h) means supporting said entry wheels for movement toward and away from said transfer pinions whereby said entry wheel gears move into driving engagement with said transfer pinions with movement of said entry wheels toward said pinions and whereby said entry wheel gears move out of driving engagement with said transfer pinions with movement of said entry wheels away from said pinions, and

(i) means associated with said entry wheels and operable in response to movement of said entry wheels away from said pinions for returning said entry wheels to the zero position.

11. A compact calculating machine comprising

(a) a series of rotatable entry wheels having two sets of side-by-side numbers from zero to nine with one set of numbers being in reverse order from the other set, said entry wheels including a gear rotatable therewith,

(b) a series of rotatable total wheels numbered from zero to nine, said total wheels being spaced from said entry wheels and including gears rotatable therewith,

(c) a series of rotatable transfer pinions positioned between said entry wheel gears and said total wheel gears,

(d) a housing supporting said entry wheels for movement toward and away from said transfer pinions whereby said entry wheel gears move into driving engagement with said transfer pinions with movement of said housing toward said pinions and whereby said entry wheel gears move out of driving engagement with said transfer pinions with movement of said housing away from said pinions,

(e) means associated with said entry wheels and operable in response to movement of said entry wheels away from said pinions for returning said entry wheels to the zero position, and

(f) a shutter plate supported for longitudinal shifting movement on said housing and including spaced apart extensions adapted to selectively cover one set of numbers on each of said entry wheels.

12. A compact calculating machine comprising

(a) a base and a series of transfer pinions extending longitudinally of and supported on said base,

(d) an entry housing supported for pivotal movement on one side of said base,

(e) a total housing supported for pivotal movement on the other side of said base,

(f) a series of rotatable numbered entry wheels carried by said entry housing and including gears rotatable therewith,

(g) a series of rotatable numbered total wheels carried by said total housing and including gears rotatable therewith,

(h) resilient means normally urging said entry housing and said total housing toward the center of said base and into abutting relationship with each other whereby said entry wheel gears and said total wheel gears are normally maintained in driving engagement with said transfer pinions, and whereby said entry wheel gears and said total wheel gears move out of driving engagement with said transfer pinions with respective pivotal movement of said entry housing and said total housing away from said pinions,

(i) means associated with said entry wheels and being operable in response to pivotal movement of said entry housing away from said transfer pinions for returning said entry wheels to a predetermined position, and

(j) means associated with said total wheels and being operable in response to pivotal movement of said total housing away from said transfer pinions for

returning said entry wheels to a predetermined position.

13. A compact calculating machine according to claim 12 wherein said means (i) and (j) each include magnets operable to rotate said entry wheels and said total wheels to said predetermined position with respective pivotal movement of said entry housing and said total housing.

14. A compact calculating machine according to claim 13 wherein a bar magnet is supported and extends below said series of entry wheels, a magnetically attractable weight is carried by each of said entry wheels, a bar magnet is supported and extends below said series of total wheels, and a magnetically attractable weight is carried by each of said total wheels.

15. A compact calculating machine according to claim 13 including resilient means in engagement with said transfer pinions to resiliently maintain said entry wheels and said total wheels in the set positions until the corresponding entry and total housings are moved away from said pinions to return said entry and total wheels to said predetermined position, said resilient means also aiding in the proper positioning of the numbers on said entry wheels during a mathematics operation.

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