T. MIDGLEY, JR.

TRANSFER MECHANISM.

APPLICATION FILED DEC. 31, 1913.

1,237,213.

Patented Aug. 14, 1917.

2 SHEETS—SHEET 1.

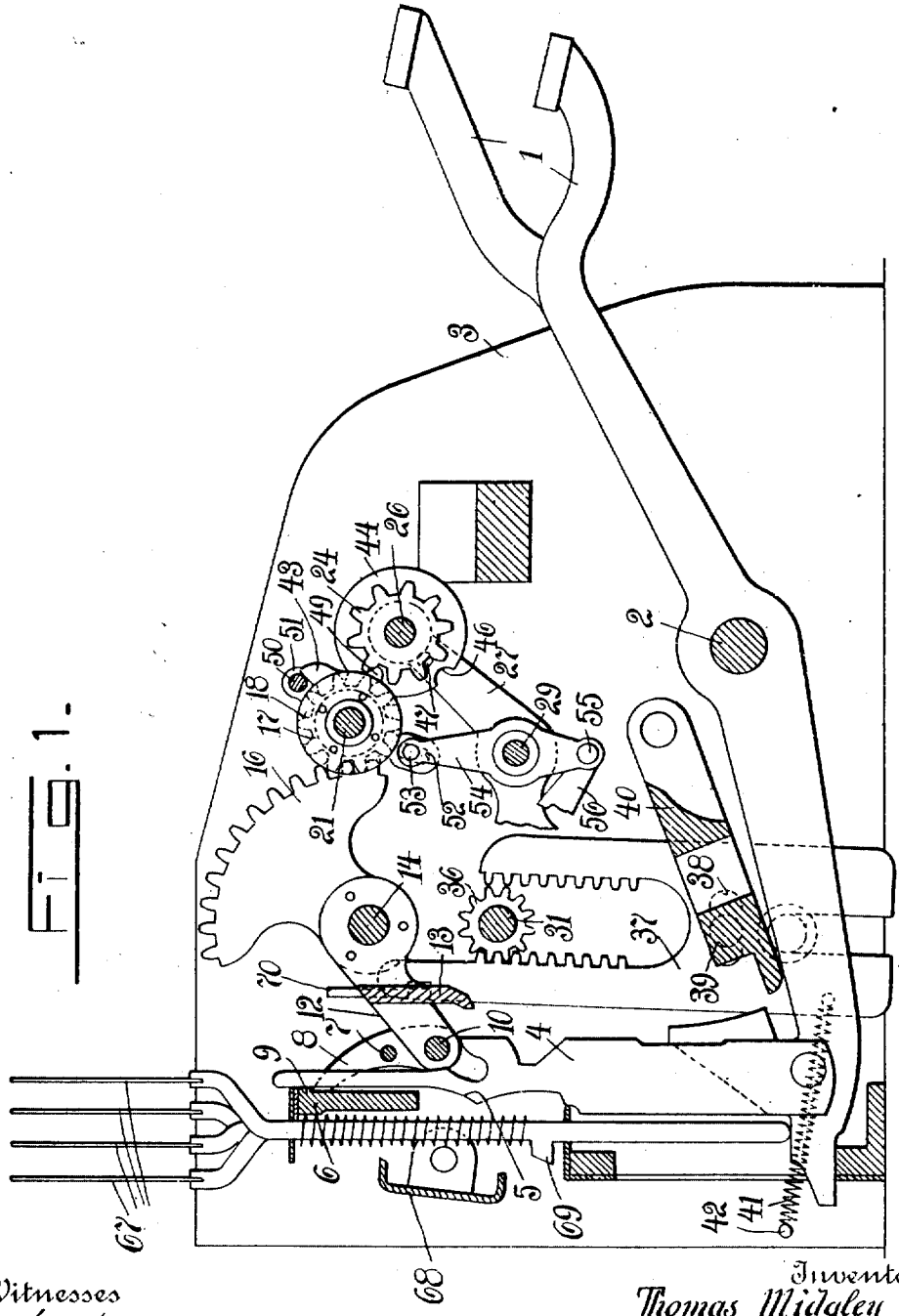

FIG. 1.

