F. L. FULLER.

CHANGE INDICATING CASH REGISTER.

APPLICATION FILED DEC. 7, 1910.

1,122,489.

Patented Dec. 29, 1914.

4 SHEETS—SHEET 1.

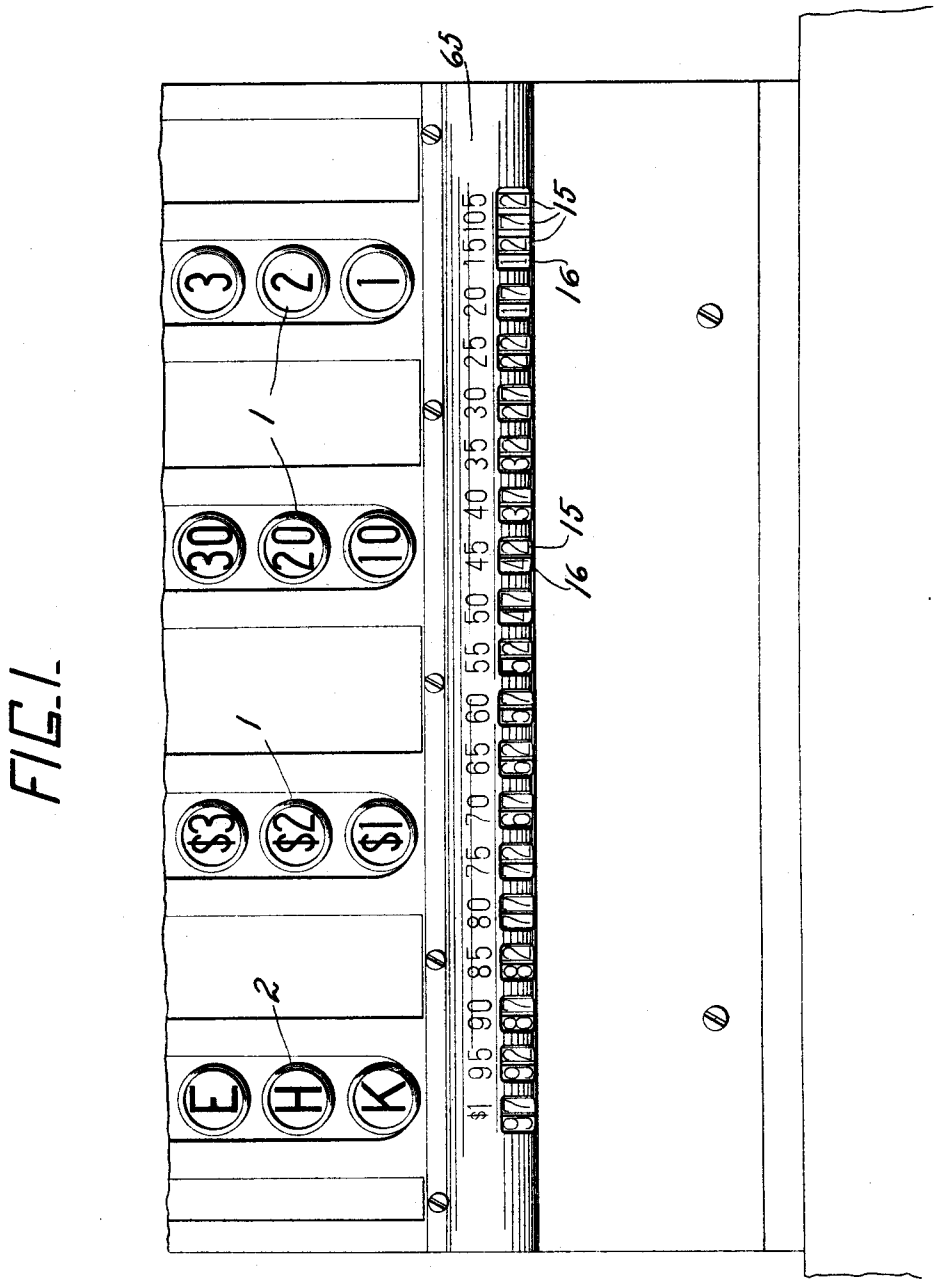


FIG. 1.

Witnesses

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4 SHEETS-SHEET 2.

FIG. 2.

