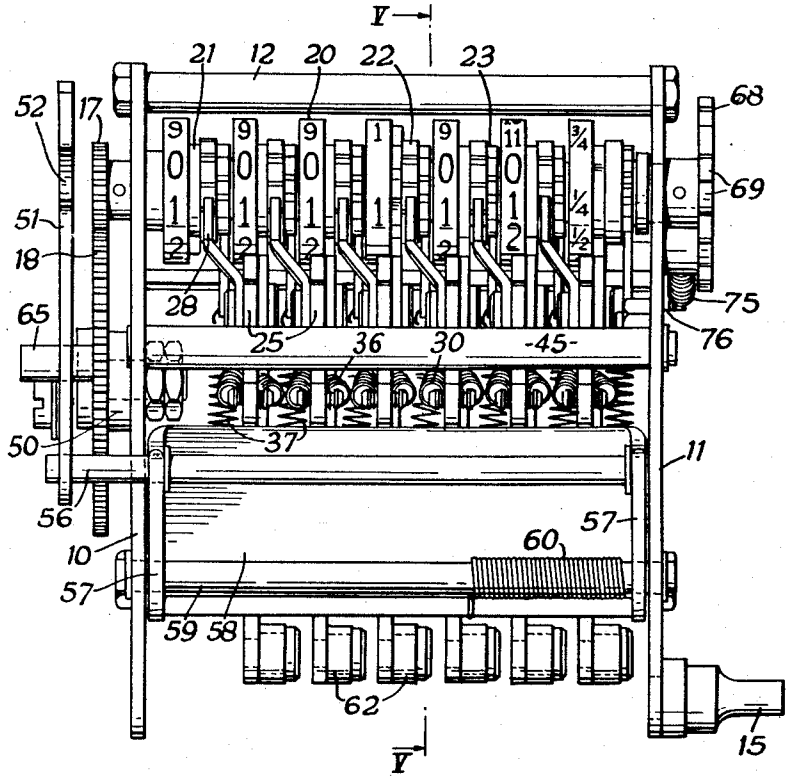
April 26, 1960 H. GROSS ET AL 2,934,266

CASH REGISTERS

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Fig. 1.



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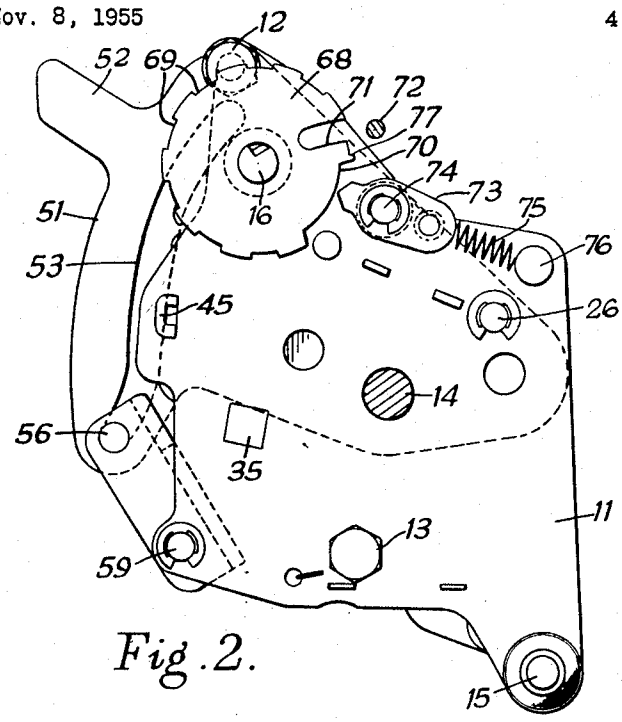


Fig. 2.

