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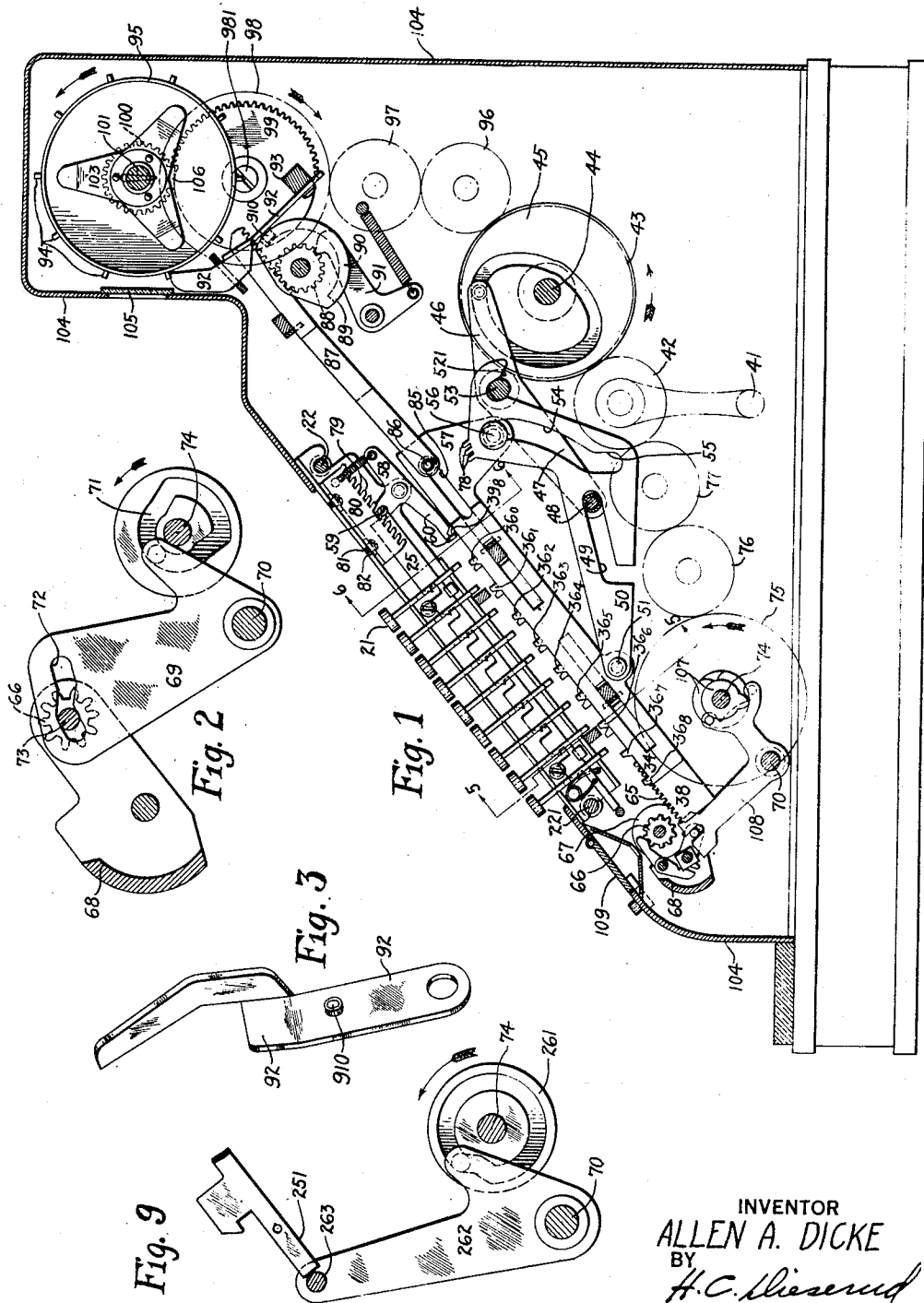
A. A. DICKE

2,105,640

CASH REGISTER

Filed March 26, 1927

3 Sheets-Sheet 1



Jan. 18, 1938.

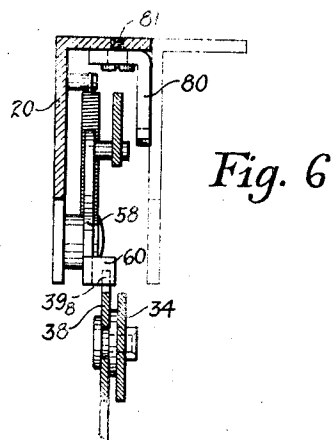
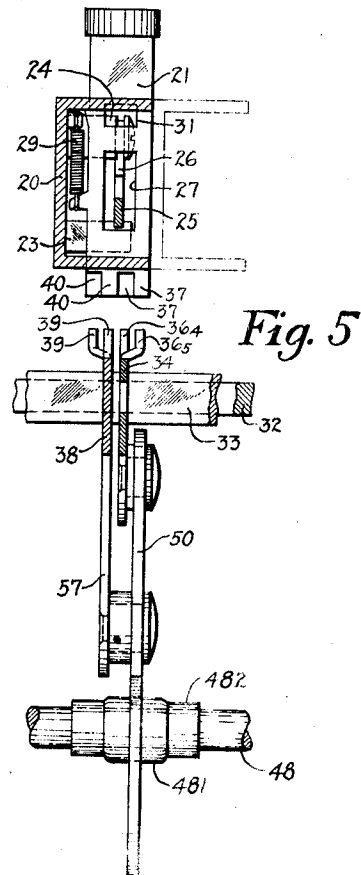
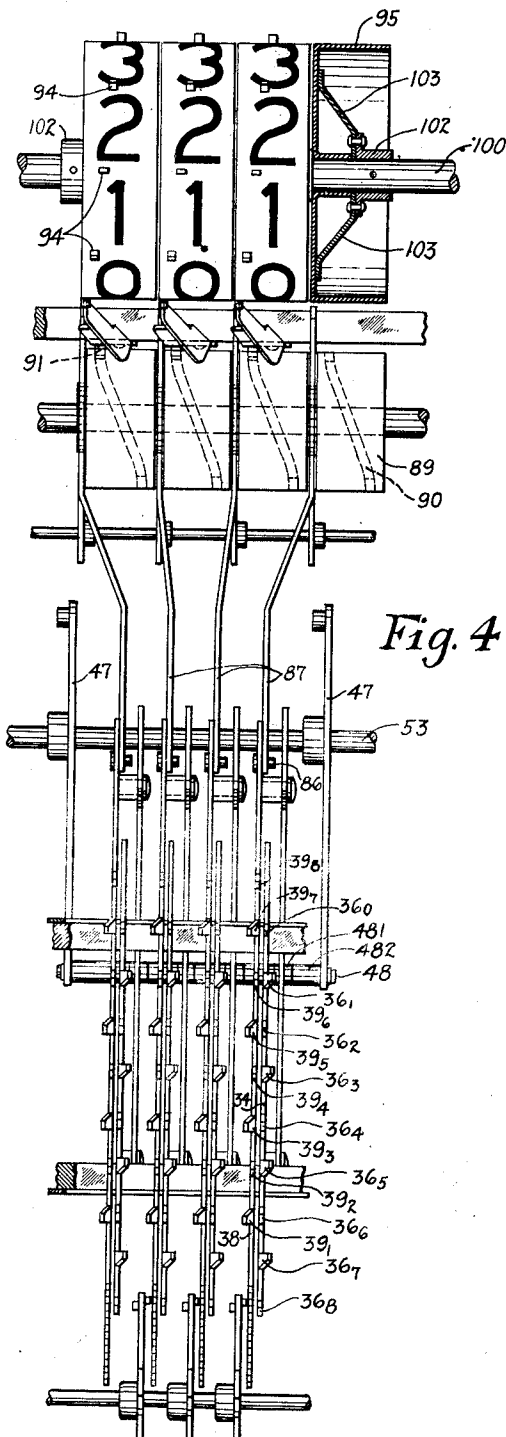
A. A. DICKE