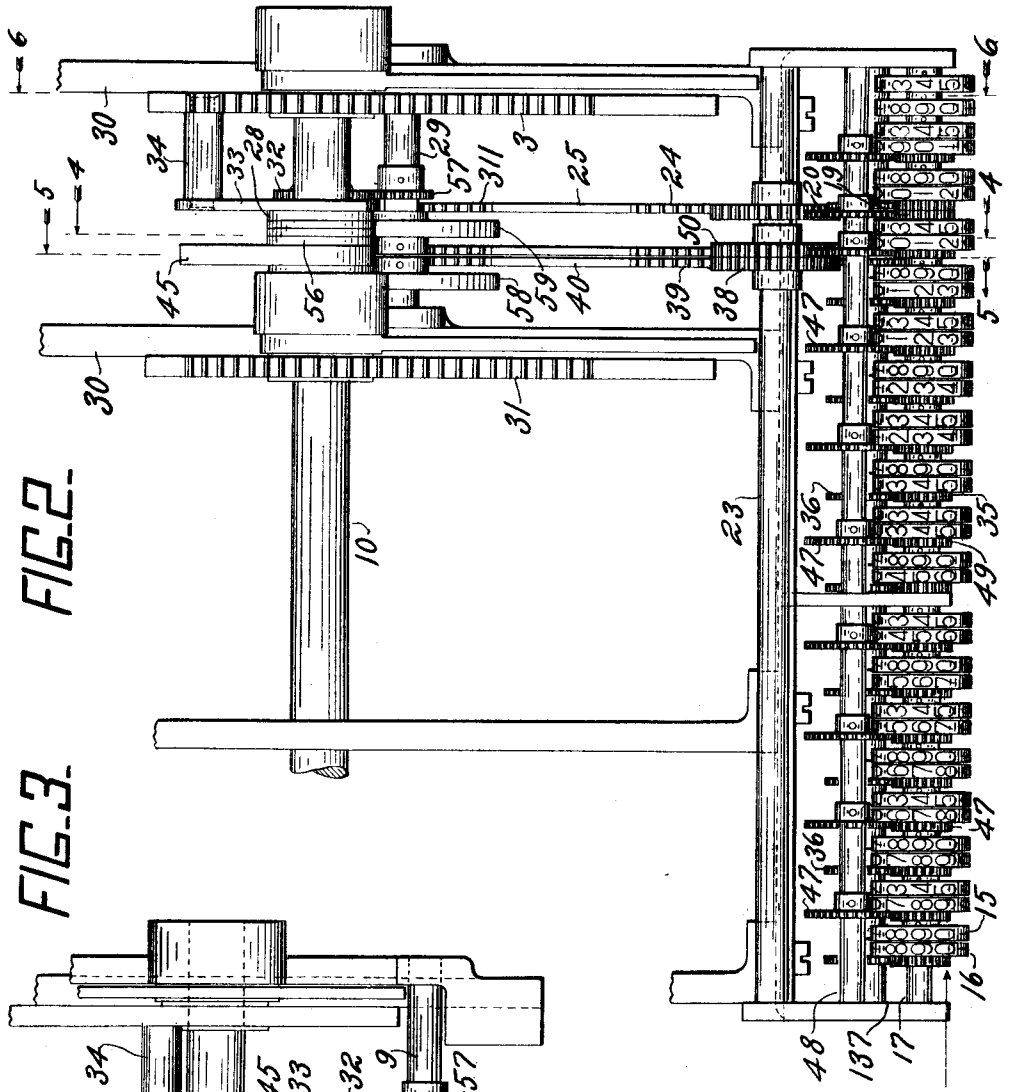
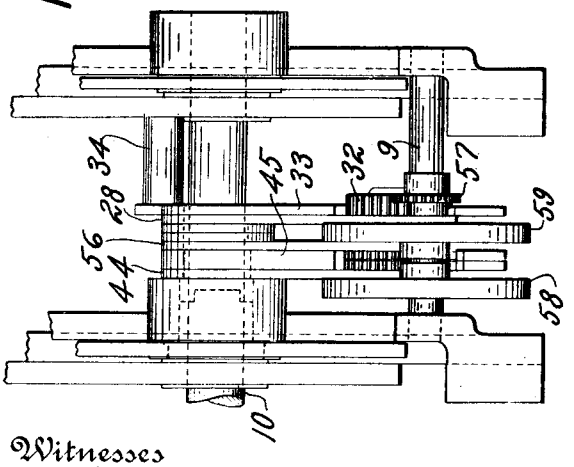


FIG. 3.



Witnesses

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4 SHEETS—SHEET 3.

FIG. 4.