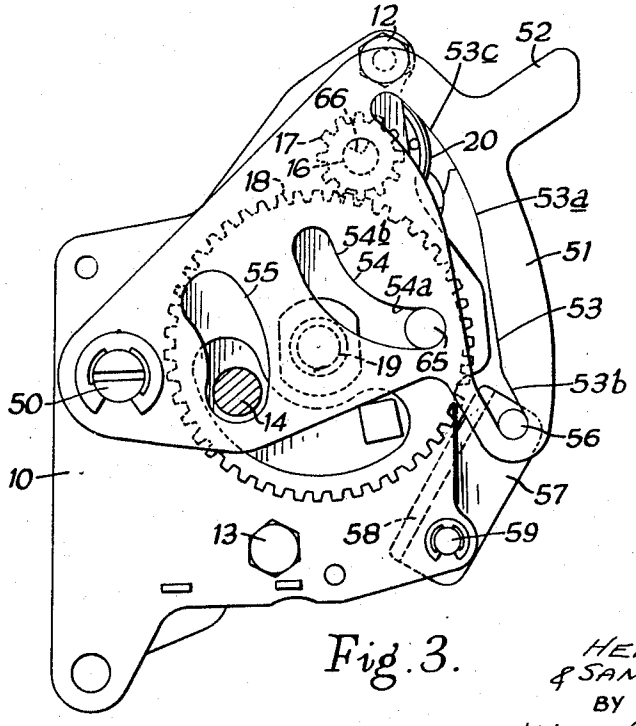


Fig. 3.

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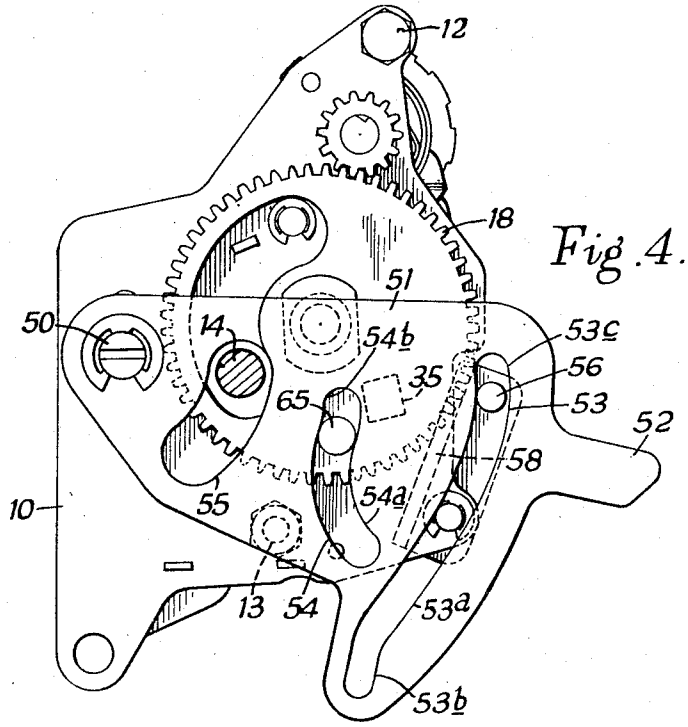
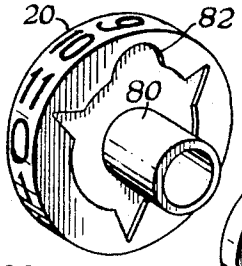
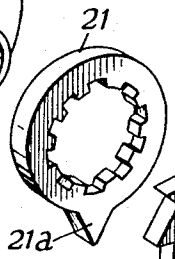
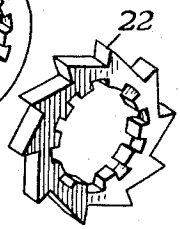


Fig. 4.







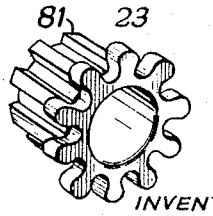


Fig. 7.

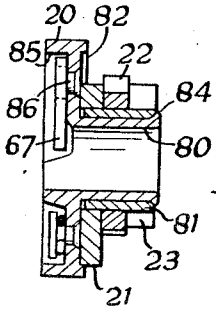


Fig. 6.

