Dec. 10, 1968 A. HEYER 3,415,447

COMPUTING MACHINE

Filed Oct. 27, 1966 3 Sheets-Sheet 1

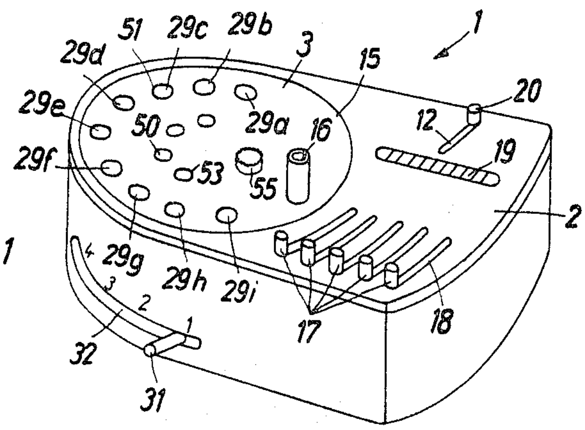

Fig. 1

Fig. 2

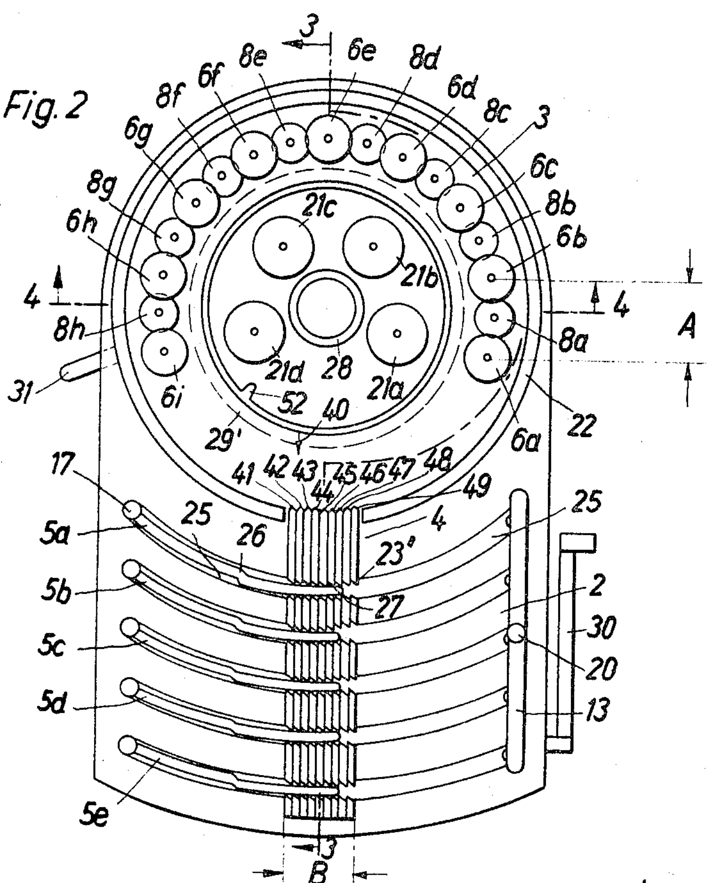

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Fig. 3

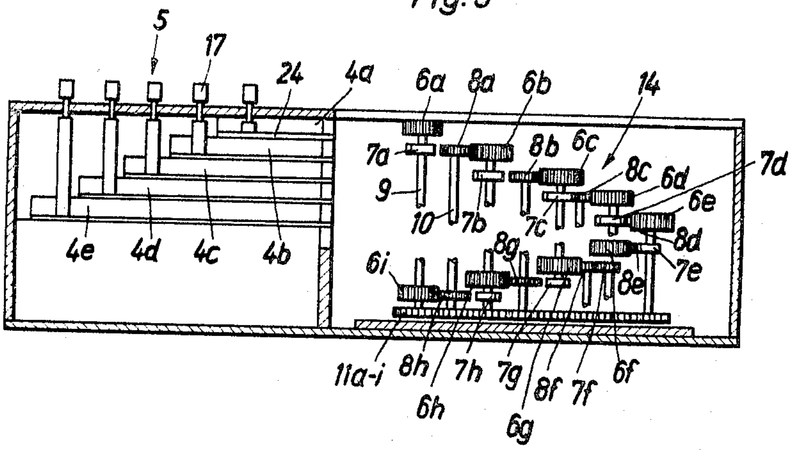

Fig. 6

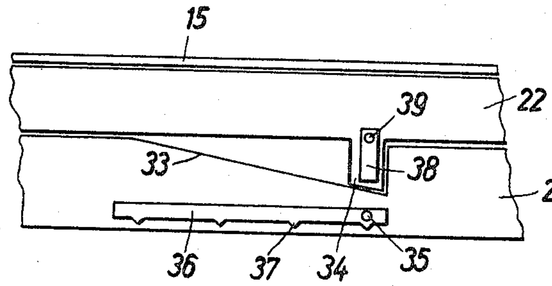

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Fig. 4

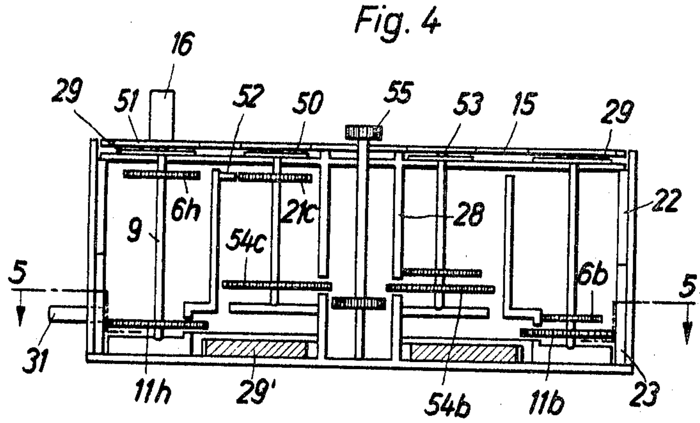
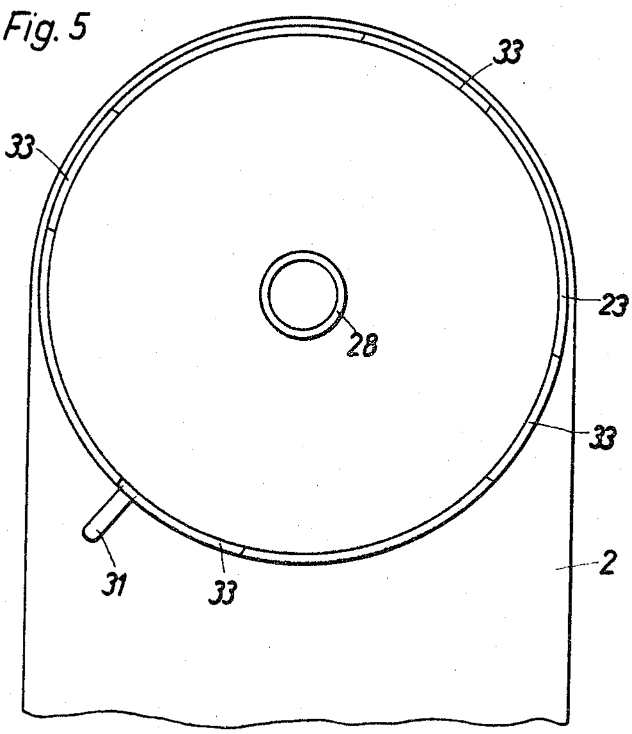


Fig. 5



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3,415,447
COMPUTING MACHINE

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Filed Oct. 27, 1966, Ser. No. 589,989
Claims priority, application Germany, Oct. 28, 1965, H 57,540
13 Claims. (Cl. 235—60)

The present invention relates to a computing or calculating machine of the type comprising a totalizer having totalizer wheels, an actuating mechanism adapted to actuate the totalizer and counting means for counting the number of actuations. Calculating machines of this type are capable of performing addition, subtraction, multiplication and division.

It is the primary object of the present invention to provide a miniaturized machine of this type which is so small and compact that a person can carry it conveniently in his pocket. It is a further object to provide a small portable calculating machine which in spite of its miniaturized dimensions is of rugged and simple structure ensuring reliable operation and long life.

Finally, it is an object of the present invention to provide a calculating machine of miniaturized and rugged structure which is foolproof and can be easily operated.

These objects are attained according to one aspect of the invention by the provision of a rotary totalizer in which the totalizer wheels are journaled in a rotary support for rotation about spaced parallel axes circumferentially distributed on a cylindrical surface and located in different parallel planes intersecting the axis of rotation of the support, the means for actuating this rotary totalizer comprising a stack of superimposed rows of teeth mounted within the frame of the calculating machine for successive engagement with the totalizer wheels upon rotation of the totalizer, each tooth being movable in the stack towards and away from the totalizer into engaging position and into a retracted position, such movement of the teeth being effected by adjustable denominational multiplicand setting members mounted in the frame of the calculating machine, each setting member being coordinated to one of the rows of teeth and connected with the teeth therein for moving a selected number of teeth representing a denomination of a multiplicand into engaging position while retracting the remainder of the teeth of the row into retracted position.