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CASH REGISTER

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3 Sheets-Sheet 2



INVENTOR
ALLEN A. DICKE
BY *H. C. Chesard*
ATTORNEY

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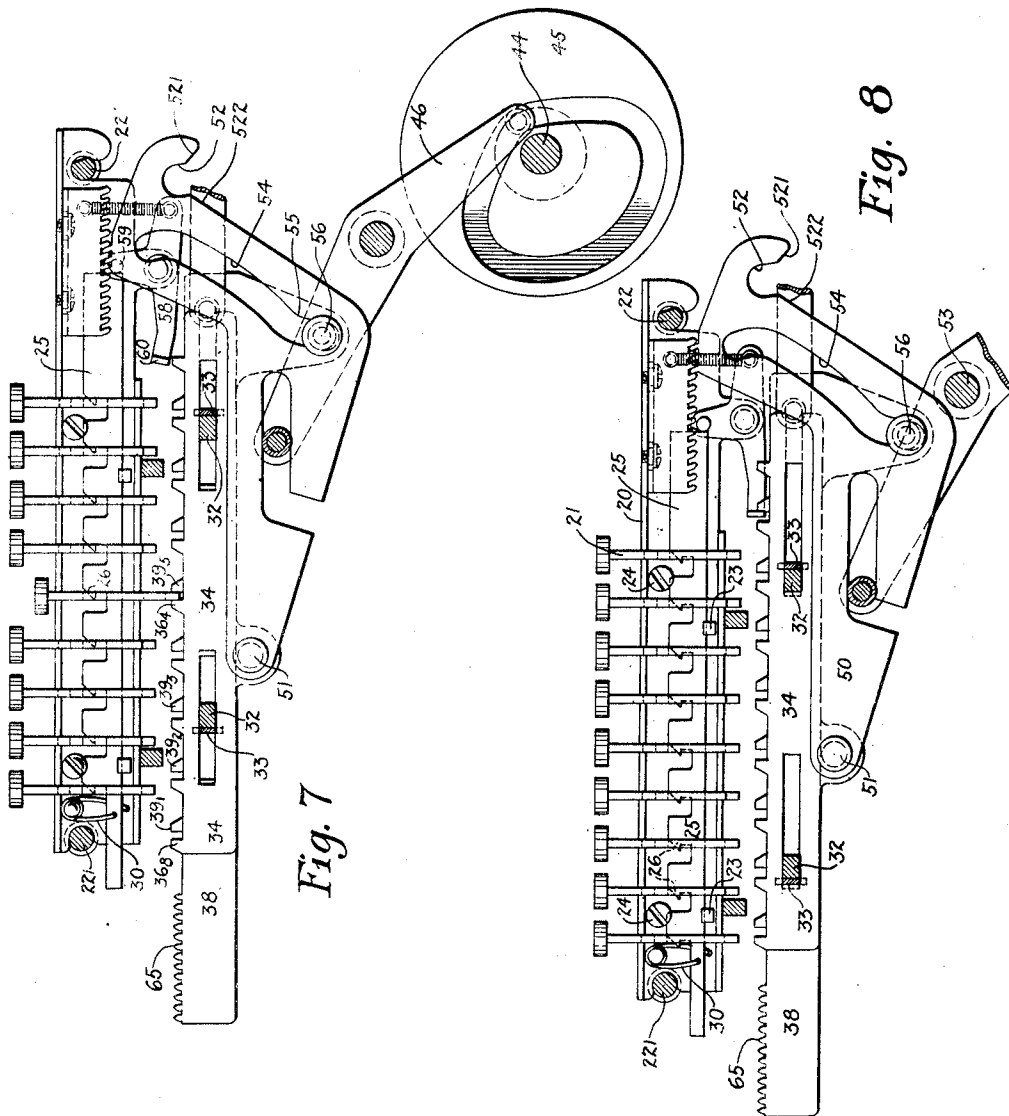
A. A. DICKE

2,105,640

CASH REGISTER

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3 Sheets-Sheet 3



INVENTOR
ALLEN A. DICKE
BY
H. C. Kieserling
ATTORNEY

UNITED STATES PATENT OFFICE

2,105,640

CASH REGISTER

Allen A. Dicke, Montclair, N. J., assignor, by
mesne assignments, to The National Cash Reg-
ister Company, Dayton, Ohio, a corporation
of Maryland

Application March 26, 1927, Serial No. 178,576

16 Claims. (Cl. 235—9)

This invention relates generally to accounting machines and the particular embodiment shown and described is of that class of machine known as cash registers which employ differential devices for transmitting the amounts entered into one or more totalizers and at the same time into certain indicating devices.

One primary object of the present invention is to provide an improved type of differential mechanism in which the actuators are positively moved in both directions as distinguished from the type in which springs are utilized to operate them in one direction. The advantage of having the actuators positively moved and restored is that the correct addition of the amounts entered in the machine is insured together with their proper indication and, if desired, their printing upon the record medium. It becomes impossible with this type of differential mechanism to oppose and prevent the full intended movement of an actuator as is readily possible where springs are employed.

A further object is to provide such a differential device in a machine of the flat keyboard type.

Briefly, the objects just stated which result from the improved design are accomplished in the preferred form of embodiment herein shown by providing two complementally movable slides, there being a pair of slides for each denomination of a totalizer, the extents of movement of the individual slides being dependent upon the value of the controlling keys which have been depressed. A universal operating member is provided for operating the slides of the different groups, the arrangement being such that the slides of each group may be stopped in different positions from the slides in other groups so that the proper differential movement may be imparted to each totalizer pinion by rack teeth formed on the related slide. One of the slides of each pair is normally locked, but when a key in the group associated with any pair is depressed the related locking element or zero stop pawl is moved out of locking engagement with the slide to permit movement of the latter by the common operating member.

In connection with the differential devices it is also an object of the invention to provide an improved form of aligning or correcting device, which gives the totalizer actuators and indicator setting devices a final adjustment which insures placing them in the proper positions. Thus any misalignment that would otherwise occur, in the event that there is a change in the dimensions

of the co-acting parts due to wear by constant use of the machine is automatically taken care of.

It is also an object of the invention to provide an improved type of key detent mechanism which is simple in construction, but effective in operation. Each detent is adapted, furthermore, to actuate the zero stop pawl for one of the pair of slides provided for the related group of keys.