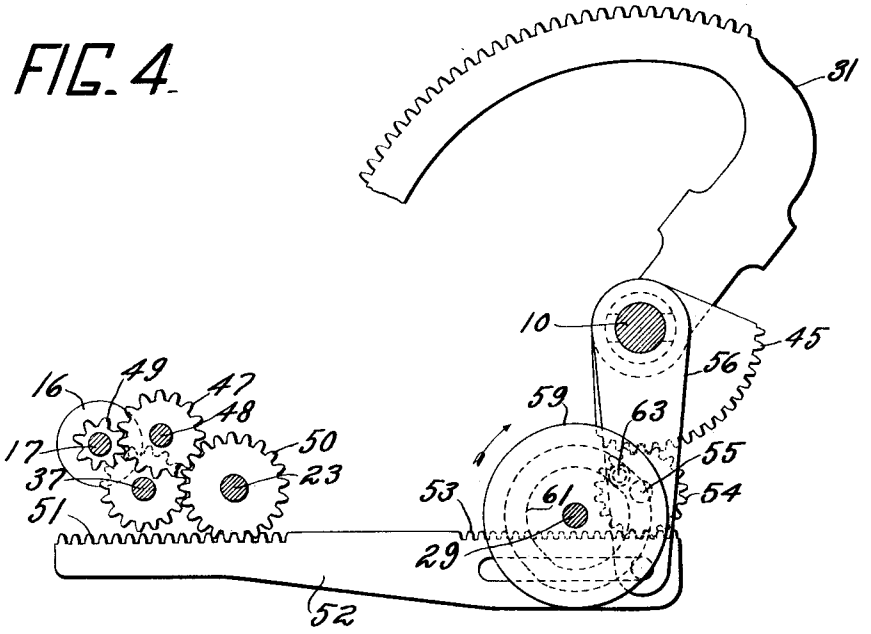
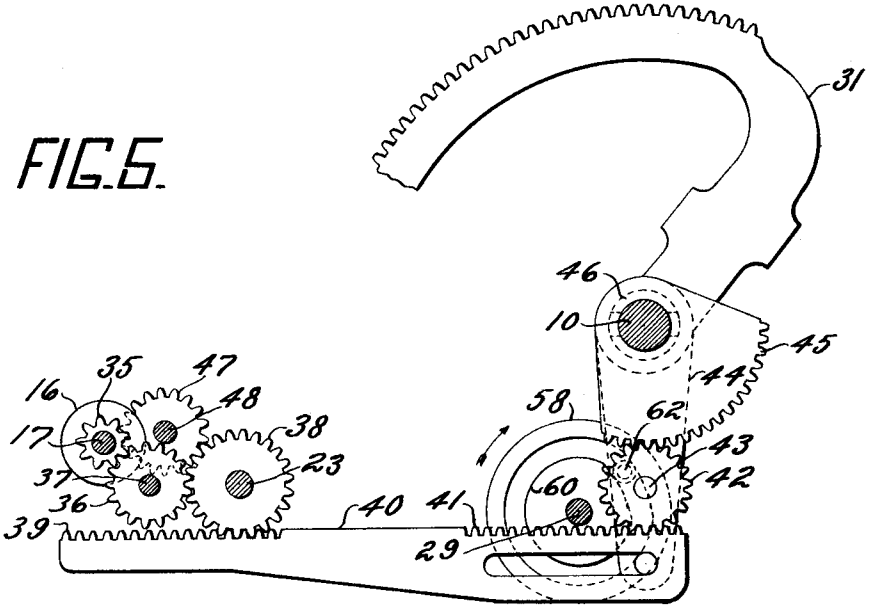


FIG. 5.



Witnesses

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CHANGE INDICATING CASH REGISTER.

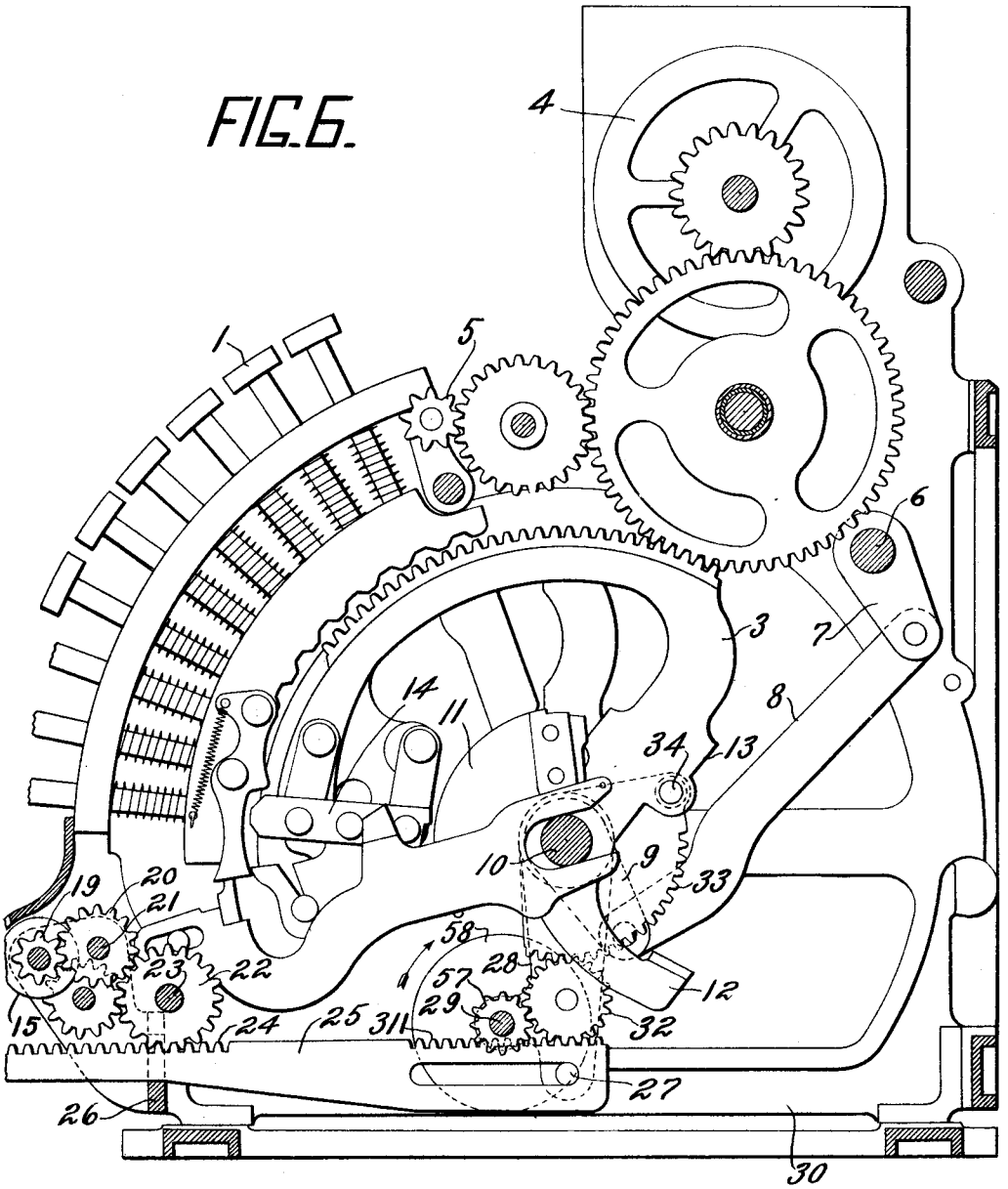
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4 SHEETS—SHEET 4.