Further features of the present invention will appear from the accompanying claims.

Further objects of the present invention will appear from a detailed description of a preferred embodiment thereof following hereinafter with reference to the drawings. It is to be understood, however, that such detailed description serves the purpose of explaining rather than that of restricting or limiting the present invention.

In the drawings

FIG. 1 is a perspective view of the miniaturized calculating machine embodying the present invention,

FIG. 2 is a plan view of the machine shown on an enlarged scale, the top plate of the housing being omitted to expose the stack of teeth to view,

FIG. 3 is a more or less diagrammatic sectional view, the section being taken along the plane 3—3 of FIG. 2, the rotary support of the totalizer and the means for counting the number of rotations of the totalizer being omitted for sake of a simplified illustration,

FIG. 4 is a sectional view taken along the plane 4—4 of FIG. 2,

FIG. 5 is a sectional view taken along the plane 5—5 of FIG. 4, the rotary totalizer being omitted, and

FIG. 6 is a development of part of the periphery of an

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annular rotary cam for the stepwise displacement of the totalizer into sequential axial positions.

As shown in FIG. 1 the frame or housing **1** of the calculating machine has flat top and bottom plates spaced about one inch and a length of about ten inches. The width of the housing amounts to about 2.5 inches. This frame or housing may consist of a light metal or of a suitable plastic. The means for actuating the totalizer wheels comprises a stack **4** composed of superimposed rows of adjacent rod-shaped teeth. The teeth of each row are disposed in adjacent relationship so as to form a layer extending parallel to the top and bottom plates of the frame **1**. In the instant embodiment there are provided five such layers each comprising nine parallel rod-shaped teeth **40**. The superimposed layers are separated by interposed horizontal partitions **24** which are fixed to the frame or housing in spaced parallel relationship one above the other. Each rod-shaped tooth **40** is movable lengthwise within the stack **4** between the partitions **24** towards and away from the totalizer described hereinafter into engaging position and into a retracted position. Adjustable denominational multiplicand setting members **5** are mounted within the housing or frame, each setting member being coordinated to one of the layers or rows of teeth **40** and connected with the teeth therein for moving a selected number of teeth into engaging position while retracting the remainder of the teeth into a retracted position. Each of these multiplicand setting members is formed by a slide **5** which is guided for lengthwise sliding motion within a groove **25** provided within the frame or housing **1**. Each rod-shaped tooth **40** is provided with a transverse recess **23'** in its top face. The recesses of the adjacent rod-shaped teeth communicate to form a passage extending transversely through the stack **4**. The slide **5** extends through such passage and is provided with a knob **17** extending outwardly through a slot **18** provided in the cover plate of the housing **1**. By means of this knob **17** the slide **5** can be manually adjusted to any one of ten positions, each position representing a denominational digit of a multiplicand.

Each slide **5** has two relatively offset sections connected by a cam portion **26** which extends at an acute angle to the guiding groove **25**. The transverse recess **23'** of each rod-shaped tooth extends parallel to the cam-shaped portion **26** of the slide **5**. The width of the recess **23'** is so dimensioned that the slide **5** engages the obliquely oppositely located edges of each groove **23'**. Preferably, each slide **5** and the groove **25** accommodating it is slightly curved as will appear from FIG. 2, the slides and the grooves being disposed in spaced parallel relationship. When the parts assume the zero position illustrated in FIG. 2, the right-hand section of each slide **5** engages the recesses **23'** and holds the teeth in retracted position. When the slide **5** is moved towards the right with reference to FIG. 2 until the cam-shaped portion **26** enters the passage formed by the adjacent recesses **23'**, the cam-shaped portion will move the rod-shaped teeth successively in the direction towards the totalizer into engaging position. In this position the teeth will be held by the left-hand section of the slide **5**.

The length of the slide is at least twice the width of the row of teeth engageable by the slide and the cam portion **26** is disposed substantially in the middle of the length of the slide **5**. The selected number of teeth moved into engaging position represents a denomination of the multiplicand. Upon completion of the calculating operation, the teeth may be restored to the zero position by movement of the slides **5** to the position shown in FIG. 2. In the course of such movement the cam portions **26** will retract the teeth **40**. The distance of the cam portion **26** from the knob **17** must equal at least the transverse width of the stack **4** in order to enable all of the teeth **41–49** to be moved to engaging position or into the retracted position.

Each slide **5** is provided with a pointed tip **27** at its end opposite to that carrying the knob **17**. This tip **27** facilitates the entrance and penetration of the slide **5** into and through the passage formed by the adjacent recesses **23'**. The groove **25** guiding each slide **5** extends on both sides of the stack **4** of teeth, as shown in FIG. 2.