Another object of the invention is the provision of an improved indicator positioning mechanism which is controlled by the positive differential mechanism. An outstanding feature of this phase of the invention is in the employment of frictional driving means for rotating the indicator drums which are always turned in the same direction. The indicator mechanism includes a series of stop devices each correlated with projections carried by the associated indicator drum so that as the latter is frictionally driven by the operating mechanism the co-operation of the stop with one of the projections will stop the indicator in its rotative movement at a position in which it will indicate the value of the key depressed. The indicator setting devices are so correlated with the differential devices that they are adjusted directly from one determining position to another during the movement of the operating mechanism. So also the indicators themselves are turned directly from one setting to the next but always in the same direction. By directly setting the determining devices as well as the indicator drums from the position in which they were left in the previous operation there is eliminated the jar caused by the sudden stopping of these parts as would be required if they were returned to a constant and normal position during each operation of the machine. As a result an easier movement and a lessening of the load on the machine is effected.

In the drawings and following description the improvements are shown embodied in a cash register of the two-motion type, that is, a register in which the operation of a key predetermines the extent of rotation which is to be given a totalizer wheel by the actuator when said actuator is driven by a subsequent operation of the operating mechanism. It will be apparent, however, when reading the description in connection with the drawings that the use of the improvements is not limited to such a machine, but they can be embodied in various forms in other types of cash registers and accounting machines. It will also be apparent, that the indicator setting and driving mechanism disclosed can, with a few changes,

which will readily suggest themselves, be used for adjusting elements other than indicators and may be used, for example, in adjusting type carriers. It is not, therefore, the desire to be limited to any particular use of the indicator setting and driving mechanisms or to any particular embodiment of the improvements as a whole.

With these and incidental objects in view the invention consists in certain novel features of construction and combination of parts, the essential elements of which are set forth in the 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.

Fig. 1 is a transverse sectional view of a cash register embodying the invention showing a bank of amount controlling keys, the differential mechanism associated therewith, the indicating devices for indicating the amounts registered in the machine and the driving mechanism for accomplishing the registering and indicating functions.

Fig. 2 is a detail view of suitable totalizer engaging devices and the associated operating cam.

Fig. 3 is a perspective view of one of the indicator position determining devices.

Fig. 4 is a view of the machine with the casing and keyboard removed taken perpendicular to the plane of the keyboard and showing the arrangement of the complemental controlling slides forming part of the differential devices. This view also shows the arrangement of the indicating mechanism.

Fig. 5 is a sectional view taken along the line 5—5 of Fig. 1 showing the key construction and the associated controlling slides.

Fig. 6 is a view taken along the line 6—6 of Fig. 1 showing particularly the zero stop and its relationship to one of the controlling slides.

Fig. 7 is a view in side elevation showing the action of the differential devices when a key in a bank is depressed and the machine is partially operated.

Fig. 8 is a view similar to Fig. 7 for showing the action of the differential device when no key in a bank is depressed and the machine is partially operated.

Fig. 9 is a detail of the key releasing mechanism.

Generally described the illustrative machine includes the following principal mechanisms: a driving mechanism, a keyboard, a differential mechanism, a totalizer for accumulating the amounts entered and an indicating mechanism for indicating the transactions as they occur in the machine.

The driving mechanism comprises an operating handle having gear connections to parallel driving shafts, one of which is adapted to operate the differential devices, one the indicating devices, and the remaining shaft to control the registering mechanism.

For controlling the operation of the differential devices a series of amount determining devices in the form of depressible keys are provided, suitable detent mechanism being provided to retain them in their depressed position during operations of the machine. As is usual in this type of machine the keys are arranged in a plurality of banks, each bank being provided with nine keys. It will be understood that while only amount keys are disclosed in the drawings a machine embodying the present invention may be equipped with clerks keys and transaction or department

keys as well, in which case similar connections to those provided for the amount keys will be provided for performing the functions usually performed by such keys, as controlling suitable indicators, printing mechanism, counter control mechanism, and the like.

In the illustrative machine the construction of the keys and the associated key detent mechanism is identical for the various denominational banks of keys and a description of one will be taken as representative of the various groups. As best shown in Fig. 5, each of the key frames 20 is preferably in the form of a channel bar and is suitably slotted so as to receive the stems of the keys 21, the upper ends of which are provided with heads so that the keys may be conveniently depressed. Each of the key frames is held in fixed position and supported at its upper end by means of circumferentially slotted rods 22 (Figs. 1 and 8) engaging a notch formed in the end of the vertical portion of the channel bar. At its lower end each channel is provided with a notch in the vertical wall which cooperates with a cross rod 221. Slidably mounted in the key frames 20 by means of slotted lugs 23 (Fig. 5 and 8) extending from the side of each channel frame and by means of slotted screws 24 also carried by the frame, is a detent plate 25. Each detent plate is provided with a plurality of hooked portions 26 and as best shown in Fig. 5, each detent 25 projects through the openings 27 formed in the keys of a related bank so that when a key is depressed against the action of a restoring spring 29 (Fig. 5) the detent plate will be moved in one direction against the resistance of a spring 30 (Fig. 8) and when the operated key is depressed sufficiently one of the hooked portions will engage an opening 31 formed in the stem of the depressed key. By reason of this construction when a key is depressed it will be held in its depressed position so that the lower portion of the key may control the differential device associated with that bank.

Located beneath the key channel frame just described are a pair of supporting bars 32 (Fig. 8) attached to which are slotted plates 33 which form the guiding means for a series of controlling slides 34. As best shown in Figs. 4 and 5 each controlling slide 34 is provided with a series of upstanding projections designated generally by 36, alternate ones being laterally bent as is best shown in Fig. 4. The amount keys are arranged, as before stated, in banks of nine each bank standing in a straight line and the lowermost key in each is adapted to represent a unit amount, while the uppermost key of each group is adapted to represent values of nine units. The projection designated 36a (Fig. 1) has its straight edge in substantially the same line as the adjacent side of the "9" key while the projection 36b is normally a distance of one unit away from its related or the "8" key, and of the remaining projections it will be noted that the projections 36 are a number of units away from their correlated keys corresponding to their subscript designations. The result of this is that when the lowermost or "1" key is depressed the co-action of the stem of the key with the projection 36a will permit the controlling slide 34 to be given a movement of eight units, and in each instance the movement of the slide with respect to the key depressed is the nine's complement of the value of the associated key.

The projections 36 are adapted to co-operate with integral extensions 37 (Fig. 5) formed on

the lower end of each of the key stems 21 it being noted that the extensions of the different keys are either, in alignment with the projections 36 which are in the plane of the plate 34 or with the projections which are bent away from the plane of the plate, so that in this way the projections 37 of the different keys are also alternately arranged in one of the two positions to the right of the center of the key as viewed in Fig. 5.