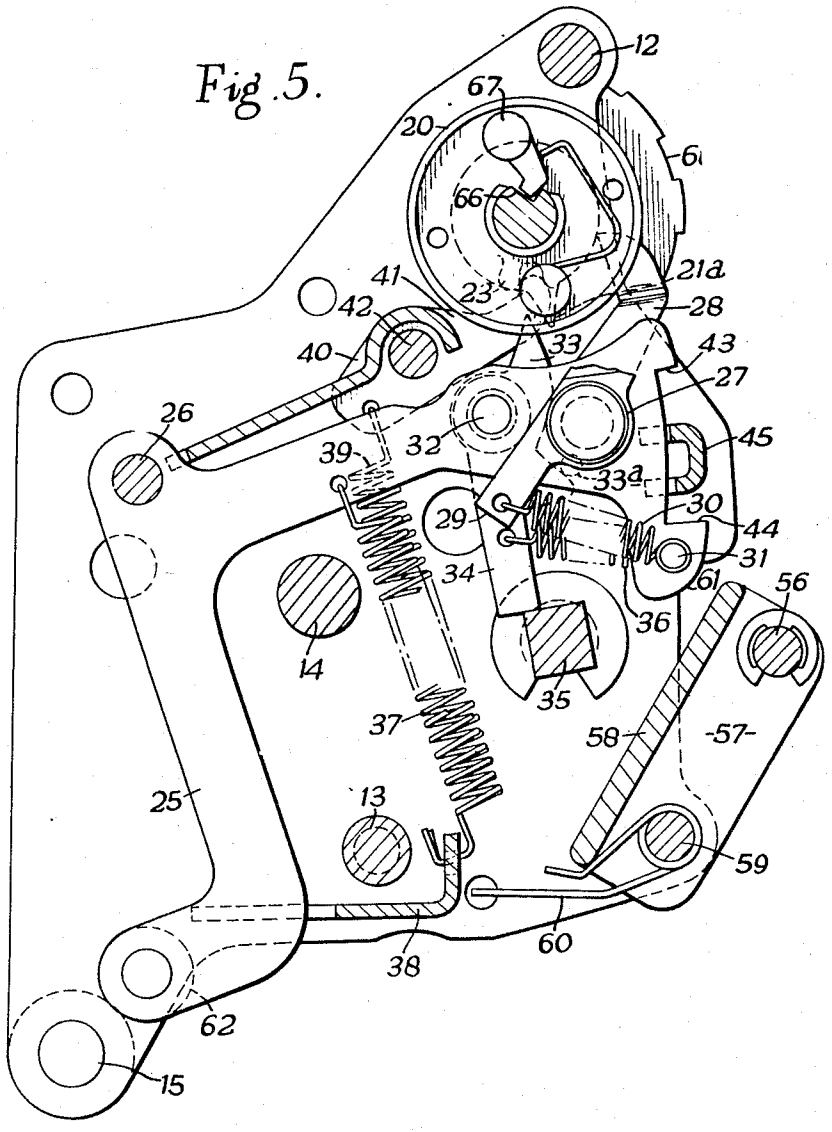
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CASH REGISTERS

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Fig. 5.



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Patented Apr. 26, 1960

2,934,266

CASH REGISTERS

Henry Gross and Samuel Gross, London, England

Application November 8, 1955, Serial No. 545,687

Claims priority, application Great Britain November 24, 1954

9 Claims. (Cl. 235—144)

This invention relates to cash registers and like adding machines of the kind having actuating amount keys and an adding unit comprising adding or numeral wheels freely mounted on a common shaft and representing different denominations, and to which movements appropriate to the actuated keys are imparted by toothed segments operatively associated with said keys, mechanisms for imparting transfers from each adding wheel to the wheel of next higher denomination and comprising reciprocable transfer levers, transfer pawls on said levers permanently engaged with ratchet wheels secured to said numerals, and trip means controlling the operation of said transfer levers, and means for re-setting or zeroising the adding unit. Such adding units as, for example, in our U.S. Patent No. 2,509,493 are usually mounted for rocking movement to engage the toothed segments under the control of a coupler bar or universal which is rocked upon actuation of the keys, though it is known to provide cash registers having fixed adding units. While primarily concerned with machines in which the adding unit is rockable, the invention nevertheless is equally applicable to machines having stationary adding units.

It has hitherto been known, in a machine of the aforesaid kind, to mount the re-setting means independently of the adding unit, and to provide connections between the re-setting means and said unit. Such an arrangement calls for a high degree of precision in manufacture, and in addition presents difficulties in assembly.

The present invention has for an object to elimination these disadvantages and to simplify both the construction and the assembly of the re-setting means by forming said means as an integral part of the adding unit. To this end, according to the invention, there is provided a cash register or like machine of the kind referred to, comprising a re-setting lever mounted on the adding unit, means actuable by the movement of said lever in one direction for driving the adding wheels to their zero positions, and a member also mounted on the adding unit and rockable by said re-setting lever into engagement with the transfer levers to lock said transfer levers against operation during re-setting.