FIG. 6.



Witnesses

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UNITED STATES PATENT OFFICE.

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CHANGE-INDICATING CASH-REGISTER.

1,122,489. Specification of Letters Patent. Patented Dec. 29, 1914.

Application filed December 7, 1910. Serial No. 596,010.

To all whom it may concern:

Be it known that I, FREDERICK L. FULLER, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Change-Indicating Cash-Registers, of which I declare the following to be a full, clear, and exact description.

This invention relates to accounting mechanisms, and among its objects is to provide an improved accounting device, herein shown as attached to a cash register of a well known type, and adapted to indicate the change due in transactions entered in the register, requiring little space and of a simple and improved construction.

With this and incidental objects in view, the invention consists in certain novel features of construction and combinations of parts, the essential elements of which are set forth in appended claims, and a preferred form of embodiment of which is hereinafter described with reference to the drawings which accompany and form part of the specification.

Figure 1 is a fragmentary front elevation of a cash register provided with an accounting device constructed according to the invention. Fig. 2 is a plan view of the accounting device, and its connections to the differential mechanism of the cash register. Fig. 3 is a detail in front elevation of part of the mechanism shown in Fig. 2. Fig. 4 is a transverse vertical section taken on the line 4—4 of Fig. 2, showing the connection between certain tens denominational elements of the accounting device and a tens differential segment of the cash register. Fig. 5 is a transverse vertical section taken on the line 5—5 of Fig. 2, showing the connection between a different set of tens elements of the accounting device and the tens differential segment of the cash register. Fig. 6 is a transverse vertical section of the entire machine taken on the line 6—6 of Fig. 2, and shows the connection between units elements of the accounting device and a unit segment gear of the cash register.

The invention is shown applied to a machine of a well known type of cash register, disclosed in patent to Cleal and Reinhart, April 13, 1897, No. 580,378, but may be readily applied to machines of other types.

In general terms the invention consists of a scale of numbers progressively arranged on the front of a cash register, and below each number an opening through which normally may be seen similar numbers on drums mounted on a single shaft. These drums have the digits "zero" to "nine" on their peripheries and are set on their supporting shaft so as normally to present to view the same numbers as the ones immediately above them on the scale. The drums representing the units denomination and the drums representing the tens denomination are geared respectively to the units and tens denominational elements of the differential mechanism of the cash register, to be backwardly rotated in accordance with the registering movement of the differential mechanism. Thus, with the aid of suitable carrying mechanism, the drums may be caused to indicate numbers representing the differences between amounts registered and the numbers immediately above the drums. For example, if goods purchased amounted to 67¢ and the purchaser tendered 75¢ in payment, the amount of change, 8¢, due the purchaser, will be found indicated below the 75 on the scale. If $1.00 were tendered, the amount of change, 33¢, due, will be found indicated below $1.00 on the scale. Similarly, if any other amount of $1.00 or less was tendered, or any other amount registered, the correct change will be indicated below the number on the scale corresponding to the amount tendered.

In transactions where change is required the amounts tendered are in multiples of five, and therefore the scale is made to read progressively in multiples of five.

The scale of numbers increases by units of five so that every alternate number on the scale is an even multiple, and every intermediate number an odd multiple, of five. The numbered drums normally indicate the same amounts as those shown on the scale numbers directly above them, and may therefore for convenience be termed the "even multiple" and the "odd multiple" sets of drums. The operating devices for the tens drums of these two sets have different transfer connections, constructed so that transfers in the even multiple sets will be effected by one step of movement of the unit drums, while no transfer in the odd multiple sets will take place unless or until the unit drums move the sixth step

The invention may be applied to any form of cash register and therefore a detailed description of the cash register itself need not be given.