The reason for having the integral extensions on the key stems alternately disposed is due to the fact that it is desirable to have the maximum movement which can be imparted to the plate 34 greater than the distance between two adjacent keys. For example, if all the projections on the plate 34 and all the integral extensions 37 of the keys 21 were in the same plane for a denominational group of keys, it will be clear that when the lowest or "1" key (Fig. 1) is depressed and the slide 34 moved upwardly until the projection 36₁ cooperates with the extension 37 of the depressed key the projection 36₇ must pass the extension of the depressed key and this movement would not be possible if the projection 36₇ of the slide was in alignment with the extension 37 of the "1" key. Instead of permitting the slide 34 to be moved until the projection 36₁ co-acted with the stem of the "1" key the projection 36₇ would first coact with the stem of this key if the alternate arrangement were not adopted. By this construction the keys may be spaced more closely, thus providing a small easily operated keyboard, while at the same time permitting of large movements of the internal parts which reduces the effect of structural variations and permit of larger tolerances in manufacture.

Mounted adjacent each slide 34 is a companion controlling slide 38 provided with rectangular notches through which the guiding and supporting bars 32 and plates 33 also project so that this slide is mounted just as the slide 34. The slide 38 is similar to the slide 34 but is adapted to be moved amounts complementary and in a direction reverse to the movement imparted to the slide 34 and therefore it is moved to an amount commensurate with the value of the key depressed. The slide 38 is provided with projections 39₁ to 39₈ (Fig. 4) which are arranged in a manner similar to the projections 36 on the slide 34 that is, alternate ones are bent out of the plane of the slide 38, the subscript denoting the distance in units that the projection and therefore the slide may be moved before the straight edge of the projection co-acts with the stem of its related key. Referring to Fig. 5 it will be noted that the stems of the keys are also provided with integral extensions 40, 40 adapted to cooperate with their related projections, these being arranged alternately between two positions similar to the extensions 37, 37.

It will be observed in the preferred embodiment that no projections are provided to cooperate with the keys to control the movement of either the slide 34 or 38 equivalent to nine steps. If so desired the necessary projections may be provided, but in the machine shown the rectangular slots formed in the slides 34 and 38 cooperating with the bars 32 are utilized to limit the movement of the slides to an extent equivalent to nine steps of movement.

The power for operating the machine may be provided by any prime mover such as electric motor, or as shown in the illustrative machine it may be supplied by a crank handle 41 (Fig. 1). The crank rotates a gear 42 meshing with a gear

43, the gearing being so arranged that two rotations of the crank will effect a complete rotation of the gear 43 and the shaft 44 to which the gear is attached. Attached to the shaft 44 is a pair of box cams 45 the cam races of which cooperate with rollers carried by the rearward extensions 46 of a pair of arms 47 (Fig. 4) loosely pivoted on a rod 53, and which are connected together by a cross rod 48 thus forming a frame. The box cams are arranged so that during each operation of the machine the frame will be rocked to operate the differential devices of the machine.

The rod 48 may carry a number of rollers 481 (Figs. 4 and 5) suitably spaced by means of collars 492 and the rollers preferably pass through and cooperate with slots 49 formed in each of a series of cam plates 50 each of which is connected at one end to its respective slide 34 by a pivot pin 51. At the other end each cam plate 50 is provided with a hooked portion 52 normally engaging the rod 53. As just stated the rod 48 passes through the slots 49 formed in all the cam plates 50 so that upon each rocking movement of the frame the slides 34 will, by mechanism about to be described, all be moved upwardly until the projections 36 abut the stems of the depressed keys of the various banks, or if no key is depressed in certain banks, until the ends of the rectangular slots in the slides 34 for those banks co-act with the bars 32.

Each cam plate 50 is provided with a slot which is comprised of a cam portion 54 and a dwell portion 55 at each end concentric with respect to pivot 51 and which co-operates with a stud 56 carried by a downward extension 57 integral with the slide 38. The slide 38 is normally locked against a downward movement by means of a triple-armed pivoted zero stop 58 which is spring-urged so that a pin 59 carried by one arm co-acts with one end of the detent plate 25, another arm being provided with a lug 60 normally engaging the projection 39₈ of the slide 38.

The operation of the above described mechanism when no key in a bank is depressed is as follows: Since no key has been depressed the zero stop 58 will remain in its normal position and will hold the slide 38 against any downward movement. Now when the crank handle 41 is turned the gear 42 will drive the gear 43 thereby rotating the shaft 44. The box cam 45 will rock the rod 48 upwardly and by its co-operation with the slot 49 will rock the cam plate 50 about the pin 51 from the position shown in Fig. 1 to the position shown in Fig. 8, it being noted that very early in the movement of the plate 50 the hooked portion 52 is disengaged from the rod 53 and during the operation is carried a considerable distance away from the latter. Since the slide 38 is locked against movement the co-operation of the slot 54 with the pin 56 will result in forcing the cam plate 50 rearwardly and upwardly and it will in turn draw the slide 34 upwardly until it assumes the position shown in Fig. 8 wherein it will be noted that the ends of the rectangular slots formed in the slide 34 have co-acted with the supporting bars 32 thus indicating that the slide 34 has received the maximum, or nine steps of movement.

If, on the other hand, the registration and indication of a certain denominational group should be five the "5" key in that particular group is depressed and will be retained in its depressed position by means of the detent mechanism previously described. It will be noted, furthermore, that when the "5" key is depressed the detent plate

25 co-acting with the pin 59 will rock the zero stop 58 so as to disengage the lug 60 from the projection 39_a of the slide 38 (Figs. 1 and 7). Upon an operation of the crank handle the bar 5 48 will be lifted as before so that the slide 34 will also be moved upwardly and rearwardly as previously described, but since in this instance the slide 38 is unlocked for operation, the co-operation of the cam slot 54 with the pin 56 will 10 also force the slide 38 downwardly or in a direction reverse to the movement imparted to the slide 34 and while the slide 34 will, during its movement, be stopped when the projection 36_a strikes one side of the stem of the "5" key, the 15 slide 38 will be moved in the reverse direction until its projection 39_a strikes the opposite side of the depressed key (see Fig. 7). When both projections are in co-operation with the key the slides will be held, it being noted that during 20 this operation the slide 38 has received five steps of movement commensurate with the key depressed, while the slide 34 on the other hand has received four steps of movement which is the complement of the value of the key depressed. 25 During the second period of the cycle of operation, the rod 48 will be moved downwardly to the position shown in Fig. 1, thereby imparting a reverse movement to both the slides 34 and 38 and bringing the parts to their normal positions. 30 As the slide 50 approaches its normal position the hook 52 will again engage the rod 53 and to provide for the proper restoration of the parts, the hook is provided with camming edges 52₁ and 52₂ on opposite sides of the opening adapted to engage the rod 53 if the parts are slightly out of 35 alignment and by a camming action to positively force the plates 34 and 38 to their normal positions. This construction insures greater accuracy of operation while reducing the required accuracy 40 in the manufacture of the parts.

Any suitable means may be provided to actuate the key detent 25 at the end of the operation of the machine to disengage the hooked portion 26 45 from the notch 27 so that the depressed key will be unlocked and released for a subsequent depression. The specific means disclosed for this purpose, as best shown in Fig. 9, comprises a cam disc 26₁ secured to the shaft 74 which is rotated by the operating crank through connections which 50 will be described later. A suitable race or cam groove is formed in the disc 26₁ and this groove cooperates with a pin or roller carried by a bell crank 262 loosely mounted on a rod 70. The upper arm of this bell crank carries a cross rod 55 263 which is supported at its opposite end by an arm similar to 262 mounted on the rod 70. Cross rod 263 is in line with and only slightly removed from the lower ends 25₁ of the detents 25 and as the shaft 74 is rotated, counterclockwise, the bell 60 crank 262 will be rocked clockwise toward the end of the operation and rod 263 will force all of the detents 25₁ rearwardly to release the depressed keys.