The said restraining member may comprise a pivoted locking plate which is engageable with cam faces on the transfer levers, whereby said levers are rocked upon commencement of the re-setting operation and are held inoperative if the trip pawls should be actuated during re-setting. Actuating of the locking plate may be effected by a cam slot in the re-setting lever and a cooperating pin on the locking plate. The re-setting lever may be formed with a further cam slot engaging a pin on a toothed wheel meshing with a pinion on the adding wheel shaft, said further cam slot being shaped to produce an initially high but gradually decreasing speed of the adding wheels during re-setting and to allow for additional movement of the re-setting lever after the adding wheels have reached their zero positions and so prevent any possibility of overrun of said wheels. Centering pawls engaging pinions rigid with the adding wheels may be provided which accurately position the wheels both during normal operation and after zeroising.

The invention is illustrated by way of example in the accompanying drawings, wherein:

Figure 1 is an elevation of the adding unit in the zero position as seen from the front (key bank side) of the machine;

Figure 2 is an elevation seen from the right of Figure 1;

Figure 3 is an end elevation seen from the left of Figure 1;

Figure 4 is a view similar to Figure 3 but showing the re-setting or zeroising lever and associated mechanism at the end of the forward stroke of said lever;

Figure 5 is a vertical section to a larger scale on line V—V of Figure 1;

Figure 6 is a detail section of one of the adding wheel units to a larger scale; and

Figure 7 is an exploded perspective view of the elements of the unit of Figure 6.

The adding unit illustrated in the drawings is of the kind described in our Patent No. 2,509,493 and which is rockable forwardly and rearwardly of the machine during each operation of the actuating or amount key levers so as to mesh the adding wheel pinions with toothed segments actuated by cams on said levers.

As shown, the adding unit comprises a pair of end plates 10, 11 secured together in spaced relationship by tie rods 12, 13 and each formed with an aperture by which the unit is rockable on a shaft 14 mounted in the end walls of the cash register. This rocking movement is imparted to the adding unit by the engagement in known manner of a quadrant cam rocked by the coupler (not shown) with a stud 15 projecting laterally from the end plate 11 of said unit. At their upper parts the end plates 10, 11 support a rotatable shaft 16 on one end of which is secured a pinion 17 meshing with a toothed wheel 18 freely mounted on a stub shaft 19 projecting from the end plate 10. The shaft 16 also carries a plurality of numeral wheel units each comprising an adding or numeral wheel 20, a transfer trip cam 21, a ratchet wheel 22 and a pinion 23, all of which are secured together in a manner later to be described for rotation as a unit. In the machine illustrated there are seven numeral wheels 20, the right-hand wheel in Figure 1 denoting fractions of a penny, the next denoting pence, the third denoting units of shillings, tthe fourth denoting ten shillings, and the last three denoting units, tens and hundreds of pounds respectively.

Each two adjacent numeral wheels have associated therewith a transfer lever 25 to which a trip movement is imparted under control of the trip cam 21 associated with the numeral wheel of lower denomination when said wheel has completed a full rotational movement from the zero position, and which trip movement is then imparted to the numeral wheel of higher denomination, as in our aforesaid Patent No. 2,509,493. The transfer levers are freely mounted on a common shaft 26 secured in the end plates 10, 11 and are of inverted L-shape. The upper arm of each transfer lever has pivotally mounted on a stud 27 thereon a transfer pawl 28 to the tail 29 of which is connected one end of a tension spring 30, the other end of said spring being connected to a stud 31 on said upper transfer lever arm. The spring 30 thus holds the pawl 28 in engagement with the ratchet wheel 22 associated with the numeral wheel of next higher denomination. Also pivotally carried by the upper arm of each transfer lever on a stud 32 projecting from the side of said arm opposite the stud 27 is a transfer trip pawl 33 adapted to be engaged by the trip cam 21 of the adding wheel unit of lower denomination of each adjacent pair of units to initiate the transfer operation. The

trip pawl carries a tail 34 engageable with a bar 35 fixed in the end frames 10, 11, and a tension spring 36 extends between said tail 34 and the stud 31. A tension spring 37 extends between the upper transfer lever arm and a bracket 38 carried by the end frames 10, 11, and said spring 37, in conjunction with the spring 36, normally holds the tail 34 of pawl 33 against the top of the bar 35. Another spring 39 extends between the bracket 38 and the tail 40 of a pawl 41, there being a pawl 41 engaging the pinion 23 of each adding wheel unit. The pawls 41 are freely mounted on a common shaft 42 carried by the end frames 10, 11. At its free end the upper arm of each transfer lever is formed with a pair of spaced abutments 43, 44, the upper of which is engageable with a bar 45 to limit rocking movement of said lever in its operative direction. The abutments 44 are provided to prevent excess rocking movement of the transfer levers in the counter-clockwise direction during the transfer operations.