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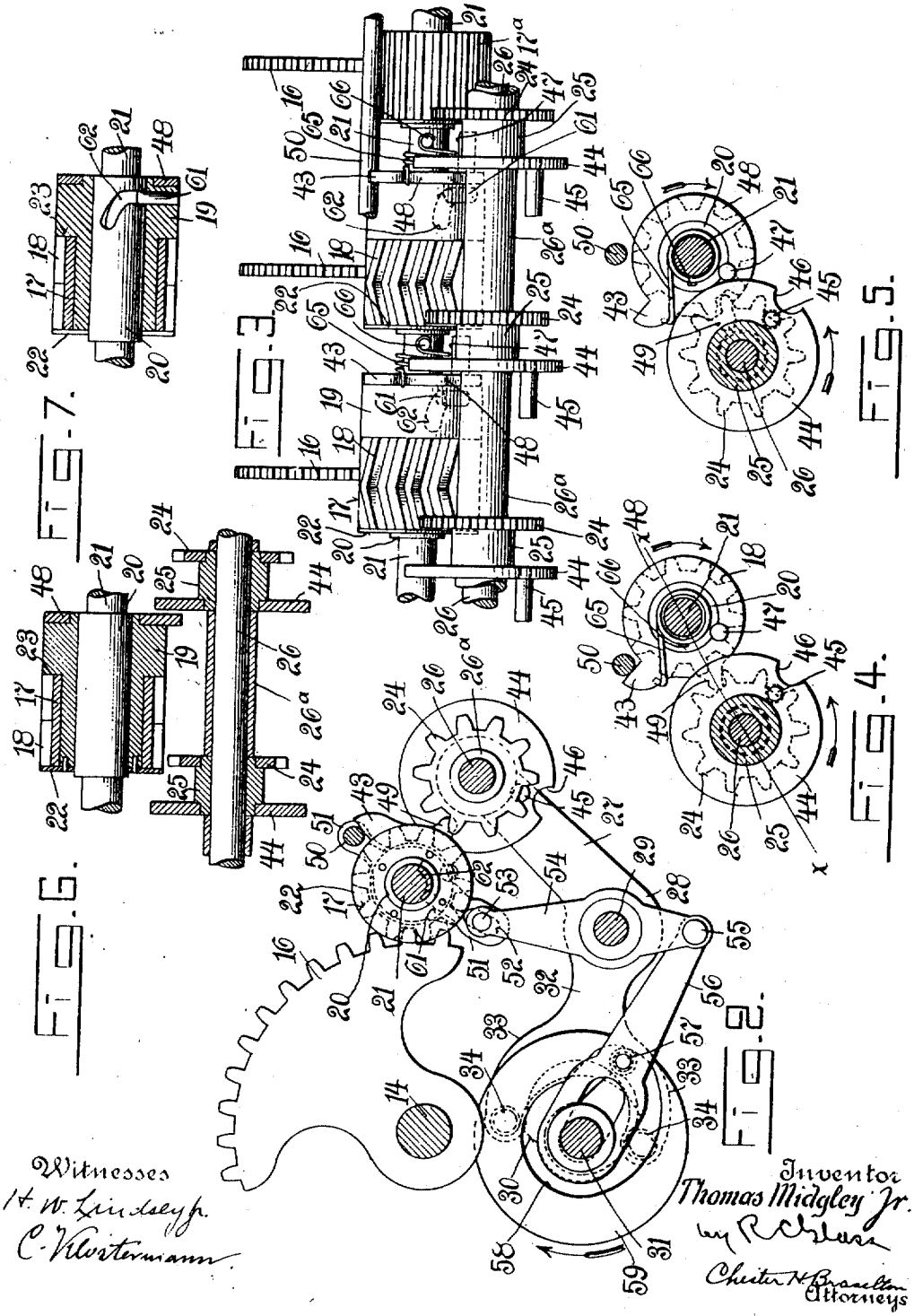

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UNITED STATES PATENT OFFICE.

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TRANSFER MECHANISM.

1,237,213. Specification of Letters Patent. Patented Aug. 14, 1917.

Application filed December 31, 1913. Serial No. 809,793.

To all whom it may concern:

Be it known that I, THOMAS MIDGLEY, Jr., a citizen of the United States, residing at Worthington, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Transfer Mechanism, of which I declare the following to be a full, clear, and exact description.

This invention relates to accounting machines and more particularly to the transfer devices for the registering mechanism thereof.

The principal object of this invention is to provide a transfer mechanism which is simple and durable in its construction, positive in its operation and accomplishes transfers at the exact moment they become necessary, regardless of whether the denominational elements of the registering mechanism are in rotation or not. In the preferred form shown herein transfers are accomplished without moving the actuators an additional step. By accomplishing transfers at the exact moments that they are required during movement of the actuating mechanism, considerable time is saved, as no time whatever need be given for the transferring operations. The saving of time is of considerable importance in highly developed machines provided with registering mechanism, as these are often designed to accomplish many different functions, and care must be taken so that the proper time is given for the attainment of each function. Therefore, a mechanism which accomplishes this object of applicant's invention is a decided improvement over many prior transfer mechanisms in which an extra step of movement is imparted to the registering elements by the actuating mechanism or other means after the actuating mechanism has been moved an extent determined by the amount manipulative means controlling the actuating mechanism, as with transfer mechanism of this latter type, considerable time is required for the transferring operation. A positive transfer mechanism such as disclosed in the preferred form of embodiment shown in the drawings is certain and minimizes the liability of the mechanical troubles existing in transfer mechanisms in which the transfers are effected by spring action.