The main elements of the machine to which the invention is applied are shown in Figs. 1, 2 and 6. These are a set of value keys 1, a bank of initial keys 2, and differential mechanism consisting of a number of segment gears 3 and 31, indicators 4, and a totalizer 5, which are operated through gear connections with the differential mechanism. Driving power is applied through a main shaft 6 having a crank and pitman connection 7, 8 and 9 to a shaft 10 upon which the segment gears 3 and 31 are all loosely journaled. Rotation of shaft 6 through the pitman 8, causes the oscillation of shaft 10, first in a counter-clockwise direction and then in a clockwise direction so that certain sectors 11, fast to shaft 10, are rocked downward and then upward to the position shown in the drawing. Fast to the sectors 11 are a number of rearwardly and downwardly extending arms 12 which, upon the counter-clockwise movement of shaft 10, engage shoulders 13 of the segment gears 3 and 31, returning any of the segment gears which may have been moved away from normal position on a previous operation of the machine, to the normal or zero positions shown in the drawing. On the return of shaft 10 segments 3 and 31 are rocked rearwardly different distances, as controlled by the keys in their respective banks, provided keys in their respective banks have been depressed.

Each bank of keys and the corresponding segment 3 is provided with latching mechanism indicated generally by the numeral 14 and which, as described in the aforesaid patent, serves, on the depression of a value key, to latch together the corresponding sector 11 and segment 3 so that the segment gear will be carried upwardly on the movement of the sector. The latching mechanism is so constructed as to engage a depressed key during its upward movement and thereby disconnect the sector 11 and segment 3, when the segment has moved a distance corresponding to the value of the depressed key.

The mechanism thus far briefly described is identical with that shown in the patent to Cleal and Reinhart.

The present invention comprises a plurality of pairs of numbered drums 15 and 16 and gear connections, including transfer mechanism, to the differential segments 3 and 31. The drums 15 represent the units denomination and are all fast to a supporting shaft 17. The two drums at the right hand end of Figs. 1 and 2 below the 5¢ and 10¢ numbers on the scale are both units drums and fast to shaft 17. This shaft has fast thereto a gear 19 (Figs. 2 and 6), meshing with an intermediate gear 20, loose on a shaft 21 and meshing with another intermediate gear 22 loose on a shaft 23. The gear 22 meshes with teeth 24 on a rack 25 slidably mounted on a support 26 and a fixed pin 27. This pin is carried by an immovable supporting arm 28 supported by shafts 10 and 29 which are journaled in the main side-frames 30. The rack 25 is provided with teeth 311 meshing with an intermediate pinion 32, in turn meshing with a segment gear 33, loosely journaled on shaft 10 but rigidly connected to the units segment of the differential mechanism, by a pin 34. Through this gear connection differential movement of segment gear 3 is communicated to all of the units drums 15 but in a direction such as backwardly to rotate the drums, so that the more the drums are rotated the less they will indicate, none of the drums being capable of rotating more than nine units, the full extent to which segment gear 3 may be oscillated.

Differential movement of the tens segment gear 31 of the differential mechanism is communicated to the tens drums 16 by the connections shown in Figs. 4 and 5. In order to provide for properly performing carrying operations, two differently timed connections are provided, as before stated, between the tens drums and the segment gear 31, one between the segment gear and the tens drums of the even multiple sets, and the other between the segment and the tens drums of the odd multiple sets.

The necessity for the two sets of connections will be apparent from a brief consideration of the problem involved. The alternate pairs of change indicating drums normally indicate even multiples of five, while each pair intermediate those pairs normally indicates an odd multiple of five. If the units drums move one step or more, a "borrowing" or subtracting transfer movement of those of the tens drums of the "even multiple" set must be given. For example, if "one" is to be subtracted from "seventy", the movement of the units drum 15 from "zero" to "nine" position, must cause the proper tens drum 16 to move from "seven" to "six" position. If, however, "one" is to be subtracted from "seventy five", no transfer movement of that tens drum is needed, as it should still indicate "seven". On the other hand, the "odd multiples" set require a subtracting transfer when the units drums of that set are given the sixth step of their movements, while the "even multiples" set do not require this transfer. As an illustration, if "six" is to be subtracted from "seventy five" the sixth step of movement of the units drum 16 of that pair will cause it to indicate "nine" and the tens drum 15 must thereat be retracted one step to indicate "six". But if "six" is subtracted from

"eighty" the sixth step of movement of drum 16 of that pair will reduce the indication from "seventy five" to "seventy four" which needs no transfer. Thus it will be seen that there must be provided two sets of subtracting or borrowing transfer devices, one operative in the even multiple sets of drums during the first step of retraction of the units drums, and the other operative in the odd multiple sets during the sixth step of retraction of the units drums. Therefore, if the purchase amount equals or exceeds "six" in the units column, both sets of transfer devices will be caused to operate, the "even multiple" sets operating during the first step of movement of the units drums, and the "odd multiple" sets, during the sixth step thereof.

The gear connection between the drums 16 of the even multiple sets is shown in Fig. 5 and consists of pinions 35 rigid with the drums and meshing with intermediate pinions 36, fast on a shaft 37, and one of which meshes with an intermediate pinion 38 loose on the rod 23. The pinion 38 meshes with teeth 39 of a rack 40, having rack teeth 41 meshing with intermediate pinions 42 journaled by a pin 43 on an arm 44 loosely hung from shaft 10. The pinion 42 meshes with a small, broad segment gear 45 which, by a collar 46, is rigidly connected to segment gear 31. Thus differential movement of the segment gear is communicated to the drums 16 of even numbers through the segment gear 45, intermediate gear 42, rack 40, and the intermediates 38 and 36.