Since the slide 38 is adapted to receive movements commensurate with the value of keys depressed, the illustrative machine is provided with means for actuating suitable registering mechanism and for this purpose the forward portion of the slide 38 is provided with rack teeth 65 (Fig. 1) 70 adapted to cooperate with a pinion 66 attached to a totalizer element 67. The totalizer pinions and totalizer elements, of each of which there is one for each denominational order, are carried by a pivoted frame 68 (Fig. 2) which may be 75 rocked at the desired time so as to bring the to-

talizer pinions 66 into and out of engagement with the totalizer operating racks 65, and in the embodiment herein shown this mechanism comprises a bell crank or cam plate 69 pivoted upon a fixed shaft 70, one arm of the bell-crank being 5 provided with a roller engaging the race of a box cam 171, while the other arm of the plate is provided with a cam slot 72 engaging the shaft 73 which supports the totalizer pinions and elements. A full revolution is imparted to the shaft 74 10 which carries the cam 71 by means of the train of mechanism comprising the gear 75 attached to the shaft 74 meshing with a gear 76, the latter in turn meshing with a gear 77 which is geared to the gear 42 previously described. The total- 15 izer pinions may be rocked into mesh with the operating racks 65 previous to any movement of the slides 33, or, if so desired, the totalizer pinions may be meshed with the operating racks just prior to the time that the slides 38 are restored 20 to their normal positions since in either case the slides 38 are moved an amount commensurate with the keys depressed. As illustrated, the form of the race in the cam 71 is such as to cause engagement of the totalizer after the slides have 25 been moved and just prior to their return movement.

Referring particularly to Figs. 1, 2, and 7 it will be noted that the cams 45 and 71 are so formed as to divide a cycle of operation into three sub- 30 stantially equal periods. During the first period cam 45 operates the bar 48 as described to produce differential movement of the slides 34 and 38, while during the second period the bar 48 is restored and during the final period there is a 35 dwell so that the bar and all parts of the differential mechanism are held stationary. Cam 71 on the other hand has a dwell or idle movement during the first and third periods but is active during the second period to engage the totalizer 40 with the actuators and at the end of this period or the beginning of the third period to disengage these parts.

The purpose of the idle portions in the third period for both cams is to allow time for the 45 operation of suitable transfer mechanism. Any mechanism suited to this purpose may be provided and one form which is particularly adapted to the mechanism shown is that disclosed in the Fuller application S. N. 263,125, filed November 50 19, 1918, United States Patent No. 1,742,701, issued January 7, 1930. In accordance with this disclosure suitable elements are partially rotated upon passage of wheels of lower order from nine to zero and subsequently after the totalizer is 55 disengaged from the actuators a series of complementary cams 107 acting seriatim upon bell cranks 108 serve to complete the transfer action into the higher order wheels. For further details of this one form of transfer mechanism which is 60 suitable for the purpose, reference may be had to the disclosure of the Fuller application mentioned or to the corresponding French Patent No. 533,459 published March 3, 1922.

Due to the fact that in manufacturing operations the dimensions of component parts may 65 vary, and also to offset inaccuracies due to wear, it is desirable to provide a correcting device to insure as nearly as possible that the slides 34 and 38 receive the proper differential movement. The 70 deviation from the proper degree of movement may be caused by the varying dimensions of the projections on the slides 34 and 38, the inaccuracies in the dimensions of the key stems and variations due to the wear of the parts by con- 75

stant use of the machine. To correct any errors that might occur, suitable aligning devices may be employed. This may be done very conveniently by providing the upper end of the cam plate 50 with one or more aligning teeth 78 which near their extreme upward position are adapted to co-operate with aligning slots 79 formed in a correcting plate 80. The latter is attached to the key frame 20 by screws 81 passing through elongated slots 82 formed in the plate 80 and into the key frame.

Theoretically, if the dimensions of the various parts were correct the series of teeth 78 would always cooperate with associated slots 79 but any change in the dimensions of the cooperating parts will cause the aligning teeth 78 to assume a position to one side or the other of the center lines of the slots 79. If the precise proper relationship does not exist it will be obvious that when the cam plate 50 receives its extreme upward movement the aligning teeth 78 will be slightly off center with respect to the aligning slots 79 but on being forced in there will be a camming action thus shifting the cam plate 50 and the slides 34 and 38 so that they will assume the proper positions. The time at which the aligning action is performed is substantially at the time the pin 56 is co-acting with the lower "dwell" 55 in the slot of cam plate 50. It should also be observed that the plate 80 is adjustably mounted on the key frame 20 so that when the parts are assembled the plate 80 may be adjusted to the proper position to effect the desired alignment of the slides 34 and 38. Then by tightening the screws 81 the plate may be held locked in this position. The plate 80 may be re-adjusted at any time if it does not function properly thus taking care of any changes that might occur in the mechanism due to natural wear of the co-operating parts.

Indicating mechanism

A novel form of mechanism is provided whereby the items registered by the machine are indicated. Fitting within a slot 85 formed in the upper end of each of the slides 38 is a stud 86 (Figs. 1 and 4) carried by a rack member 87 the teeth of which co-operate with a pinion 88 attached to a cam 89 having a cam slot 90 formed in its periphery. A spring-pressed aligning pawl 91 is adapted to engage the interdental spaces of each pinion 88 to hold the cam 89 in any of its adjusted positions.

Fig. 1 illustrates the position that the parts assume when no key in the particular bank shown was depressed during the preceding operation. When the slide 38 is moved downwardly to a position determined by the value of the key depressed the upper end of the slot 85 co-acting with the stud 86 will draw the rack member 87 downwardly and through the pinion 88 will adjust the cam member 89 accordingly. However, if the amount last registered has left the stud 86 in such a position in the slot 85 that the movement of the slide 38 is not sufficient to permit the upper end of the slot 85 to contact with the stud 86 and draw the rack 87 to the new position it will be clear that the upper end of the slide 34 will contact with the stud 86 to force it upwardly and adjust the rack member to the position desired.

It will be noted that the upper end of the slide 34 and the upper end of the slot 85 formed in the slide 38, are so shaped that they may suitably engage opposite sides of the stud 86 to

positively move it from one position to the other and at a certain point in the operation to clamp the stud between them. When the rack member 87 has been adjusted to its new position it will be held in such position by means of the holding pawl 91. This will permit the complementally moved slides 34 and 38 to be restored to normal without disturbing the position of the rack member 87. Since the rack member is always left in its adjusted position it will be obvious that the rack and connected parts are moved positively directly from one position to the other without being restored to a constant or normal position thereby eliminating to a great extent the wear on these parts and a jar in their movement, as well as reducing the power required.