The embodiment shown is designed for calculations involving a multiplicand having five denominations. Accordingly, there are provided five rows *4a*, *4b*, *4c*, *4d* and *4e* of teeth and five multiplicand setting members *5a*, *5b*, *5c*, *5d* and *5e*. As shown in FIG. 2, the rod-shaped teeth of each row are of equal length but the teeth of the lowermost row *4e* are longer than the teeth of the next higher row *4d* and these are longer than the teeth of the next higher row *4c* etc. The various lengths of the superimposed rows of teeth are so stepped, that each transverse passageway formed by the adjacent recesses **23'** is exposed at its top for engagement by the slide **5** which may be formed by an upright strip-shaped member.

Suitable resilient detent means may be provided to resiliently detain each slide **5** in any one of its adjusted ten positions. As such detent means are well known in the art, they need not be described nor shown in the drawings. The adjusted ten positions are spaced a distance corresponding to the width of each rod-shaped tooth. Therefore, each slide **5** may be moved stepwise to thereby displace the teeth of the coordinated row successively into the engaging position.

Preferably, the position of each slide **5** is indicated by suitable means such as a window **19** provided in the top plate of the housing for exposing one of the ten digits engraved in the top surface of each slide **5**. Hence, each adjusted position of each slide **5** is indicated by one of the digits which will appear in the window **19**. Therefore, a multiplicand having five digits may be readily set up by means of the knobs **17**.

A restoring member **13** is movably mounted in the frame **1** for engagement with and restoration of the multiplicand setting members *5a–5e* to their initial positions shown in FIG. 2 in which they keep all of the teeth **40** in their retracted positions. In the embodiment shown, the restoring member **13** is formed by a bar provided at its center with an upright knob **20** extending upwardly through a guide slot **12** provided in the top plate of the housing **1** and extending parallel to the guide slots **25**. The bar **13** is provided at its bottom with projections each extending into one of the guide slots **25**. When the knob **20** is shifted from the position shown in FIG. 1 to the left, the downward projections of the bar **13** will engage the tips **27** and will move the slides *5a–5e* to the zero positions illustrated in FIG. 2. The restoration of all of the slides by operation of the single knob **20** is of particular advantage when addition or subtraction is to be performed requiring that different amounts be rapidly and successively set up by means of the slides *5a–5e*.

The rotary totalizer is composed of the following elements:

(1) A support **28** mounted in the frame or housing **1** for rotation about a vertical central totalizer axis which coincides with the axis of a central knob **55** shown in FIG. 4, the support **28** being mounted for both rotation and stepwise displacement along the totalizer axis into sequential axial positions spaced equal distances;

(2) A plurality of denominational totalizer wheels *6a*, *6b*, *6c*, etc. *6i* mounted in the support **28** for rotation about individual axes which extend parallel to the central totalizer axis and are circumferentially distributed on an imaginary cylindrical surface which coaxially surrounds the central totalizer axis.

These totalizer wheels are located in different parallel planes which intersect the totalizer axis at right angles and are spaced the aforementioned distances;

(3) Ten-carrying means for rotating each totalizer wheel of one denomination by an angular unit upon completion of the rotation of the totalizer wheel of the next lower denomination through ten units.

When the rotary support **28** assumes its lowermost axial position, the totalizer wheels *6a–6e* are in registry with the layers *4a–4e* of teeth **40**. Each totalizer wheel is fixed to a vertical shaft **9** journaled in the support **28** at a distance from the central axis thereof. For this purpose the support **28** is composed of circular parallel top and bottom plates interconnected by suitable vertical members.

The ten-carrying means for each totalizer wheel includes a cam fixed to the totalizer wheel. These cams are illustrated in FIG. 3 at *7a–7h* as being fixedly connected to the respective totalizer wheels by the shafts **9**.

Moreover, the ten-carrying means for each totalizer wheel includes a coordinated transfer gear which meshes with the next one of said totalizer wheels and is rotatably mounted in the support **28** for engagement by the cam. These transfer gears are shown in FIG. 3 at *8a–8h*. Each cam is mounted at the same level as the totalizer wheel of the following denomination.

Hence, it will appear that each transfer gear **8** is located between the associated cam **7** and the totalizer wheel **6** of the next higher denomination and meshes therewith. Each transfer wheel *8a–8h* is fixed to a shaft **10** which is freely rotatably mounted in the support **28**.