Mounted on a stub shaft 50 carried by the end frame 10 is a manually operable re-setting or zeroising lever 51 provided with an operating handle 52 which projects through a slot in the front part of the machine casing (not shown). The lever 51 is formed with two cam slots 53, 54, and with a third slot 55 which is concentric with the stub shaft 50 and through which the shaft 14 extends to limit rocking movement of said lever in opposite directions. The cam slot 53 has three portions of different curvature; the major central portion 53*a* being slightly outwardly directed from the lower end towards the upper end; the short lower end portion 53*b* being substantially linear and being inwardly directed from the lower end towards the upper end; and the upper end portion 53*c* being generally concentric with the stub shaft 50. Engaging in the cam slot 53 is a pin 56 fixed in the flanged ends 57 of a plate 58 fulcrummed on a shaft 59 secured in the end frames 10, 11. The plate 58 is urged by a spring 60 in the clockwise direction as seen in Figure 5, and is engageable, upon actuation of the zeroising lever 51, with a cam face 61 on the free end of the upper arm of the transfer lever. The lower arm of each transfer lever carries a roller 62 which, when the transfer lever has been tripped, is engaged by one of a series of cams (not shown) to return said lever to its initial position and so impart a transfer to the next higher numeral wheel, said cams being operated by the movement imparted to the coupler bar by the operating key levers as described in our aforesaid Patent No. 2,509,493.

The cam slot 54 in the zeroising lever engages a pin 65 carried by the toothed wheel 18, and has a pronounced reversely curved portion 54*a* and a concentric portion 54*b*. Actuation of the zeroising lever is accordingly transmitted through pin 65, wheel 18 and pinion 17 to the adding wheel shaft 16. Said shaft is formed with a longitudinal groove 66 which, on rotation of the shaft, is adapted to pick up pawls 67 carried by the numeral wheels and return said wheels to their zero positions. The other end of the adding wheel shaft 16 has secured thereon a disc 68 (Fig. 2) provided on its periphery with a series of short shallow notches 69, a longer and deeper notch 70, and a slot 71. This slot is arcuate and has a curvature which, in the rest position of the reset lever, is concentric with the pivot shaft 14 of the adding unit. The slot 71 is engageable, during rocking movement of the adding unit, with a pin 72 fixed on the machine. A full stroke pawl 73 is pivoted on a stub shaft 74 on the end frame 11 and is resiliently held in a mid-position by a spring 75 extending between the tail of the pawl and a stud 76 fixed to the said end frame. The nose of the pawl is provided with oppositely inclined flat side faces and has a width greater than that of the slot 71. A notch 77 is also formed on the periphery of the disc 68 between the notch 70 and the slot 71.

The operation of the adding unit upon actuation of the operating or amount keys is very similar to that of the adding unit of our aforesaid Patent No. 2,509,493. The toothed quadrants associated with the key levers are engaged with the pinions 23, and the adding wheel units are thus rotated in a counter-clockwise direction as seen in Figure 5 by corresponding amounts. Transfer from any one adding wheel to the next is effected by the engagement of a projection 21*a* on the cam disc 21 associated with the adding wheel of lower denomination with the corresponding trip pawl 33, the latter being rocked in the clockwise direction to disengage its tail 34 from the bar 35. This enables the spring 37 to rock the transfer lever in the clockwise direction, during which the transfer pawl 28 runs idly over the ratchet wheel 22 of the higher denomination adding wheel unit to engage the next tooth thereon. As the transfer lever is returned to its initial or rest position the transfer pawl 28 turns the higher denomination ratchet wheel through one step and the spring 36 returns the trip pawl to re-engage with the top of bar 35.