For convenience of illustration the present invention is shown in connection with the form of key operated differential mechanism which has been shown and described in U. S. Letters Patent No. 497,860, granted May 23, 1893, to T. Carney. It will be obvious, however, from this specification and the accompanying drawings that the present transfer mechanism can be equally well employed in any type of cash register or registering machine, whether it be a key operated machine or a two motion machine, that is, a machine in which the operation of the keys predetermine the extent of rotation which is to be imparted to the registering wheels by the actuators while the actuators are driven by subsequent operation of the operating mechanism. It is, therefore, not desired to limit this invention to any particular embodiment, the claims being intended to define the transfer mechanism, and not the actuating devices except in combination.

With these 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 central transverse sectional view of the type of machine shown and described in the aforesaid Letters Patent with this invention applied thereto.

Fig. 2 is a detail view showing the transfer and totalizing mechanisms with the means for moving the totalizer into engagement with the transfer wheels and the means for restoring the transfer mechanism to normal position.

Fig. 3 is a partial front elevation of the totalizer and transfer mechanisms and actuating segment gears shown in Fig. 2.

Fig. 4 is a detail view showing in side elevation a transfer device and a totalizer pinion with a transfer disk before the transfer wheel and transfer pinion have been meshed with each other.

Fig. 5 is the same detail view shown in Fig. 4 except that the totalizer pinion is shown in mesh with the transfer wheel.

Fig. 6 is a sectional view taken through a transfer device and two totalizer pinions approximately on the line X—X of Fig. 4 and looking downward at a right angle to this line.

Fig. 7 is a sectional view through a transfer device showing the slot and pin connection for shifting the transfer wheel for the purpose of effecting the required transfer.

Described in general terms, the machine in the illustrative form comprises a plurality of manipulative devices, such as keys, which comprise the operating mechanism for entering items on the totalizer. These keys are arranged on a rod and they are operated invariable distances and impart differential movements to actuating segment gears. These segment gears constantly mesh with a transfer wheel having teeth or threads forming obtuse angles. The transfer wheels are mounted on drums and rotate independently of the drums. A stationary rod or shaft which supports the drums has cam grooves or slots one for each drum into which pins seated in the drums constantly project. Upon the beginning of the depression of one or more of the operating keys, the totalizer pinions are rocked into engagement with the transfer wheels and as a transfer pinion passes a position requiring a transfer, a pin on a transfer disk rigid with the totalizer pinion engages the drum supporting the transfer wheel for the totalizer pinion of next higher order and causes the drum, through the slot and pin connection, to be shifted axially on the stationary supporting shaft. This axial movement because of the construction of the threads on a transfer wheel effects an extra step of movement of the totalizer wheel to which "one" is to be transferred. Finally the totalizer is rocked out of mesh with the transfer wheels and then the operated drums supporting the transfer wheels which have effected transfers are shifted axially on the shaft to normal position.

Referring to Fig. 1 of the drawings, the operating means for actuating the actuating mechanism for the totalizer comprises the keys 1 pivoted on a transverse rod 2 which is supported by the side frames 3 of the machine. These keys have loosely attached near their rear ends uprights 4 which are graduated as is well known in the art and fully described and shown in the before mentioned patent. The upper ends of the uprights 4 are cammed forward as the keys are depressed by curved surfaces 5, formed upon the rear edge of each of the uprights 4, coming in contact with a tie bar 6 supported by the side frames 3 of the machine. As the upper ends of the uprights 4 move forwardly they contact with transverse rods 7 carried by locking pawls 8 and rock the upper ends of said pawls out of locking engagement with a latch or flange 9 formed upon the upper forward edge of the tie bar 6. These pawls 8 are pivoted at their lower ends upon transverse rods 10 which are supported by rearwardly extending arms 12 of actuating frames each of which comprises two arms 12 and a bar 13 connecting the arms 12, each of which arms 12 are suitably supported by a transverse shaft 14 suitably secured in the side frames 3 of the machine. It is to be understood that the keys 1 are arranged in banks and for each key bank there is one of these actuating frames carrying a transverse rod 10 and locking pawls 8 which in turn carry a rod 7. Spring means (not shown) are provided to force the pawls 8 into locking position as shown in Fig. 1 in order to prevent any accidental displacement of the registering frames.