The pinions 16 of the odd multiple sets are differentially rotated through similar connections to the segment gear 31 consisting of intermediate gears 47 (Figs. 2 and 4) fast on a shaft 48 and meshing with pinions 49 rigid with the drums. One of the pinions 47 also meshes with an intermediate gear 50, loose on shaft 23 and meshing with rack teeth 51 of a rack bar 52. The rack bar 52 has teeth 53 meshing with an intermediate gear 54, journaled on a pin 55 on an arm 56 loosely hung from shaft 10. Pinion 54 meshes with the broad segment gear 45 rigidly connected with segment gear 31 as previously mentioned.

Carrying operations may be performed while the segment gears 31 are moving, by rocking either of the arms 44 or 56 rearwardly a distance sufficient to cause the pinions 54 or 42 to roll over the segment gear 45 one tooth space, thus causing the racks 52 or 40 to move rearwardly an extra tooth space, and thereby causing the extra unit of movement of the drums 16.

The carrying mechanism is controlled by the units segment gear 3 and is constructed so that when the segment gear 3 is moved one space or more, the rotation of the units drums, of the even multiple sets, will effect a transfer to the respective companion tens drums, and when the segment gear moves six spaces or more, the drums 15 of the odd multiple sets will move past their zero positions, and thereby a transfer will be effected to the respective companion tens drums. For this purpose the intermediate gear 32, (Fig. 6), which is rotated by segment gear 3, meshes with a pinion 57 fast to shaft 29, and shaft 29 carries rigidly disks 58 and 59 having cam grooves 60 and 61, respectively co-acting with pins 62 and 63 on arms 44 and 56. The disks 58 and 59 are accordingly differentially rotated in accordance with movement of segment 3. Cam groove 60 is so formed as to rock the arm 44 rearwardly during the first step of movement of the disks, while cam groove 61 is so formed as to rock the arm 56 rearwardly during the sixth step of movement of the disks. During this first step of movement the drums 15 of the even multiple sets pass from the "zero" to the "nine" position, while during the sixth step of movement the drums 15 of the odd multiple sets pass through the same positions.

The object of the foregoing construction will be apparent from a brief description of its operation.

Normally the drums 15 and 16 present to view numbers which are identical with the numbers above the drums on scale 65 (Fig. 1). The normal position of drums 15 and 16 is shown in Fig. 2 and the reading line is indicated in this figure and it may readily be seen that the numbers on the reading line correspond with numbers on the scale 65 except in the case of $1.00 and 10¢ on the scale, which, for convenience, are indicated on the drums as zero but could as well be indicated by these numbers. Fig. 1 shows drums 15 and 16 in the position they would assume when a sale amounting to 3¢ is entered in the machine. Thus "two" appears below the figure "five," "seven" below "ten," "twelve" below "fifteen," etc., indicating the correct change below any amount which may be tendered as indicated by scale 65. It may be seen that for such of the drums as normally indicate 20, 30, 40, 50, etc., a transfer operation is made necessary in order to indicate 17, 27, 37, etc. This transfer operation occurs by the rearward movement of arm 44 while segment gear 3 moves the first space, thus causing all of the tens drums 16, of the even multiple sets, *e. g.*, those normally indicating 20, 30, 40, etc., to rotate backwardly an extra space.

If any amount is entered requiring segment gear 3 to rotate six spaces or more, thus causing the units drums 15 of the odd multiple sets to rotate beyond the zero position, a transfer operation will be effected to the companion tens drums as would be necessary correctly to indicate the change.

This transfer operation is effected by the backward movement of arm 56 while cam 59 moves the sixth unit of space.

It will be seen from the preceding description that the present invention provides a simple and cheaply constructed but efficient change indicating device, giving without calculation, the change in fractional currency due at any purchase. This range is entirely sufficient for a large majority of uses, but the capacity of the machine may evidently readily be increased by duplication of the mechanism shown, in connection with higher denominations of purchase keys. Moreover, it will be evident that its use is not limited to making change, but many other problems may be solved by it, and that it may, for example, take the place of many varieties of slide rules. Therefore, it may be said that while the form of mechanism herein shown and described is admirably adapted to fulfil the objects primarily stated it is to be understood that it is not intended to confine the invention to the one form of embodiment herein shown and described as it is susceptible of embodiment in various forms all coming within the scope of the claims which follow.

What is claimed is:

1. In a machine of the class described, the combination with a plurality of drums arranged in groups, the drums of the groups being movable relative to each other and having digits on their peripheries, the arrangement of the digits on each group being different from the others when the various groups are in normal position, and means for rotating corresponding drums of all groups similar extents whereby different digits of the several groups are brought to a common reading line for the purpose described.

2. In a machine of the class described, the combination with a plurality of drums arranged in groups, the drums of the groups being movable relative to each other and having digits on their peripheries, the arrangement of the digits on each group being different from the others when the various groups are in normal position, and means for differentially and backwardly rotating the corresponding drums of all the groups similar extends whereby different digits of the several groups are brought to a common reading line for the purpose described.