The cam slot 90 is adapted to receive the roller 919 (Figs. 1, 3, and 4) carried by an indicator stop arm 92 which is pivotally mounted on a fixed block 93. The upper end of the indicator stop arm 92 is bent as shown in Fig. 3, so that it may cooperate with one of a series of stop lugs 94 attached to the associated indicator drum 95. It will be noted that while the stop lugs 94 are equally spaced circumferentially about the periphery of the indicator drum 95 they are at different distances from the edges of the indicator drums. The result of this construction is that the end of the indicator stop arm 92 which is shifted transversely of the drum by rotation of the cam 89 may cooperate with only one stop lug and is out of the path of the remaining lugs as the indicator is being rotated by means which will now be described.

The gear 43 (Fig. 1) previously described is adapted to mesh with an idler gear 96 which meshes with a similar gear 97 which in turn is adapted to cause a rotative movement of a larger gear 98 loosely carried by a stud 981. Attached to the gear 98 is a disk 99 provided with teeth around approximately half of its periphery and adapted to mesh with teeth formed on a mutilated gear 100 fast to a drive shaft 101. It will be noted that the gear 100 is provided with a projection 106 which has its outer surface concentric with respect to the stud 981 and is normally adapted to co-operate with the periphery of the disk 99 thus forming in effect a Geneva lock to normally lock the shaft 101. The train of gearing just described is such that a complete rotation of the gear 43 and therefore two revolutions of the crank handle 41 will produce a single rotation of the disk 99 but since the disk 99 may be rotated to a certain extent, substantially 180°, before its gear teeth cooperate with the teeth of the gear 100 this idle movement will permit the disk 99 to be moved independently of the gear 100 and the latter will remain locked by the Geneva action. The lost motion between these two members thus provided is such that the shaft 101 will only be driven during the second half cycle of the machine when the gear teeth on the disk 99 will mesh with the teeth of the gear 100.

Rigidly secured to the shaft 101 are a series of collars 102 (Fig. 4) each of which has attached thereto a spider comprised of bent spring fingers 103 which are adapted to press against the side of the associated indicator drum 95, it being understood that the friction between the ends of the spring fingers and the indicator drum in each case is sufficient so that rotative movement of the shaft 101 will cause a similar movement of all the indicators so long as they are free to turn but when an indicator is stopped by the co-operation of one of its peripheral lugs with its related indi-

cator stop arm 92 that indicator will be stopped but the shaft 100 and the spiders 103 will continue their rotative movement.

The operation of the above described mechanism is as follows: During the first part of the cycle of the operation of the machine, substantially 120° of rotation of shaft 44, the rack members 87 will be adjusted by the complementally moved slides thereby rotating the gear 88 and the cam members 89 so that the cam 90 in co-operation with the roller 910 will shift the indicator stop arm 92 to such a position that it will be in the path of the desired lug 94 on the indicator drum. The detent 91 will serve to retain the parts in the new position of adjustment. During this operation of the machine and a part of the succeeding period the gear 43 will drive the gear 96 and through the gear 97 meshing with the gear 98, the disk 99 will be rotated to bring its teeth into co-operative relationship with the teeth of the gear 100 by the end of the first half cycle of the machine. When the teeth on the disk 99 rotate the gear 100 during the second half of the cycle of operation the spring-pressed fingers 103 will drive each of the indicator drums until the variously positioned indicator stop arms 92 cooperating with the stop lugs 94 of the indicator drums will prevent them from being rotated further and will hold the indicator drums so that at the end of the second half of the cycle of operation all the indicators will be adjusted to indicate the amounts registered under control of the different denominational groups of keys.

In the event that no key in a bank is depressed the stop arm 92 will be shifted, if it is not already there, so that it cooperates with the stop lug corresponding to the zero mark on the indicator drum.

While the cams 45 are so designed that the plates 50 and hence the complemental slides 34 and 38 will be returned toward normal after substantially 120° rotation and these parts will be fully restored after about 240° rotation of shaft 44 the racks 87 and cam members 89 will be held in adjusted position by means of detents 91 so that the stop arms 92 will remain in proper positions to arrest the indicator drums as desired.

The gearing for driving the shaft 101 and the spiders 103 is so designed that they are given a complete revolution at each operation of the machine. This is to insure that an indicator may, whenever necessary, receive nine steps of movement which, in the embodiment shown, is the maximum required. It will be clear that when an indicator is to remain in the same position as in a preceding operation the stop arm 92 will remain in the path of the same lug 94 and no movement will be imparted to the indicator drum. If the new indication in a particular order is to be one higher than the previous indication the indicator drum will be given just one step of movement. The maximum movement of the drum, nine-tenths of a revolution, will be required when the new indication is one less than the previous indication. When the machine is operated rapidly there may be some danger of slight slippage between the spring-fingers and the indicator drums before the indicators are stopped by their stop arms but this should never exceed 36° of angular movement so that by giving a complete rotation to the shaft 101 a movement of nine steps of the indicator drums will always be insured. Obviously if it is found necessary or desirable the shaft 101 might be given a greater movement than a full rotation in order to completely

avoid any danger of not carrying the indicators nine steps.

As best shown in Fig. 1 the entire machine is enclosed by a cabinet 104 which is apertured so that the indicators may be viewed through the glass 105. In the illustrative machine the indicators are adopted to display the amounts registered only toward the front but if desired these drums might be enlarged to carry twenty figures with one set of ten visible from the front and the others from the rear or a second set of drums suitably coordinated with those illustrated, by means well known in the art, might be provided. A lid 109 which is normally locked serves to conceal the totalizer wheels but may be opened to permit reading of the totals.

General summary of operation

The operation will doubtless be understood from the foregoing but it may be briefly recapitulated to render the sequential action of the various parts clear in the relations which they bear to each other.

It will be assumed, for example, that it is desired to register and indicate an amount of 50¢. It will, therefore, be necessary to depress only the "5" key in the dimes denominational group of keys and when the "5" key is depressed against the resistance of the spring 29 (Fig. 5) the co-action of the upper edge of the opening 27 of the key with the beveled edge of the hook portion 26 of detent 25 will move the detent upwardly against the resistance of the spring 30 (Fig. 7). When the operated key is depressed sufficiently the spring will act to carry the hook portion into the opening 31 formed in the stem of the depressed key, thereby locking the key in depressed position. When the detent is operated the upper end co-acting with the pin 59 (Fig. 7) will rock the zero stop 58 so as to disengage the lug 60 from the projection 39a of the dimes slide 38 thus unlocking the latter for operation. It will be noted, however, that since no key in the units order has been depressed the locking lug 60 of the zero stop 58 for that order will remain in engagement with the projection 39a of the associated slide 38 so that this particular slide will remain locked against operation, as will the slides of hundreds and higher orders.