The rotary support **28** may be manually rotated about its central vertical axis. For this purpose the support **28** is provided with a handle formed by a crank pin **16** fixed to and extending upwardly from the top plate **15** of the support **28**, as shown in FIGS. 1 and 4. During the rotation of the rotary support **28** the totalizer wheels *6a–6i* perform on orbiting motion around the central axis of the rotary support and during this motion move past the stationary stack **4** of teeth for engagement with and actuation by such of the teeth as have been advanced into engaging position by suitable adjustment of the setting members *5a–5e*. Each totalizer wheel is actuated once during any revolution of the rotary totalizer support **28**.

Hence, it will appear that the rod-shaped teeth **40** projected into engaging position in accordance with the numbers appearing in the window **19** will mesh with the totalizer wheels **6** located in the planes of the layers or rows *4a–4e* and will be turned as many pitches as teeth in such layers have been projected into engaging position. The amount set up in the rotary totalizer upon actuation thereof is indicated by suitable number wheels **29**, each number wheel being coaxially connected with one of the totalizer wheels *6a–6h*. Preferably, the number wheels have a larger diameter than the totalizer wheels and overlay each other. In the embodiment shown, each number wheel is fixed to the top of the shaft **9** and is provided with the digits 0–9 for display thereof in a window provided in the top plate **15** of the rotary support **28**. In FIG. 4 these windows are shown at **51**. They are distributed along a circle coaxially surrounding the axis of the rotary support **28**.

Whenever a totalizer wheel *6a–6h* is moved beyond its 9-position, the cam **7** connected therewith will engage the transfer gear *8a–8h* for rotation by one pitch to thereby turn the totalizer wheel of the next higher denomination through one angular unit. As the totalizer wheels *6a–6h* are actuated successively one only at a time by the teeth **40**, each totalizer wheel is free to be actuated by the cam *7a–7h* for the ten-carrying operation. In this manner the amount set up in the window **19** will be fully transferred to the rotary totalizer once during any revolution thereof.

In order to ensure successive actuation of the totalizer wheels *6a–6h* by the teeth **40**, adjacent shafts **9** must be spaced such a distance that one totalizer wheel at a time only can mesh with the teeth **40**.

The rotary totalizer further comprises clearing gears **11a–11i** which are rotatably mounted on the support **28** and are disposed within a common plane, each clearing gear being connected with one of the totalizer wheels for common rotation. In the embodiment shown, each clearing gear **11a–11i** is fixed to the bottom end of the shaft **9** of the associated totalizer wheel. A manually operable gear **29'** shown in FIG. 4 is coaxially disposed with respect to the rotary support **28** and is mounted for movement into and out of engaging position in which it meshes with the clearing gears **11a–11h**. Moreover, suitable manual means which may include a lever **30** are provided for moving the manually operable gear **29'** into the engaging position and for effecting relative rotation between the manually operable gear **29'** and the support **28**. This relative rotation will cause the clearing gears **11a–11i** to be rotated to the zero position. The clearing gears are multilated so as to become disengaged from the gear **29'** upon arrival in the zero position.

Preferably, the gear **29'** is non-rotatably mounted on the bottom plate of the frame **1** and is guided for vertical displacement between an upper meshing position in which it meshes with the clearing gears **11a–11i** and a disengaged lower position shown in FIG. 4. The lever **30** is pivotally mounted in the housing and has an arm (not shown) which engages the gear **29'** and is capable of lifting or lowering the same.

When it is desired to clear the rotary totalizer, the lever **30** is manually operated so as to lift the gear **29'** into its upper meshing position and then the rotary support is rotated through one revolution by means of the crank pin **16** whereby all of the totalizer wheels **6a–6i** are restored to their zero positions.

When the operator desires to multiply the multiplicand set up in the window **19** with a multiplier having a plurality of denominations, the calculating operation commences with the rotary totalizer in the lowermost of its sequential axial positions. In this lowermost position the rotary totalizer is manually rotated as many revolutions as are indicated by the lowermost multiplier denomination, this manual rotation being effected in the positive clockwise direction. Thereafter the rotary totalizer is lifted into the second one of its sequential axial positions by lifting means to be described hereinafter. Thereupon the rotary totalizer is manually rotated as many revolutions as correspond to the second denomination of the multiplier. As many of such sequential manual operations are carried out as corresponds to the number of multiplier denominations.

The first lifting operation has the effect that the teeth of the layer **4a** in which the lowest denomination of the multiplicand is set up will no longer actuate the totalizer wheel **6a** but will rather actuate the totalizer wheel **6b** representing the next higher denominational unit of the totalizer. Similarly, all of the other totalizer wheels will be actuated by rows of teeth **40** of the next higher denomination of the multiplicand.