When it is desired to zeroise the adding unit the lever 51 is rocked in the forward or clockwise direction from the position shown in Figure 3 to the position shown in Figure 4. During the initial phase (I) of this movement, while the pin 56 is traversing the part 53*b* of cam slot 53, the plate 58 is rocked in the counter-clockwise direction to engage the cam faces 61 of the transfer levers and rock said levers in the counter-clockwise direction. This lifts the tails 34 of the trip pawls 33 from the bar 35. At the same time the pin 65, traversing the lower end 54*a* of cam slot 54 imparts its movement to the toothed wheel 18 and thus to pinion 17 and shaft 16, the latter rotating in the counter-clockwise direction as seen in Figure 3. As the pin 56 passes along the central part 53*a* of cam slot 53 (phase II) the plate 58, is rocked slightly in the clockwise direction to ensure that the projection 21*a* on the trip cam discs will clear the pawls 33 when the adding wheels reach the zero position, the tails 34 of said pawls remaining however, disengaged from the top of bar 35. By the time the pin 56 has reached the end of the cam slot part 53*a* the shaft 16 has been given nearly a complete counter-clockwise revolution, and all the adding wheels have been turned on, in the same direction as during the adding operations, to the zero position by the engagement of their pawls 67 in the groove 66 in said shaft. Also the pin 65 has reached the concentric part 54*b* of cam slot 54 so that no further rotational movement is imparted to the toothed wheel 18, pinion 17 and shaft 16.

The trip cam discs 21 have now reached the position shown in Figure 5, during which movement they have rocked the trip pawls 33 in the clockwise direction by the engagement with said pawls of the projections 21*a*. After the projections have passed the pawls the latter are returned to the rest position, determined by stop pins 33*a* on the transfer levers, by the springs 36. During the concluding phase (III) of the movement of lever 51 the plate 58 remains in the same position as at the end of phase (II).

It will be understood that, during this forward operative stroke of the zeroising lever 51, the plate 58 moves and maintains the transfer levers 25 in a position in which the trip pawls are freed from the bar 35 until after the adding wheels have been zeroised. This ensures that the transfer levers associated with those trip pawls which are actuated by the cam discs 21 during the zeroising operation, and which would otherwise be rocked by their springs 37 into the tripped position, are held in the untripped position. Due to the shape of the cam slot 54 the shaft 16 is initially rotated at a high speed which gradually is reduced as the pin 65 approaches the concentric slot part 54*b*. This concentric part, which conforms to the concentric part 53*c* of cam slot 53, allows for additional movement of the re-setting lever (phase III) after the adding wheels have reached their zero

positions and so ensures that said wheels are not subjected to any sudden shocks when stopping. Instead the adding wheel units are smoothly arrested in the zero position by the engagement of the pawls **41** with the pinions **23**. For this purpose the pinion teeth are of substantially involute shape at their root ends but are radiused to approximately semi-cylindrical shape at their outer ends. The nose of each pawl **41** is rounded so as to engage evenly between the pinion teeth and stop the latter accurately without the possibility of the pinion remaining in an intermediate position. The pawls **41** also function in the same way during the normal adding operations, and for this purpose each pinion has the same number of teeth as the associated ratchet wheel **22**, i.e. twelve for the pence wheel, ten for the units shillings wheel and so on.

Also during the forward stroke of the zeroising lever the pawl **73**, once the notch **77** of disc **68** has engaged said pawl, prevents return of the zeroising lever until said forward stroke has been completed. The notches **77** and **69** are for this purpose of such shallow depth as to prevent rocking of the pawl from one inclined position to the opposite inclined position. As the slot **71** in the disc has a width less than that of the pawl, reversal of the pawl within said slot is also prevented. The pawl is reversible at the end of each full forward and return rotation of shaft **16** by engagement with one or other end of the notch **70**, said notch being of a depth sufficient to clear the nose of the pawl. As soon as the zeroising lever is moved from the rest position (Figure 3) the slot **71** in the disc **68** is displaced in relation to the pin **72** and rocking of the adding unit, and thus actuation of the keys, is prevented. At the end of the forward stroke of the zeroising lever, the slot **71** is still out of register with the pin **72** as the disc **68** is given rather less than a full rotation, and the keys are consequently locked against actuation until the zeroising lever is fully returned to the rest position. The notch **70** is of a length sufficient to receive the pawl **73** in either end position of rotation of the disc **68**. During the return movement of the zeroising lever the plate **58** is first rocked by the cam slot part **53***a* to lift the tails **34** of the trip pawls **33** away from the top of bar **35**, during which movement the pin **65** is moved by the cam slot part **54***a* to rotate shaft **16**. The speed of rotation of shaft **16** is progressively increased as the pin **56** passes into and along the cam slot part **53***b*, but this movement of the shaft is not transmitted to the adding wheels and is arrested without affecting the adding wheels when the pin **65** engages the lower end of cam slot **54**. During the last phase of the return movement of the zeroising lever the plate **58** is rocked clear of the edges **61** of the transfer levers and said levers are returned by their springs to re-engage the trip pawl tails **34** with the bar **35**.