After the necessary key or keys have been depressed a further operation of the machine consists in operating the crank handle 41 (Fig. 1) giving the latter two complete revolutions to perform the functions of registering and indicating the amount set up. As the crank handle 41 is turned the gear 42 will drive the gear 43 thereby rotating the shaft 44 so that the pair of box cams 45 will rock the frame comprising the side arms 47 and the cross rod 48 whereby the latter is raised. As the rod 48 is elevated its co-operation with the slot 49 of the cam plate 50 associated with the units denominational order will rock the cam plate about the pin 51 from the position shown in Fig. 1 to the position shown in Fig. 8. It will be observed that since the slide 38 is locked against movement by the zero stop 58, elevation of the rod 48 in causing the cam slot 54 to co-operate with the pin 56 will cause the slide 34 to be forced upwardly until it assumes the position shown in Fig. 8 wherein it will be noted that the ends of the rectangular slots formed in the slide 34 have engaged the supporting bars 32 thereby stopping movement of the slide after it has received the maximum movement of "9" steps.

Simultaneously, elevation of the rod 48 will also rock the cam plate 50 (Fig. 7) associated with the dimes denominational order, but since in this instance the slide 38 is unlocked for operation due to the disengagement of the lug 60 of the associated zero stop 59 from the projection 29s, the co-operation of the cam slot 54 with the pin 56 will force the slide 38 in a direction which is the reverse of the movement imparted at the same time to the slide 34 and as the slides move relative to each other the slide 34 will be stopped when the projection 36a strikes one side of the stem of the "5" key and the slide 38 will be moved until its projection 29s strikes the opposite side of the depressed key (see Fig. 7). Therefore, it will be noted that while the slide 34 received four steps of movement the slide 38 received five steps of movement commensurate with the value of the key depressed.

During the rotation of the crank handle 41 the gear 42 (Fig. 1) will drive the gear 75 through the intermediate gears 77 and 76 so as to give the shaft 74 a revolution and by the action of the cam 71 (Fig. 2) upon the roller carried by the totalizer engaging plate 69, said plate will be rocked counter-clockwise (as viewed in Fig. 2) so that the cam slot 72 will rock the totalizer frame 68 to bring the totalizer pinions 65 into engagement with the actuating racks 65 at substantially the time the dimes rack has been moved to its differential or "5" position. It will be noted that the cam 71 is provided with a dwell for about 120° after which the camming surface to act on the plate 69 begins. In the case under discussion, the actuating rack 65 associated with the units order has received no movement so that the units totalizer pinion 66 will be meshed with its rack while the latter is at normal.

At substantially one third of the revolution of the shafts 44 and 74, at which time the rod 48 approaches its extreme upper position which is just prior to the time the totalizer pinions are engaged with the actuator racks 65 the aligning teeth 78 of the several plates 50 (Figs. 7 and 8) will be forced into the aligning slots 79 of the adjusting plates 80 thus insuring the proper positioning of the parts and, if they are out of correct alignment, it will result in shifting the cam plates 50 and slides 34 and 38 into their proper positions. At the time at which the aligning operation is performed each pin 56 is coacting with the dwell 55 of the cam slot 54 formed in its related cam plate 50.

If the amount last registered by the units denominational order was zero the associated pin 86 (Fig. 1) would have been, at the beginning of the operation now being considered, in such a position as to co-operate with the upper end of the slot 85 formed in the slide 38 in which position the stop arm 92 has its engaging end in co-operation with the stop lug 94 related to the zero mark on the indicator drum 95. This is also the position the parts will assume after the first third of the operation of the machine under the conditions specified. Therefore, as far as the units denominational order is concerned movement of the slide 34 to its maximum position will merely cause it to contact the pin 85 without shifting the rack member 87, cam 89 or stop arm 92.

If, however, the amount registered in the dimes denominational order during the previous transaction should also have been zero, it will be observed that when the slide 38 is moved downwardly a distance of five units, as described for

the operation under consideration, the end of the slot 85 co-acting with the pin 85 will draw the rack member 87 downwardly a corresponding amount. Through the gear 88 the cam 89 will be rotated sufficiently so that the cam slot formed therein co-acting with the roller 91 will shift the zero stop arm 90 to such a position that the engaging end of the indicator stop arm 92 will be brought into the path of the stop lug 94 appropriated to the "5" indicia on the indicator drum 95 associated with the dimes denominational order.

During the time that the indicator stop arms 92 are being adjusted to the proper positions, which as previously stated, is during the first third of a cycle of operation, the gear 43 will drive the pinions 96 and 97 so that the latter will drive the gear 98 and the disk 99 but during this time the periphery of the disk co-operating with the projection 106 of the gear 100, will lock the shaft 109 against rotation.

During the second of the three periods into which the operation of the machine may be roughly divided the pairs of slides 34 and 38 associated with the different denominational orders will be returned to their normal positions. Thus the rod 48 will at this time be restored to its lower position and it will rock the cam plate 50 associated with the units denominational order so that by co-operation of the cam slot 54 with the pin 56 the slide 34 will be brought to its normal position. The slide 38 will, of course, have remained at normal throughout. Simultaneously the cam plate 50 associated with the dimes denominational order will also be restored so that by co-operation of the related pin 56 with the cam slot 54 the slides 34 and 38 for this order will be restored to their normal positions. During the time that the slide 38 associated with the dimes denominational order is being restored the rack teeth 65 will rotate the dimes totalizer pinion 66 giving the associated totalizer wheel 67 a rotative movement of "5" units whereby five will be added to this element. At the extreme end of this phase of the operation of the machine the cam edges 521 (Fig. 1) of the hooks 52 formed on the several cam plates 50 will co-act with the rod 53 thereby readjusting the cam plates 34 and 38 if they are not already brought to their proper positions. It will be understood that the action of the differential elements in those orders above the dimes denomination in which no keys have been depressed will be precisely the same as described for the units order elements.

During the time that the slide 38 associated with the dimes denominational order was being returned to its normal position the aligning pawl 91 co-acting with the teeth of the pinion 88 served to hold the stop arm 92 in its adjusted position which, in the present instance, was such that the indicator stop arm was in alignment with the stop lug 94 associated with the "5" indicia on the dimes indicator drum 95.

It is to be noted that while the operation of the machine is divided into three periods of approximately 120° so far as the cams 45 and 71 are concerned the operation of the indicators by the disks 99 calls for only two periods each of which is substantially 180°. Therefore it is not until the beginning of the second rotation of the crank handle 41 that the teeth on the disk 99 (Fig. 1) will co-operate with the teeth of the gear 100 thereby driving the shaft 101 so that the spring-pressed fingers 103 will drive all the

indicator drums simultaneously in the direction indicated by the arrow in Fig. 1. The indicator drum associated with the dimes denominational order will be rotated until the stop lug 94 associated with the "5" indicia co-operates with the related indicator stop arm 92 thereby preventing that indicator from being further rotated. At this time the "5" indicia will be brought to such position that it may be viewed through the indicator glass 105.

Since the indicator stop arm 92 associated with the units denominational order is already in alignment with the stop lug 94 associated with the "0" indicia, under the conditions assumed, the indicator drum 95 for this order will be held against movement from the start so that as the shaft 101 is rotated the spider 103 will merely slide around the side wall of the indicator drum without changing the position of the latter.