3. In an accounting machine, the combination with a plurality of sets of drums bearing the digits "zero" to "nine" on their peripheries, and in their normal positions presenting different numbers to view, of means for differentially and backwardly rotating the drums, and transfer mechanism common to all of the drums of each set.

4. In an accounting machine, the combination with a plurality of sets of pinions, of means for differentially rotating the pinions, and transfer mechanism common to and simultaneously operable on all the pinions of each set.

5. In a machine of the class described, the combination with a plurality of indicating devices arranged in groups, the devices in the groups being moved relatively to each other and having digits thereon, the arrangement of the digits on each group being different from the others when the various groups are in normal position, and means for imparting similar extents of movement to corresponding indicating devices of all groups whereby different digits of the several groups are brought to a common reading point for the purpose described.

6. In an accounting machine, the combination with a plurality of pairs of relatively movable drums having the digits "zero" to "nine" on their peripheries, and progressively arranged so that each pair presents a different number to view, of differential mechanism connected to each pair of drums so that all the pairs may be rotated equal extents.

7. In an accounting machine, the combination with a shaft, of a plurality of drums, adapted to receive from one to nine steps of movement, bearing the digits "zero" to "nine" on their peripheries, and positioned on said shaft so that certain of them normally present "zero" and others "five" to view, and a differential mechanism connected to all of said drums to rotate the same equal extents of one to nine steps.

8. In an accounting machine, the combination with a shaft, of a plurality of drums, adapted to receive from one to ten steps of movement, having the digits "zero" to "nine" on their peripheries, and positioned on said shaft so as to present different digits to view, of differential mechanism, and a gear connection between the differential mechanism and said drums whereby the drums may all be rotated equal extents of one to ten steps.

9. In a change indicator, the combination with a plurality of pairs of drums having the digits "zero" to "nine" on their peripheries, the drums of each pair representing different denominations, of separate differential mechanism for each denomination of the drums, two sets of transfer devices, and cams controlled in their movements by the differential mechanism of lower order and constructed to actuate one of the sets of transfer devices by the first unit of movement of the controlling differential mechanism and the other of the sets of transfer devices by the sixth unit of movement of the differential mechanism.

10. In a change indicator, the combination with a plurality of pairs of drums bearing the digits "zero" to "nine" on their pe-

ripheries, the drums of each pair representing different denominations, of a differential mechanism for rotating all of the drums of one denomination, a separate differential mechanism for rotating all of the drums of another denomination, means whereby when the differential mechanism of lower order moves the first unit it causes a transfer to certain of the higher order drums and when it moves the sixth unit it causes a transfer to certain others of the higher order drums.

11. In a change indicator, the combination with a plurality of pairs of drums bearings digits "zero" to "nine" on their peripheries, the drums of each pair representing different denominations, and normally set in combination to expose different even and odd numbers, and a transfer mechanism constructed to transfer to certain of the drums of higher order each time the corresponding lower order drums are given the sixth step of movement.

12. In a change indicator, the combination with a shaft, of a plurality of pairs of drums bearing numerals on their peripheries, and positioned on said shaft to expose different numbers, the drums of each pair representing different denominations, and means for simultaneously rotating equal distances all of the drums of like denomination.

13. In an accounting machine, the combination with a plurality of pairs of drums bearing numerals on their peripheries, of mechanism for differentially rotating the drums, and devices, controlled by the rotating mechanism of lower order, for effecting a transfer to certain of the higher order drums at each first step of movement of said rotating mechanism, and for effecting a transfer to the other higher order drums at each sixth step of movement of said mechanism.

14. In a change indicator, the combination with a scale of numbers representing different amounts in multiples of five, of a plurality of pairs of drums bearing digits from "zero" to "nine" on their peripheries and normally exposing numbers corresponding to the numbers on the scale, one drum of each pair of drums representing the units denomination, and the other drum of each pair representing the tens denomination, mechanism for rotating the drums, a transfer mechanism arranged to transfer to the tens drums of "even multiple" pairs whenever the units drums are rotated away from normal position and to carry the tens drums of "odd multiple" pairs whenever the units drums are rotated six steps.

15. In a change indicator, the combination with a scale of numbers in multiples of five representing amounts which may be tendered, of a plurality of pairs of drums bearing digits from "zero" to "nine" on their peripheries and normally exposing numbers corresponding to the numbers on the scale, one drum of each pair of drums representing units denomination and the other drum of each pair representing tens denomination, mechanism for rotating the drums, and transfer mechanism controlled by the units drums and arranged to transfer to the tens drums of "even multiple" pairs whenever the units drums are rotated away from normal position.

16. In an accounting machine, the combination with a plurality of drums bearing numerals differing by multiples of "five," of mechanism for differentially actuating said drums and comprising units and tens mechanism, a gear connection between the units drums of each pair and the units differential mechanism, a gear connection between the tens drums and the tens differential mechanism, mechanism for effecting a transfer to the ten drums of "even multiple" pairs at the first step of movement of the units drums, and for effecting a transfer to the tens drums of "odd multiple" pairs during the sixth step of movement of said units drums.