Each of these registering frames is provided with an actuating segment gear 16 which is fast to one of the arms 12 and loosely mounted on the shaft 14. Each actuating segment gear 16 as shown in Figs. 2 and 3 meshes with a corresponding transfer wheel 17 which is provided with teeth or threads 18 each of which forms an obtuse angle and the vertex of the angle points in the direction of movement of a wheel during rotation of the totalizer wheels. Each transfer wheel 17 is mounted to rotate freely on a corresponding drum 19 which is loosely mounted upon a collar or enlarged portion 20 (Figs. 6 and 7) on a stationary rod or shaft 21 which is carried by the side frames 3 of the machine. Each transfer wheel 17 is prevented from moving axially in one direction relative to its drum 19 by a plate 22 fast to the drum 19 and in the other direction by an enlarged portion 23 of the drum. The totalizer wheels 24 are fast to sleeves 25 (Figs. 4, 5 and 6) which have a rotating movement upon the shaft 26. Sleeves 26ª (Fig. 6) surrounding the shaft 26 prevents movement of the totalizer wheels longitudinally of the shaft 26. The shaft 26 is supported at the outer ends by two forwardly and upwardly extending arms 27 of the totalizer frame. Each of these arms form part of levers 28 loosely mounted upon a shaft 29 secured to the frame work of the machine.

The pinions 24 are normally out of mesh with the teeth 18 of the transfer wheel 17 and are rocked into engagement by cams 30 (Fig. 2) secured to the rotation shaft 31, upon the beginning of movement of any of the keys 1. The rearwardly extending arms 32 of the levers 28 comprising part of the totalizer frame are bifurcated and each prong 33 of the bifurcated portion is provided with an anti-friction roller 34 with which a cam 30 engages. But one of these cams 30 is shown but it will be understood that a similar cam is provided to rock the lever 28 at the opposite end of the totalizer frame. It will be seen from this figure that the first movement of the cams 30 which is in the direction of the arrow rocks the totalizer frame about its pivotal point 29 so as

to carry the pinions 24 into engagement with the transfer wheels 17 so that a continued downward movement of the operated key or keys 1 will cause the uprights 4 to engage with the transverse bars 10 of the actuating frames and in this manner cause the actuating segments 16 to rotate the transfer wheels 17 and thereby the totalizer pinions 24 extents determined by the value of the keys depressed. It will be seen in Fig. 3 that the units totalizer pinion 24 at the right of the figure is adapted to engage with the broad gear wheel 17^a which is loosely mounted on the stationary shaft 21 and is constantly engaged with the actuating segment 16 operated by the units or cents keys 1. The threads of this wheel are parallel with the axis of the shaft and do not form angles as do the threads of the transfer wheels for the totalizer pinions of higher order as there is no totalizer pinion of lower order from which "one" is to be carried.

The rotation shaft 31 as shown in Fig. 1 is provided with a pinion 36 which engages a two-faced rack plate 37. This rack plate is provided with a slot 38 into which projects a lug 39 projecting from a key coupler or universal bar 40 common to the keys 1, as is well-known in the art. From this description it will be seen that when the keys 1 are depressed the rack plate 37 will be elevated and the shaft 31 rotated in a clockwise direction as viewed in Figs. 1 and 2. At the end of the downward movement of the operated key a spring 41 under tension between the rack bar and a pin 42 fast to the frame work at the back of the machine will shift the rack plate 37 so that the teeth formed on the forward side of this plate will engage the pinion 36, and as the rack plate is lowered by the return of the key to normal position it will continue the rotation of the shaft 31, it being understood that the rack plate 37 is suitably guided by a plate 70 projecting from one of the side frames 3 so that the one side or the other of the two-face rack plates will always be in engagement with the pinion 36.

Fast to the sleeves 25 on which the totalizer pinions 24 are rigidly mounted are transfer disks 44 each of which carries a pin or stud 45 projecting from its left hand face. The periphery of each of these transfer disks is provided with a semi-circular cut or recess 46 and the radius of the disk which passes through the stud 45 also passes into this cut. When the totalizer pinions are rocked into mesh with the transfer wheels 17 the periphery of each of the transfer disks 44 is carried into contact with a stud 47 projecting laterally from the base of a nearly circular disk 48 fast to the right hand side of the drum 19 carrying the transfer wheel 17 which meshes with the totalizer pinion of next higher denomination. The circular portion of this disk is just flush with the periphery of the enlarged portion 23 of the drum 19 and carries two projecting portions 43 and 49.

A rod 50 (Figs. 1 and 2) which is carried at the outer end of the upwardly extending arms of two levers 51 loosely mounted near the ends of the stationary shaft 21, normally engages the radial face of the projection 43 on the disk 48. The lower ends of the levers 51 are provided with slots 52 through which pins 53 projecting from the upper ends of levers 54 pass. The levers 54 are loosely mounted upon the shaft 29 and at their lower ends are connected by pins 55 to pitmen 56. The pitmen 56 are bifurcated at their rear ends and straddle the rotating shaft 31 and the pitmen also carry rollers 57 which play in cam grooves 58 formed in the faces of disks 59 rigidly mounted on the rotating shaft 31. The configuration of the cam grooves 58 is such that at the beginning of the downstroke of the operating key the pitmen 56 will be drawn rearward to rock the levers 54 clockwise and the levers 51 counter clockwise and thereby carry the rod 50 out of normal engagement with the projections 43 on the disks 48 as shown in Fig. 5.