Preferably, the rotary totalizer is equipped with more denominations than is the actuating mechanism. In the embodiment shown, the actuating mechanism comprises five rows or layers of teeth **40** whereas the rotary totalizer has eight totalizer wheels. Therefore, multiplication by a four-digit-multiplier may be effected.

The means for stepwise lifting the rotary totalizer into the sequential axial positions will now be described with reference to FIGS. 4, 5 and 6.

An annular strip forming a cylindrical cam **23** surrounds the lower portion of the rotary totalizer in coaxial relationship therewith and is mounted for manual rotation within the housing **1** contacting the curved portion of the side wall thereof. A radial pin **31** fixed to the rotary cam **23** extends outwardly for manual rotation of the cam through a circumferential slot **32** provided in the side wall of the housing. The upper edge of the cam **23** is provided with four circumferentially distributed recesses providing inclined edge portions **33**. Moreover, the cam **23** is provided with a circumferential slot **36** and the lower edge of this slot is provided with four recesses **37** adapted to be selectively engaged by a suitable detent **35** which is mounted on the inside of the housing and is subjected to the influence of a spring (not shown) tending to engage the detent with the selected recess **37**. In this manner the pin **31** may be used as a handle for rotating the cam **23** into anyone of four positions indicated in FIG. 1 by the numbers **1, 2, 3** and **4**.

A second annular strip **22** is coaxially mounted on top of the strip **23** and below the overlying marginal zone of the top plate **15** to rotatably support this top plate and the totalizer support of which it forms a part. The annular strip **22** constitutes a follower means which is guided in the frame or housing **1** for axial displacement. For this purpose, the strip **22** has a vertical slot **38** and an internal pin **39** fixed to the housing **1** extends into the slot **38** thus preventing rotation of the annular strip **22**. Moreover, the strip **22** has four downward projections **34** resting on the inclined edges **33**.

Hence, it will appear that the annular strip **22** constitutes follower means mounted on the frame **1** for axially displacing the rotary totalizer upon rotation of the rotary cam **23**.

A manual displacement of the radial pin **31** from one detent recess **37** to the next recess will lift the totalizer support **28** a distance corresponding to that of the adjacent horizontal central planes of the layers **4a–4e**. Therefore, successive displacements of the pin **31** through the positions **1–4** indicated in FIG. 1 will successively bring the totalizer wheels **6f–6h** into the horizontal planes of the layers **4c–4e**, while the totalizer wheels **6a–6c** will be lifted above the level of **4a**. When the rotary totalizer is manually rotated, the rows of teeth **40** will no longer mesh with the totalizer wheels **6a–6e** but will rather mesh with the corresponding totalizer wheels **6d–6h**. The effect of this operation will be explained by reference to the multiplication of the multiplicand with a multiplier having two denominations. In the first phase of this operation, in which the rotary totalizer is in the axial position No. 1, it must be rotated through as many revolutions as corresponds to the lower denomination of the multiplier. In the second phase of the operation in which the rotary multiplier has been lifted to the position No. 2, it must be rotated through as many revolutions as corresponds to the higher denomination of the multiplier.

Preferably, counting means are cooperatively connected with the totalizer support for indicating the number of revolutions performed by the totalizer support **28** in each of its axial positions. For this purpose the cover plate **15** of the rotary totalizer is provided with windows **53** distributed along a circle. Counter-wheels **50** each provided with two series of digits 0–9 extending in opposite directions are fixed to vertical rotary shafts journaled in the support **28** and are visible through the windows **53**. These shafts are adapted to be driven by gears **21a–21d** (FIG. 4) disposed at different levels. A cam **52** is fixed to the housing or frame **1** for engagement with and actuation of one of the gears **21a–21d** which is located at the level of the cam **52**. During any revolution of the rotary totalizer one of the gears **21a–21d** will be actuated through one pitch by the cam **52**. The counting wheels **21a–21c** can be restored by manual rotation of a central pinion fixed to the shaft of knob **55**. This shaft is axially movably mounted in the support **28**. Therefore, the operator may lift the central pinion into engagement with mutilated gears **54a–54d** fixed to the shafts of the counting wheels **21a–21d**. Subsequent manual operation of the knob **55** will result in a restoration of the counting wheels **21** to zero position.

Preferably, the diameters of the counting gears are large enough so that these counting gears **21a–21d** overlap each other.

The totalizer wheels or their shafts are preferably provided with resilient detent means of a known type to prevent overthrow. As such detent means are well known in the art, they need not be described or shown. Alternatively, the rotary support **28** may be provided with suitable chambers encasing the totalizer wheels or other gears and filled with a lubricant which because of its viscosity will exert sufficient friction on the totalizer wheels to prevent any overthrow beyond the proper angular position. In this manner a faulty operation caused by the momentum of the rotary wheels will be prevented.