As previously mentioned, the adding wheel units each comprise the wheel **20**, trip cam disc **21**, ratchet wheel **22** and pinion **23**, all said elements being secured together. For this purpose the wheel **20** has a hub **80** extending therefrom at one side and which has a free fit on the shaft **16**. The pinion **23** is formed integrally with a sleeve **81** which fits over the hub **80**. This sleeve is externally splined to engage with internal splines on the ratchet wheel **22** and cam disc **21**.

To assemble the adding wheel unit, after the ratchet wheel **22** and cam **21** have been placed on the sleeve **81**, the latter is fitted over the hub **80** so that the cam engages in a correspondingly shaped depression **82** in the side of the adding wheel, whereupon the outer end **84** of the hub **80** is expanded to secure the elements **21**, **22** and **23** against displacement axially of the wheel **20**. The re-set pawl **67** is mounted in an annular depression **85** in the opposite face of the wheel **20** for pivotal movement about a pin **86**. To facilitate the construction of the pinion **23** and sleeve **81**, the latter has a diameter rather greater than the pinion teeth root diameter. The teeth

roots and the splines on the sleeve can thus be produced in a single machining operation.

The construction of the adding unit and the mounting thereon of the re-setting means as above described will be understood to simplify the assembly of said re-setting means and unit. Moreover, the construction is further simplified and production cheapened since reasonable tolerances may be allowed in the operative parts, particularly in the locking plate **58** and the cooperating cam faces **61** of the transfer levers.

We claim:

1. In an adding machine, the combination with an adding unit having a frame, numeral wheels of different denominations mounted in said frame, pivoted transfer levers, transfer pawls on said transfer levers engaged with said numeral wheels, trip pawls also on said transfer levers, and trip means on the numeral wheels engageable with the trip pawls to condition the transfer levers for transfer, means to oscillate said transfer levers to effect transfers, and amount keys for actuating said numeral wheels, of a numeral wheel re-setting lever pivoted on the adding unit frame, means actuated by the re-setting lever to advance the numeral wheels to their zero positions, a locking plate also pivoted on the adding unit frame, and a pin on said locking plate engaged in a cam slot in the re-setting lever thereby to rock the locking plate into engagement with the transfer levers to restrain said transfer levers against operative movement during re-setting.

2. An adding machine as claimed in claim 1, wherein the adding unit frame carries a fixed member and the trip pawls have portions normally seating on said fixed member, the said cam slot being formed with a first portion which actuates the locking plate to rock the transfer levers in a direction to disengage the trip pawls from said fixed member and with a second portion which actuates the locking plate to permit return of the transfer levers to a position in which the trip means on the numeral wheels will clear the trip pawls when the adding wheels reach the zero position.

3. In an adding machine, the combination with an adding unit having a frame, numeral wheels of different denominations freely mounted on a common shaft in said frame, pivoted transfer levers, transfer pawls on said transfer levers engaged with said numeral wheels, trip pawls also on said transfer levers, and trip means on the numeral wheels engageable with the trip pawls to condition the transfer levers for transfer, means to oscillate said transfer levers to effect transfers, and amount keys for actuating said numeral wheels, of a numeral wheel re-setting lever pivoted on the adding unit frame, a toothed wheel movable with said re-setting lever, a pinion on the numeral wheel shaft meshed with said toothed wheel, pawls on the numeral wheels, engageable in a groove in the said shaft to advance said wheels to their zero position, and a locking plate also pivoted on the adding unit frame and rockable by the re-setting lever into engagement with the transfer levers to restrain said transfer levers against operative movement during re-setting.

4. An adding machine as claimed in claim 3, wherein the re-setting lever is formed with a cam slot, and the said toothed wheel carries an eccentrically arranged pin engaged in the cam slot, said cam slot being shaped to produce an initially high but progressively reducing speed of said toothed wheel.