After a totalizer pinion has been moved nine steps from zero position, the relieving cut 46 of the transfer disk 44 is brought opposite the stud 47 on the disk 48 and at the same time the stud 45 on the transfer disk 44 engages the projection 49 on the disk 48 and thereby rotates the drum 19 carrying the transfer wheel 17 of next higher denomination a slight distance in the direction in which the transfer wheel is being rotated, that is, counter-clockwise, and as the totalizer pinion passes the zero position it passes out of engagement with the projection 49. As shown in Figs. 3 and 7 each drum 23 carries a pin 61 rigidly and radially seated in its enlarged portion 23. The inner end of the pin 61 projects beyond the internal periphery of the drum 19 into a curved groove or slot 62 in the enlarged portion 20 of the shaft 21. This cam groove or slot 62 is so constructed that when the drum 19 is given a movement relative to the shaft 21 by the engagement of the pin 45 with the projection 49 on the disk 48 the drum 19 and therefore the transfer wheel 17 are moved to the left and longitudinally on the stationary shaft 21. As shown in Fig. 3 the actuating segment gears 16 engage the threads 18 of its transfer wheel 17 immediately to the right of the vertices of the angles formed by the threads so that when a transfer wheel is shifted to the left with its drum it will be advanced $\frac{1}{2}$ a step of movement ahead of its actuating segment gear 16 if the latter is moving or moved

one-half of a step if the gear is not moving and therefore the movement of totalizer pinion will be advanced ½ a step ahead of the actuating segment gear due to the extra ½ step of movement of the transfer wheel. Again referring to Fig. 3, it will be seen that each totalizer pinion engages the threads 18 near the left hand side of its transfer wheels so that when the axial movement of the transfer wheel to the left is effected the totalizer wheel will be driven ½ a step ahead of the transfer wheel. As the transfer wheel has been moved ½ a step ahead of the actuating segment 16 and the totalizer pinion has been moved ½ a step ahead of the transfer wheel 17 it can readily be seen that the totalizer wheel will be moved one step ahead of the actuating segment gears 16 to effect the required transfer. Of course, the extent of movement effected by the lateral shifting of the transfer wheels depends on the inclination of the teeth on these wheels to the axis of the shaft, but this inclination is made such as to, in the operation just described, impart in total an extra step of movement to the totalizer pinion when the transfer wheel is shifted laterally. It may be noted here that transfers may be accomplished regardless of whether the actuating segment for the totalizer pinion to which one is to be carried is stationary or being moved. In either case it is the sliding movement between the inclined teeth of the transfer wheel and the teeth of the actuating segment gear 16 and totalizer pinion that effects the transfer, this sliding movement advancing the totalizer pinion one step and the transfer wheel ½ of one step without affecting the actuating segment gear meshing with the transfer wheel.

On the upstroke of the key 1 which has been operated, the rod 50 will be rocked back to normal position by the cams 58 and during this movement it will engage the radial faces of the projections 43 on the disks 48 of the drums 19, which have been displaced longitudinally of the shaft 21, and will carry the drums and transfer wheels back to normal position. It will be apparent that this movement of the rod 50 will move the transfer wheels and drums which have been displaced back to their normal positions through the coöperation of the cam grooves 62 with the pins 61. Springs 65, one for each transfer wheel, are coiled about the stationary shaft 21 to the right of the drums 19 and one end of the springs are bent about the projections 43 on the disks 48 while their opposite ends are fastened to studs 66 projected from the stationary shaft 21, as best shown in Fig. 3. These springs are only provided to aid the transfer disks 44 in turning the drums 19 against any friction that might occur between the drums and the stationary shaft 21. These springs might be dispensed with and as they do not form essential or necessary elements of the transfer mechanism; their presence does not prevent this mechanism from being positive throughout its operation.

As shown in Fig. 1 the rear end of the keys support tablet indicators 67 of a well-known form. When the keys are depressed they elevate their indicators into view and the latter are locked in their elevated positions by a locking yoke 68 engaging under projections 69 on the supporting rods of the tablet indicators.