The operation of the computing machine will now be described with reference to calculation examples.

Multiplication: 65,795 is to be multiplied by 6,348. The machine is first cleared by suitable manual operation of the knob **20** and by a manual rotation of the rotary totalizer preceded by operation of knob **55** and arm **30**. Then the multiplicand 65,795 is set up by means of the knobs **17** which are so shifted that the multiplicand will appear in the window **19**. Then the rotary totalizer is rotated by means of the crank pin **16** through 8 revolutions in the clockwise direction, 8 being the units denomination of the multiplier. As a result, "8" will appear in the window **53** shown in FIG. 1 in the topmost position. The digits 5, 2, 6, 3, 6, 0 will appear in the windows **51*f*–51*a***.

Thereupon, rotary totalizer will be lifted by manual displacement of pin **31**, to the position No. 2. Thereupon, the rotary multiplier will again be rotated in clockwise direction until "4" will appear in the window **53** which is the second from the top in FIG. 1. As a result, the amount 3,158,160 will appear in the windows **51**. Thereupon, the pin **31** must be manually shifted to the position No. 3 whereupon the rotary totalizer is manually rotated in the clockwise direction until the multiplier digit 3 appears in the window **53** shown in FIG. 1 as the third from the top. As a result, the amount 22,896,660 will be displayed by the windows **51**. Finally, the pin **31** is shifted to the position No. 4 whereupon the rotary totalizer is rotated in clockwise direction until "6" appears in the window **50** shown in FIG. 1 as the lowermost window **50**. As a result, the final product amounting to 417,666,660 will be displayed by the windows **51**.

When division is to be performed, the dividend must be set up by the knobs **17** so that it will be displayed in the window **19**. Thereafter this amount is transferred into the totalizer by a single rotation thereof in clockwise direction with pin **31** in the No. 1 position. The dividend will then be indicated in the windows **51**. Thereupon the divisor is set up by the knobs **17** so that it will appear in the window **19**. Thereafter pin **31** is shifted a number of steps which corresponds to the difference of the denominations of the divisor and the dividend. Take the example, for instance, that the dividend has five denominations and the divisor has two denominations. The difference amounts to 3. Therefore, pin **31** is shifted three steps to the No. 4 position. Then the divisor is subtractively introduced into the rotary totalizer by manual rotation thereof in the anti-clockwise direction. This rotation is continued until the highest denomination of the amount indicated by the windows **51** will have been reduced to a minimum. Thereafter pin **31** is shifted one step to the right and the rotary totalizer will again be rotated in anti-clockwise direction.

In this operation the counter-wheels **21*c*** are rotated rearwardly. Suitable provisions well known in the art may be made to ensure proper indication in the windows **53** of the number of the negative revolutions of the totalizer. For this purpose, the number wheels **50** may be provided, for instance, with two series of digits one starting from "0" in the clockwise direction and the other one starting from the same digit "0" in the anti-clockwise direction.

Where two amounts are to added, the first amount will be first set up in the window **19** and will then be

introduced into the totalizer by a single revolution thereof in the clockwise direction. Thereafter, the second amount is set up in the window **19** and is again introduced into the totalizer by a single revolution in clockwise direction. Where the second amount is to be subtracted from the first one, the rotation of the totalizer is effected in the anti-clockwise direction through one revolution.

It will be appreciated from the foregoing that the novel computing or calculating machine is of a very compact structure and is composed of a minimum of elements. Therefore, its dimensions may be easily so chosen that a person can carry the machine in his pocket. Moreover, the different computing operations can be easily and quickly performed in a foolproof manner and the amounts to be handled and the result of the computing operation are so clearly exhibited in the windows **19**, **51** and **53** that they can be easily read. If desired, the windows may be equipped with magnifying lenses to improve the exhibition of the numbers.

Owing to the horizontal disposition and the circumferential distribution of the totalizer wheels **6*a*–6*h*** on the rotary support **28** the vertical dimension of the machine, i.e. the distance of the top plate from the bottom plate of the housing, is reduced to a minimum. The width and length of the housing are extremely small owing to the compact structure of the actuating means including the stack of rod-shaped teeth **40**. The overlapping disposition of the number wheels **29** and **50** affords ample space thereon for the accommodation of large digits which can be easily read. The axial displacement of the rotary totalizer by the annular cam **23** cooperating with the annular follower member **22** has the advantage that the sequential axial displacements of the totalizer can be easily and accurately performed with a minimum of friction.