As before stated the cam stop in the cam 71 so formed that the totalizer will be rocked into mesh with the racks 65 after about one third of the cycle of the machine has been completed and it will be held in mesh during the succeeding third of the cycle. At the end of this second period in the cycle, however, the cam 71 will rock the totalizer engaging plate 69 (Fig. 2) reversely so that the totalizer frame will be rocked about its pivotal point to bring the totalizer pinions 63 out of mesh with the actuating racks 65. It is at this point or during the final period of the operation of the machine that the transfer mechanism is operated by the cams 107 carried by shaft 74. Thus if the additions in any of the orders of the totalizer served to carry the wheels from 9 to 0 or beyond certain elements, such as those fully disclosed in the Fuller application mentioned, would be partially rotated and the subsequent operation of cams 107 after the totalizer has been disengaged from the racks would complete the carry and restore the transfer elements.

For the purpose of operating the key detent 25 so that the "5" key will be permitted to be returned to its normal position under the influence of the spring 29 the cam 261 secured to the shaft 74 is provided and this is adapted to rock the arms 262 carrying rod 263 to cause the latter to force the detent rearwardly, thus permitting the machine to be conditioned for the entry of subsequent items. Therefore, it will be observed that at the end of the operation of the machine the totalizer will have received an entry of 0.50 and the indicator drums will be adjusted to indicate this amount.

It will be seen that the construction herein shown and described is admirably adapted to fulfill the objects primarily stated. It is to be understood that the inventions herein described are susceptible of embodiment in many other forms which will be obvious to those skilled in the art, hence in the claims which follow essential elements are recited without limitations as to details of construction.

Furthermore, many of the features herein disclosed may be applied to the other structures either in part, or in whole. The novel aligning devices for the actuators may be used in connection with other types and forms of differential devices and used with similar benefits and advantages. That part of the invention which relates to the means for determining the position of the indicating or similar devices in a cash register or analogous machine in such a manner as to obviate restoration of the determining means

to zero in each operation, does not depend upon the particular method shown for its proper functioning, since it will be obvious to those skilled in the art that the determining means may be used in connection with other forms of differential devices.

While the novel positioning devices have been shown in connection with indicators it will be obvious that the same mechanism may be used for other purposes such as adjusting type carriers and where the term "digit carrier" appears in some of the claims it is intended to cover any form of device which by its different positions designates different values, such as, an indicator, a type carrier, or a registering element of a totalizer.

While the form of mechanism herein described is admirably adapted to fulfill 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, since it may be embodied in various forms, all coming within the scope of the claims which follow:

What is claimed is:—

1. In an accounting machine, the combination of a plurality of stop members, a pair of longitudinally movable members adapted to cooperate with the stop members, said members having a constant aggregate movement on each operation of the machine, a plate fulcrumed on one of said pair of members, a cam slot and stud connection between the plate and the other of the pair of members, and an operating device for said plate.

2. In an accounting machine, the combination of two differentially movable members, a row of keys cooperating directly with the members for limiting the movement thereof, a connecting device between said members, a slot formed in the connecting device, a rod engaging the slot, and an operating member having excursions of invariable extents during all operations of the machine for operating the rod and the connecting device whereby the members are moved differentially.

3. In an accounting machine, the combination of a pair of relatively movable members each provided with a plurality of stops, a series of manipulative means cooperating directly with said stops, a connecting device comprising a plate fulcrumed on one member and having a pin and a cam surface connection with the remaining member, and means for actuating the plate so as to move the members in opposite directions until one of the stops of each member cooperates with an operated manipulative means.

4. In an accounting machine, the combination of a pair of shiftable members each provided with a plurality of stops, a series of manipulative devices cooperating directly with said stops, and a cam plate connecting the members for shifting the members until one of the stops carried by each cooperates with the operated manipulative device.

5. In an accounting machine, the combination of a pair of shiftable members each provided with a plurality of stops, a series of manipulative devices cooperating directly with said stops, a floating cam plate for shifting the members until one of the stops on each member cooperates with an operated manipulative device, said plate serving also to restore said members to normal.

6. In an accounting machine, the combination of a pair of shiftable members each provided with a plurality of stops, a series of manipulative members cooperating with said stops, a cam plate for shifting the members until one of the stops on

each member cooperates with the operated manipulative member, said plate serving also to restore said members to normal, and means formed on said plate comprising a cam edge co-
 5 operating with a fixed rod for aligning said members in normal position.

7. In an accounting machine, the combination of a pair of shiftable members each provided with a plurality of stops, a series of manipulative
 10 members cooperating with said stops, a reciprocable cam member for shifting the members until one of the stops carried by each member cooperates with the operated manipulative member and means carried by said cam member and co-
 15 operating with fixed elements for re-adjusting the shiftable members during the movement of the cam member in both directions.

8. In an accounting machine, the combination of a pair of shiftable members each provided with a plurality of stops, a series of manipulative mem-
 20 bers cooperating with said stops, a reciprocable cam member for shifting the members until one of the stops carried by each member cooperates with an operated manipulative member and
 25 means associated with the cam member for re-adjusting the shiftable members during the movement of the cam member in both directions.

9. In an accounting machine, the combination with an operating device for an accounting element, of means for limiting differentially the
 30 movement of said device, means for positioning the operating device differentially, and an aligning means carried by the positioning means for correcting an inaccurate positioning of the op-
 35 erating device.

10. In an accounting machine, the combination of an accounting element, a plurality of shiftable members one of which includes a driving means
 40 for said accounting element, a cam member for moving the shiftable members relative to each other and thereby positioning the driving means, and aligning means carried by the cam member for re-adjusting the shiftable members to correct
 45 an inaccurate positioning of the driving means.

11. In an accounting machine, the combination with a plurality of shiftable members, one of which includes a driving means for an account-
 50 ing element, a cam member for moving the shiftable members relative to each other and thereby positioning the driving means, means for re-

adjusting the shiftable members to correct an inaccurate positioning of the driving means, said means including a fixed member having aligning slots and an aligning tooth carried by the align-
 5 ing member adapted to cooperate with the aligning slots in the fixed member.

12. In an accounting machine, the combination of a plurality of stops, an operating device differentially positioned under control of the
 10 stops, a pivoted member rockable for differentially actuating the operating device, and means controlled by and operated during the rocking movement of the pivoted member for aligning the operating device.

13. In an accounting machine, the combination 15 of a plurality of stops, an operating device differentially positioned under control of the stops, a pivoted member for differentially actuating the operating device, and means carried by the pivoted member cooperating with an aligning
 20 plate for correcting any inaccurate positioning of the operating device.

14. In an accounting device, the combination of an accounting device actuator, a member for driving the actuator differentially, an aligning
 25 means, and means carried by said member cooperating with the aligning means to correct an inaccurate positioning of the actuator, one of said means being adjustably mounted.

15. In an accounting machine, the combination 30 of differentially adjustable members, means to move the members complementary extents longitudinally of each other, the means including a plate pivoted on one member and having a cam surface formed therein cooperating with a pro-
 35 jecting element carried by the other adjustable member, and an operating device for actuating the plate.

16. In a machine of the class described, two
 40 slidable members lying in parallel planes, a plate pivoted on one member and connected to the other by a pin and cam slot, actuating means connected to the plate, and stop means cooperating with the members to limit movement of the
 45 latter, the parts being so proportioned and arranged that a movement of the actuating means causes the members to move complementary extents through the camming action of the slot and under the control of the stop means.

ALLEN A. DICKE.