It is thought that the description given above sufficiently sets forth the principle and mode of operation of the present invention. It is clear that each transfer device consists of a transfer wheel 17, a drum 19 and connections between the drum and its supporting shaft whereby the drum and transfer wheel are shifted longitudinally on the shaft. This longitudinal movement is accomplished positively by the transfer pinion of next lower denomination and the angled threads on the transfer wheels upon longitudinal movement of the wheels advance the totalizer pinions the required step. The connection between the drums and shaft comprises, as shown in the preferred form, pins 61 carried by the drums and riding the cam slots 62 in the shaft 21. This mechanism is so constructed that transfers are accomplished at the exact moment required regardless of whether the actuating segment gears for the pinions to which one is to be carried are moving, and this operation is positive throughout.

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 differentially movable actuators; of transfer wheels rotated thereby; totalizing pinions adapted to be rotated by the differentially movable actuators through said transfer wheels; means for shifting the transfer wheels to effect transfers; and mechanism for shifting the transfer wheels back to normal position after the transfers have been completed.

2. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby; totalizing pinions adapted to be rotated by the differentially movable actuators through said transfer wheels; means for shifting the transfer wheels to effect transfers regardless

of whether or not rotation of the transfer wheels is being effected by the differentially movable actuators; and mechanism for shifting the transfer wheels back to normal position after the transfers have been completed.

3. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby and constantly in engagement therewith; totalizing pinions adapted to be rotated by the differentially movable actuators through said transfer wheels; means for shifting the transfer wheels to effect transfers; and mechanism for shifting the transfer wheels back to normal position after the transfers have been completed.

4. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby; totalizing pinions adapted to be rotated by the transfer wheels and normally disengaged therefrom; means for engaging the transfer wheels with the totalizing pinions; and means controlled by the totalizing pinions for shifting the transfer wheels to effect transfers.

5. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby and constantly in engagement therewith; totalizing pinions disengaged therefrom; means for engaging the transfer wheels with the totalizing pinions; and means controlled by the totalizing pinions for shifting the transfer wheels to effect transfers.

6. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby; totalizing pinions adapted to be rotated by the transfer wheels and normally disengaged therefrom; a device for engaging the transfer wheels with the totalizing pinions; means controlled by the totalizing pinions for bodily moving the transfer wheels to effect transfers; and mechanism for bodily moving the transfer wheels back to normal position after the totalizing pinions have been operated.

7. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby and constantly in engagement therewith; totalizing pinions adapted to be rotated by the transfer wheels and normally disengaged therefrom; a device for engaging the transfer wheels with the totalizing pinions; means controlled by the totalizing pinions for bodily moving the transfer wheels to effect transfers; and mechanism for bodily moving the transfer wheels back to normal position after the totalizing pinions have been operated.

8. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby; totalizing pinions adapted to be rotated by the transfer wheels; and means for bodily moving the transfer wheels to move the latter one-half a step ahead of the differentially movable actuators and the totalizing pinions one-half a step ahead of the transfer wheels when transfers are required.

9. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby and constantly in engagement therewith; totalizing pinions adapted to be rotated by the transfer wheels; and means for bodily moving the transfer wheels to move the latter one-half a step ahead of the differentially movable actuators and the totalizing pinions one-half a step ahead of the transfer wheels when transfers are required.

10. In a machine of the class described, the combination with differentially movable actuators; of a totalizer comprising a plurality of totalizing elements controlled by their corresponding differentially movable actuators; and rotary transfer elements adapted to be engaged by the totalizing pinions and constructed to be shifted bodily whereby the transfer elements shifted are rotated one-half a step ahead of the differentially movable actuators and the totalizing pinions are moved one-half of a step ahead of the shifted transfer wheels.

11. In a machine of the class described, the combination with differentially movable actuators; of a totalizer comprising a plurality of totalizing elements controlled by their corresponding differentially movable actuators; and rotary transfer elements adapted to be engaged by the totalizing pinions and constructed to be shifted bodily whereby the transfer elements shifted are rotated one-half of a step ahead of the differentially movable actuators and the totalizing pinions are moved one-half of a step ahead of the shifted transfer wheels regardless of whether the totalizing elements are being moved by the movement of their differentially movable actuators.

12. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby; totalizing pinions adapted to be rotated by the differentially movable actuators through said transfer wheels; means for shifting the transfer wheels to effect transfers; and mechanism for positively shifting the transfer wheels back to normal position after the transfers have been completed.

13. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby and constantly in engagement therewith; totalizing pinions adapted to be rotated by the differentially movable actuators through said transfer wheels; means for shifting the

transfer wheels to effect transfers, and mechanism for positively shifting the transfer wheels back to normal position after the transfers have been completed.

14. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby; totalizing pinions adapted to be rotated by the transfer wheels and normally disengaged therefrom; means for engaging the transfer wheels with the totalizing pinions; and means controlled by the totalizing pinions for positively shifting the transfer wheels to effect transfers.

15. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby and having threads each shaped to form an angle; totalizer pinions adapted to be engaged with said transfer wheels; and means for shifting the transfer wheels part of the threads forming one side of the angles thereby causing the transfer wheels to move one-half of a step farther than the differentially movable actuators while the other part of the threads cause the totalizing pinions to move one step farther than the transfer wheels to cause the totalizer pinions to move an additional step when transfers are required.

16. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby; totalizing pinions adapted to be rotated by the differentially movable actuators through said transfer wheels; means for shifting the transfer wheels to effect transfers and so constructed as to simultaneously effect transfers by transfers if transfers by transfers are to be accomplished, and mechanism for shifting the transfer wheels back to normal position after the transfers have been completed.

17. In a machine of the class described, the combination with actuating mechanism; of transfer wheels rotated thereby; drums about which said transfer wheels rotate without effecting movement of the drums; totalizing pinions adapted to be rotated by the transfer wheels; and means controlled by the totalizing pinions for rotating said drums to shift the transfer wheels and thereby effect transfers from totalizing pinions of lower order to those of higher order.

18. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby; drums about which said transfer wheels rotate without effecting movement of the drums; totalizing pinions adapted to be rotated by the transfer wheels; means controlled by the totalizing pinions for rotating said drums; and slot and pin connections for causing the rotation of the drums to shift the transfer wheels and thereby effect transfers from totalizing pinions of lower order to those of higher order.

19. In a machine of the class described, the combination with actuating mechanism; of transfer wheels rotated thereby; drums about which said transfer wheels rotate; totalizing pinions adapted to be rotated by the transfer wheels; means controlled by the totalizing pinions for rotating said drums to shift the transfer wheels and thereby effect transfers from totalizing pinions of lower order to those of higher order; and means for positively preventing the rotation of said drums until transfers are required.

20. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby; drums about which said transfer wheels rotate; totalizing pinions adapted to be rotated by the transfer wheels; means controlled by the totalizing pinions for rotating said drums; slot and pin connections for causing the rotation of the drums to shift the transfer wheels and thereby effect transfers from totalizing pinions of lower order to those of higher order; and means for positively preventing the rotation of said drums until transfers are required.

21. In a machine of the class described, the combination with actuating mechanism; of transfer wheels rotated thereby; drums about which said transfer wheels rotate; totalizing pinions adapted to be rotated by the transfer wheels; for means controlled by totalizing pinions for rotating said drums to shift the transfer wheels and thereby effect transfers from totalizing pinions of lower order to those of higher order; means for positively preventing the rotation of said drums until transfers are required; and means for restoring the drums to normal position after transfers have been effected.

22. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby; drums about which said transfer wheels rotate without effecting movement of the drums; totalizing pinions adapted to be rotated by the transfer wheels; means controlled by the totalizing pinions for rotating said drums; slot and pin connections for causing the rotation of the drums to shift the transfer wheels and thereby effect transfers from totalizing pinions of lower order to those of higher order; and means for positively restoring the drums to normal position after transfers have been effected.

23. In a machine of the class described, the combination with actuating mechanism; of transfer wheels rotated thereby; drums about which said transfer wheels rotate without effecting movement of the drums; totalizing pinions adapted to be rotated by the transfer wheels; and means controlled

by the totalizing pinions for shifting said drums and the transfer wheels and thereby effecting transfers from totalizing pinions of lower order to those of higher order.

24. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby; drums about which said transfer wheels rotate and carrying pins; a rod supporting said drums and having cam slots engaged by said pins; totalizing pinions adapted to be rotated by the transfer wheels; pins rigid with said totalizing wheels for engaging said drums as the totalizing pinions pass positions requiring transfers to shift the transfer wheels and thereby effect the required transfers.

25. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby; drums about which said transfer wheels rotate and carrying pins; a rod supporting said drums and having cam slots engaged by said pins; totalizing pinions adapted to be rotated by the transfer wheels; disks rigid with said totalizing pinions, having notches and carrying pins adapted to rotate said drums to shift the transfer wheels and thereby effect transfers; and studs on said drums adapted to engage the peripheries of said disks to prevent rotation of the drums until transfers are required, the notches in the disks being in juxtaposition with the studs when transfers are required.

26. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby and constantly in engagement therewith; drums about which said transfer wheels rotate, and carrying pins; a rod supporting said drums and having cam slots engaged by said pins; totalizing pinions adapted to be rotated by the transfer wheels; and pins rigid with said totalizing wheels for engaging said drums as the totalizing pinions pass positions requiring transfers to shift the transfer wheels and thereby effect the required transfers.

27. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby and constantly in engagement therewith; drums about which said transfer wheels rotate, and carrying pins; a rod supporting said drums and having cam slots engaged by said pins; totalizing pinions adapted to be rotated by the transfer wheels; disks rigid with said totalizing pinions, having notches and carrying pins adapted to rotate said drums to shift the transfer wheels and thereby effect transfers; and studs on said drums adapted to engage the peripheries of said disks to prevent rotation of the drums until transfers are required, the notches in the disks being in juxtaposition with the studs when transfers are required.

28. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby; drums about which said transfer wheels rotate, and carrying pins; a rod supporting said drums and having cam slots engaged by said pins; totalizing pinions adapted to be rotated by the transfer wheels; disks rigid with said totalizing pinions, having notches and carrying pins adapted to rotate said drums to shift the transfer wheels and thereby effect transfers; studs on said drums adapted to engage the peripheries of said disks to prevent rotation of the drums until transfers are required, the notches in the disks being in juxtaposition with the studs when transfers are required; and means for shifting said transfer wheels back to normal position.

29. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby and constantly in engagement therewith; drums about which said transfer wheels rotate and carrying pins; a rod supporting said drums and having cam slots engaged by said pins; totalizing pinions adapted to be rotated by the transfer wheels; pins rigid with said totalizing wheels for engaging said drums as the totalizing pinions pass positions requiring transfers to shift the transfer wheels and thereby effect the required transfers; and means for shifting said transfer wheels back to normal position.

30. In a machine of the class described, the combination with differentally movable actuators; of transfer wheels rotated thereby; drums about which said transfer wheels rotate, and carrying pins; a rod supporting said drums and having cam slots engaged by said pins; totalizing pinions adapted to be rotated by the transfer wheels; disks rigid with said totalizing pinions, having notches and carrying pins adapted to rotate said drums to shift the transfer wheels and thereby effect transfers; studs on said drums adapted to engage the peripheries of said disks to prevent rotation of the drums until transfers are required, the notches in the disks being in juxtaposition with the studs when transfers are required; and a common operating bar for positively rotating said drums to cause the transfer wheels to be shifted back to normal position.

31. In a machine of the class described, the combination with differentially movable actuators, of transfer devices rotated thereby, totalizer elements to be rotated by the actuators through said transfer devices, the transfer devices being constructed to also effect transfers by movement at an angle to the direction of movement of the actuators,

and means controlled by the totalizer elements for imparting said transfer movement to the transfer devices.

32. In a machine of the class described, the combination with totalizer actuators, of totalizer elements normally disconnected from the actuators, transfer devices intermediate the totalizer elements and the actuators, means for connecting the totalizer elements to the actuators through the transfer devices, said devices being movable relative to both the actuators and the totalizer elements to effect transfers while the actuators and totalizer elements are so connected, and means controlled by the totalizer elements for imparting said relative movement to the transfer devices.

33. In a machine of the class described, the combination with differentially movable actuators, of totalizing pinions, transfer devices intermediate the actuators and the totalizing pinions and constantly in engagement with the former, means for engaging and disengaging the totalizer pinions and the transfer devices, and means controlled by lower order totalizer pinions for moving said devices relative to their actuators to effect transfer operations of the higher order totalizer pinions.

34. In a machine of the class described, the combination with totalizer pinions, of differentially movable actuators, means constantly in engagement with the actuators for transmitting movement of the actuators to the totalizer pinions and movable relative to both the actuators and the totalizer pinions to actuate the latter to effect transfers, and devices controlled by the totalizer elements for imparting said relative movement to the aforesaid means.

35. In a machine of the class described, the combination with totalizer actuators, of totalizing elements normally disconnected from the actuators, transfer devices intermediate the actuators and the totalizer elements, means for connecting the totalizer elements to the actuators through the transfer devices, said devices being movable relative to both the actuators and the totalizer elements to set the totalizer elements a step ahead of their actuators while the actuators and totalizer elements are so connected, and devices positively operated by the totalizer elements for imparting said relative movement to the transfer device.

36. In a machine of the class described, the combination with differentially movable actuators; of transfer wheels rotated thereby, said wheels having teeth arranged at angles to the planes of its axis; totalizing pinions adapted to be rotated by the differentially movable actuators through said transfer wheels; means for shifting the transfer wheels to effect transfer; and mechanism for shifting the transfer wheels back to normal position after the transfers have been completed.

37. In a machine of the class described, the combination with differentially movable actuators; of totalizing pinions adapted to be differentially actuated thereby, a gear intermediate the actuators and totalizer pinions, said gear having teeth arranged at angles to the planes of its axis, and means for shifting said gear in the direction of its axis to effect a movement of the totalizing pinions independent of the movement of the actuators.

38. In a machine of the class described, the combination with a differentially movable actuator; of a totalizing pinion adapted to be actuated thereby; and a herring bone gear intermediate said actuator and totalizing pinion, and means for moving said gear in the direction of its axis to effect a movement of the totalizing pinion independent of the actuator.

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

THOMAS MIDGLEY, JR.

Witnesses:
W. W. FULLER,
M. B. STROHM.