The embodiment of the present invention described hereinabove with reference to the drawings is capable of numerous modifications. It is possible, for instance, to give the slides *5a–5e* and the grooves **25** guiding them a straight shape rather than a curved shape. Other modifications will readily appear to anyone skilled in the art.

This application is intended to cover any variations, uses, or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains, and as fall within the scope of the invention or the limits of the appended claims.

What I claim is:

1. A computing machine comprising a frame, a rotary totalizer composed (1) of a support mounted in said frame for rotation about a totalizer axis and for stepwise displacement along said axis into sequential axial positions spaced equal distances, (2) of a plurality of denominational totalizer wheels mounted in said support for rotation about individual axes which extend parallel to said totalizer axis and are circumferentially distributed on a cylindrical surface coaxially surrounding said totalizer axis, said totalizer wheels being located in different parallel planes which intersect said totalizer axis at right angles and are spaced said equal distances, and (3) of ten-carrying means for rotating each totalizer wheel of one denomination by an angular unit upon completion of the rotation of the totalizer wheel of the next lower denomination through ten units, a stack of superimposed rows of teeth, each row having nine teeth and extending in a plane coinciding with one of said planes, said stack being mounted within said frame for successive engagement of said stack with said totalizer wheels upon rotation of said totalizer about said axis, each tooth being movable in said stack towards and away from said totalizer into engaging position and into a retracted position, and adjustable denominational multiplicand setting members mounted in said frame, each setting member being coordinated to one of said rows and connected with the teeth therein for moving a selected number of teeth representing a denomination of a multiplicand into engaging position while retracting the remainder of the teeth of said one of said rows into retracted position.

2. A computing machine as claimed in claim 1 in which said ten-carrying means for each totalizer wheel comprises a cam fixed to said totalizer wheel, and a transfer gear meshing with the next one of said totalizer wheels and rotatably mounted in said support for engagement by said cam.

3. A computing machine as claimed in claim 1 in which said rotary totalizer further comprises clearing gears rotatably mounted in said support and disposed within a common plane, each clearing gear being connected with one of said totalizer wheels for common rotation, a manually operable gear coaxial with said support and mounted for movement into and out of engaging position in which it meshes with the clearing gears, and manual means for moving said manually operable gear into said engaging position and for effecting relative rotation between said manually operable gear and said support.

4. A computing machine as claimed in claim 1 further comprising counting means cooperatively connected with said support for indicating the number of rotations performed by said totalizer support in each of said axial positions, said number of rotations representing a denominational digit of the multiplier.

5. A computing machine as claimed in claim 4 in which said counting means comprises a cam fixed to said frame and a countergear rotatably mounted on said support in each of said parallel planes for actuation by said cam in one of said sequential axial positions.

6. A computing machine as claimed in claim 1 in which said rotary totalizer further comprises number wheels, each number wheel being coaxially connected with one of said totalizer wheels and having a larger diameter than said totalizer wheels, said number wheels overlapping each other.

7. A computing machine as claimed in claim 1 further comprising means for the stepwise displacement of said totalizer into said sequential axial positions, said means comprising an annular rotary cam disposed on said frame coaxially to said rotary totalizer and follower means on said frame for displacement by said rotary cam and for axially displacing said totalizer upon rotation of said rotary cam.

8. A computing machine as claimed in claim 7 further comprising detent means on said annular rotary cam for

resiliently arresting said annular rotary cam in sequential angular positions corresponding to said sequential axial positions of said rotary totalizer.

9. A computing machine as claimed in claim 1 in which each of said adjustable denominational multiplicand setting members comprises a slide guided in said frame for engagement with one of said superimposed rows of teeth, said slide having a cam portion for moving said selected number of teeth into engaging position.

10. A computing machine as claimed in claim 9 in which each of said teeth has a recess between its ends, said slide extending through the recesses of all of the teeth of one of said rows, said slide having two relatively offset sections connected by said cam portion, one section moving the teeth through which it extends into said engaging position, while the other section moves the teeth through which it extends into said retracted position.

11. A computing machine as claimed in claim 10 in which the length of said slide is at least twice the length of said row of teeth.

12. A computing machine as claimed in claim 1 further comprising a restoring member movably mounted in said frame for engagement with and restoration of said multiplicand setting members to their initial positions in which they keep all of said teeth in said retracted positions.

13. A computing machine as claimed in claim 1 in which said adjustable denominational multiplicand setting members comprise parallel space slides guided in said frame and extending transversely through said stack, the teeth of each of said rows having transverse recesses in adjacent relationship communicating with each other to form a transverse passage extending through said stack, said stack having as many passage as superimposed rows of teeth are provided, each of said slides extending through one of said passages and having two relatively offset sections connected by a cam portion.

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