17. In an accounting machine, the combination with two differentially movable elements of different denominational orders, of an accounting device having corresponding elements, permanent gear connections between the differentially movable elements and the accounting device elements, one of said connections including a pinion shiftable in its own plane, and means under the control of the other of said connections for shifting said pinion while retaining said permanent connections.

18. In an accounting machine, the combination with two differentially movable elements of different denominational orders, of an accounting device having corresponding elements and permanent gear connections between the differentially movable elements and the accounting device elements, one of said connections including a pinion, and the other of said connections including a rotatable cam for shifting the pinion in its own plane while retaining said permanent connections.

19. In an accounting machine, the combination with an accounting device having a plurality of denominational elements, of differentially movable mechanism having corresponding elements, and a planetary gear transfer mechanism controlled by and acting between elements of the differential mechanism.

20. In an accounting machine, the combination with an accounting device having a plurality of denominational elements, of differential mechanism having corresponding elements, permanent gear connections between the elements of the accounting device and

the differential mechanism, one of said gear connections including a pivoted arm on which is journaled an intermediate pinion, and another of said gear connections including a rotatable cam coacting with said arm for the purpose of rocking the arm around its pivot while retaining said permanent connections.

21. In a change indicator, the combination with a plurality of accounting devices each comprising a series of elements of different denominations; differential mechanism comprising a series of elements each appropriate to and constantly in operative relation with all the accounting elements of like denomination; two sets of transfer devices, each effective on a certain group of accounting devices, between a differential element of lower order and the differential element of next higher order; and connections whereby one set of transfer devices will be effective on the first unit of movement and the other set of transfer devices on the sixth unit of movement of the differential element of lower order.

22. In a change indicator, the combination with a plurality of accounting devices each comprising a pair of elements of different denominations; differential mechanism comprising elements each appropriate to one of the denominations of accounting elements; adjustable connections intermediate the differential element of higher order and different groups of the denominational elements of higher order whereby a movement of said differential element may move the different groups unlike extents; and two sets of transfer devices for adjusting said connections operable between the differential elements and controlled by, and rendered effective at different points in the travel of the differential element of lower order.

23. In a machine of the class described, the combination with a plurality of indicating devices arranged in groups and having digits thereon, the arrangement of the digits on each group being different from the others when the various groups are in normal position and the devices of the groups being relatively movable, of a plate mounted adjacent to said indicating devices and bearing numerals with which the digits of the various groups of indicating devices are brought in juxtaposition thereto, and means for differentially adjusting said indicating devices for the purpose described.

24. In a machine of the class described, the combination with a plurality of indicating devices arranged in groups and having digits thereon, the indicating devices of the groups being movable relatively to each other and the arrangement of the digits on each group being different from the others when the various groups are in normal position, of a plate mounted adjacent to said indicating devices and bearing numerals with which the digits of the various groups of indicating devices are brought in juxtaposition thereto, and means for similarly adjusting the corresponding indicating devices of all of the groups for the purpose described.

25. In a machine of the class described, the combination with a plurality of drums arranged in groups and having digits on their peripheries, the drums of the groups being movable relatively to each other the arrangement of the digits on each group being different from the others when the various groups are in normal position, of a covering for said drum having a scale thereon and openings adjacent to said scale through which openings the digits on the various groups of drums are exposed and means for similarly rotating the corresponding drums of all of the groups for the purpose described.

26. In a machine of the class described, the combination with a plurality of indicating devices arranged in groups comprising relatively movable elements of the units and tens denominations, and a differentially movable member and connections for driving the corresponding elements of all groups.

27. In a machine of the class described, the combination with a plurality of indicating devices arranged in groups, each group comprising relatively movable units and tens denominational elements, and a differentially movable member and connections for driving the corresponding elements of all groups similar extents.

28. In a machine of the class described, the combination with a plurality of indicating devices arranged in groups, each group comprising relatively movable digit bearing elements of different denominations, of a plate mounted adjacent to said indicating devices and bearing numerals with which the digits of the various groups of indicating devices are brought in juxtaposition thereto, and a differentially movably member and connections for driving the corresponding elements of each group similar extents for the purpose described.

29. In a machine of the class described, the combination with a plurality of indicating devices arranged in groups, each group comprising digit bearing elements of lower and higher order, of means for imparting similar degrees of movement to the lower order elements of each group, and means controlling the actuation of the higher order elements by the first degree of movement imparted to the elements of lower order.

30. In a machine of the class described, the combination with a plurality of indi-

cating devices arranged in groups, each group comprising digit bearing drums of lower and higher order, of means for rotating the lower order drums of each group similar extents, and means actuated by the rotating means for the lower order elements for actuating also the higher elements of each group.

31. In a machine of the class described, the combination with a plurality of drums arranged in groups, each drum having a single series of digits "0" to "9" arranged equidistantly about its periphery, and the arrangement of the digits on each group being different from the others when the various groups are in normal position, and means for rotating the corresponding drums to similar extents whereby different digits of the several groups are brought to a common reading line for the purpose described.

In testimony whereof I affix my signature in the presence of two witnesses.

FREDERICK L. FULLER.

Witnesses:
R. C. GLASS,
CARL W. BEUST.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."