5. In an adding machine, the combination with an adding unit having a frame, numeral wheels of different denominations freely mounted on a common shaft in said frame, pivoted transfer levers, transfer pawls on said transfer levers engaged with said numeral wheels, trip pawls also on said transfer levers, and trip means on the numeral wheels engageable with the trip pawls to condition the transfer levers for transfer, means to oscillate said transfer levers to effect transfers, and amount

keys for actuating said numeral wheels, of a numeral wheel re-setting lever pivoted on the adding unit frame, gearing connecting the re-setting lever with the numeral wheel shaft including a pin on one gear wheel engaged in a first cam slot in said re-setting lever, means coupling said numeral wheels to said shaft during actuating of the re-setting lever to advance said wheels to their zero position, a locking plate also pivoted on the adding unit frame, and a pin on said locking plate engaged in a second cam slot in said re-setting lever thereby to rock the locking plate into engagement with the transfer levers to restrain said transfer levers against operative movement during re-setting, each cam slot having a concentric portion which permits idle movement of the re-setting lever beyond the position in which the numeral wheels are zeroised while retaining the locking plate in engagement with the transfer levers.

6. An adding machine as claimed in claim 5, wherein a peripherally notched disc fixed on the numeral wheel shaft is engaged by a reversing pawl on the adding unit, one only of the said notches being dimensioned to permit reversal of said pawl thereby to ensure a full rotation of said shaft during re-setting.

7. In an adding machine, the combination with an adding unit having a frame, numeral wheels of different denominations mounted in said frame on a common axis, a hub on one side of each numeral wheel, pinions mounted on said hubs, splined sleeves rigid with said pinions, ratchet wheels splined on said sleeves, pivoted transfer levers, transfer pawls on said transfer levers engaged with said ratchet wheels, trip cams also splined on said sleeves and seated in correspondingly shaped recesses in the sides of the numeral wheels, trip pawls on said transfer levers engageable by said trip cams to condition the transfer levers for transfer, actuating amount keys, toothed segments actuable by said keys and engageable with the numeral wheel pinions, and means to oscillate said transfer levers to effect transfers, of a numeral wheel re-setting lever pivoted on the adding unit frame, means actuable by the re-setting lever to advance the numeral wheels to their zero positions, and a locking plate also pivoted on the adding unit frame and rockable by the re-setting lever into engagement with the transfer levers to restrain said transfer levers against operative movement during re-setting.

8. In an adding machine, the combination with an adding unit having a frame, numeral wheels of different denominations mounted in said frame on a common axis, a hub on one side of each numeral wheel, pinions mounted on said hubs and having the teeth thereof radiused at their outer ends, splined sleeves rigid with said pinions, ratchet wheels splined on said sleeves, pivoted transfer levers, transfer pawls on said transfer levers engaged with said ratchet wheels, trip cams also splined on said sleeves and secured to said numeral wheels, trip pawls on said transfer levers engageable by said trip cams to condition the transfer levers for transfer, actuating amount keys, toothed segments actuable by said keys and engageable with the numeral wheel pinions, pawls mounted on the adding unit frame, said pawls having radiused noses engaging the radiused ends of the pinion teeth to thereby accurately locate the adding wheels after each operation, and means to oscillate said transfer levers to effect transfers, of a numeral wheel re-setting lever pivoted on the adding unit frame, means actuable by the re-setting lever to advance the numeral wheels to their zero positions, and a locking plate also pivoted on the adding unit frame and rockable by the re-setting lever into engagement with the transfer levers to restrain said transfer levers against operative movement during re-setting.

9. In an adding machine, the combination with an adding unit having a frame, numeral wheels of different denominations mounted in said frame on a common axis, a hub on one side of each numeral wheel, pinions mounted on said hubs, splined sleeves rigid with said pinions, said sleeves being of greater external diameter than the roots of the pinion teeth and the spline grooves on said sleeves being contiguous with the tooth spaces and machined to the depth of the tooth roots, ratchet wheels splined on said sleeves, pivoted transfer levers, transfer pawls on said transfer levers engaged with said ratchet wheels, trip cams also splined on said sleeves and secured to said numeral wheels, trip pawls on said transfer levers engageable by said trip cams to condition the transfer levers for transfer, actuating amount keys, toothed segments actuable by said keys and engageable with the numeral wheel pinions, and means to oscillate said transfer levers to effect transfers, of a numeral wheel re-setting lever pivoted on the adding unit frame, means actuable by the re-setting lever to advance the numeral wheels to their zero positions, and a locking plate also pivoted on the adding unit frame and rockable by the re-setting lever into engagement with the transfer levers to restrain said transfer levers against operative movement during re-setting.

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