United States Patent [19]

Greskovics

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[45] **Feb. 26, 1974**

[54] **MECHANICAL MECHANISM**

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[73] Assignee: **Litton Business Systems, Inc.,** New York, N.Y.

[22] Filed: **Sept. 11, 1972**

[21] Appl. No.: **270,601**

Related U.S. Application Data

[62] Division of Ser. No. 50,063, June 26, 1970, Pat. No. 3,698,628.

[52] **U.S. Cl.** **74/55,** 74/435

[51] **Int. Cl.** **F16h 25/14,** F16h 27/08

[58] **Field of Search** ..... 74/55, 84, 435, 436, 665 Q

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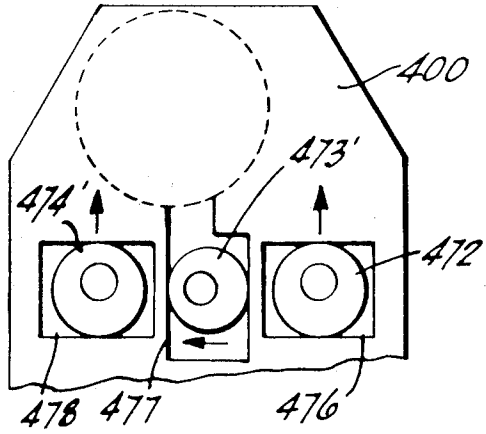
Primary Examiner—Allen D. Herrmann

Attorney, Agent, or Firm—Alan C. Rose

[57] **ABSTRACT**

A cash register is provided with an accumulator and a display. On ADD cycles of the cash register, the accumulator is moved in one direction to engage the digit tape by a pair of eccentrics, and on TOTAL cycles, it is moved in another direction by another eccentric to transfer digital information to the display. Control of the eccentrics is provided by an axially movable timing gear which provides a modified geneva-type mechanical movement.

19 Claims, 29 Drawing Figures



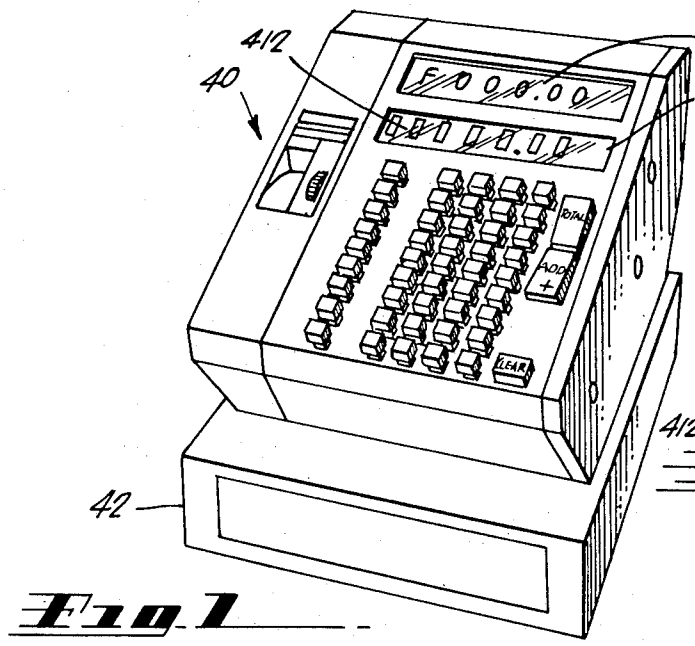


Fig. 1

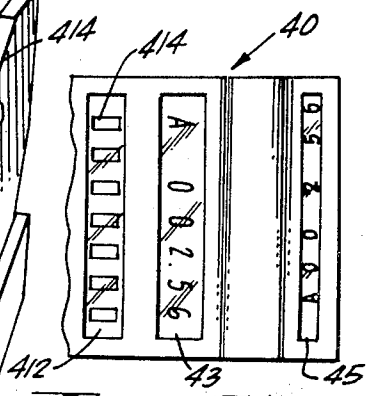


Fig. 1A

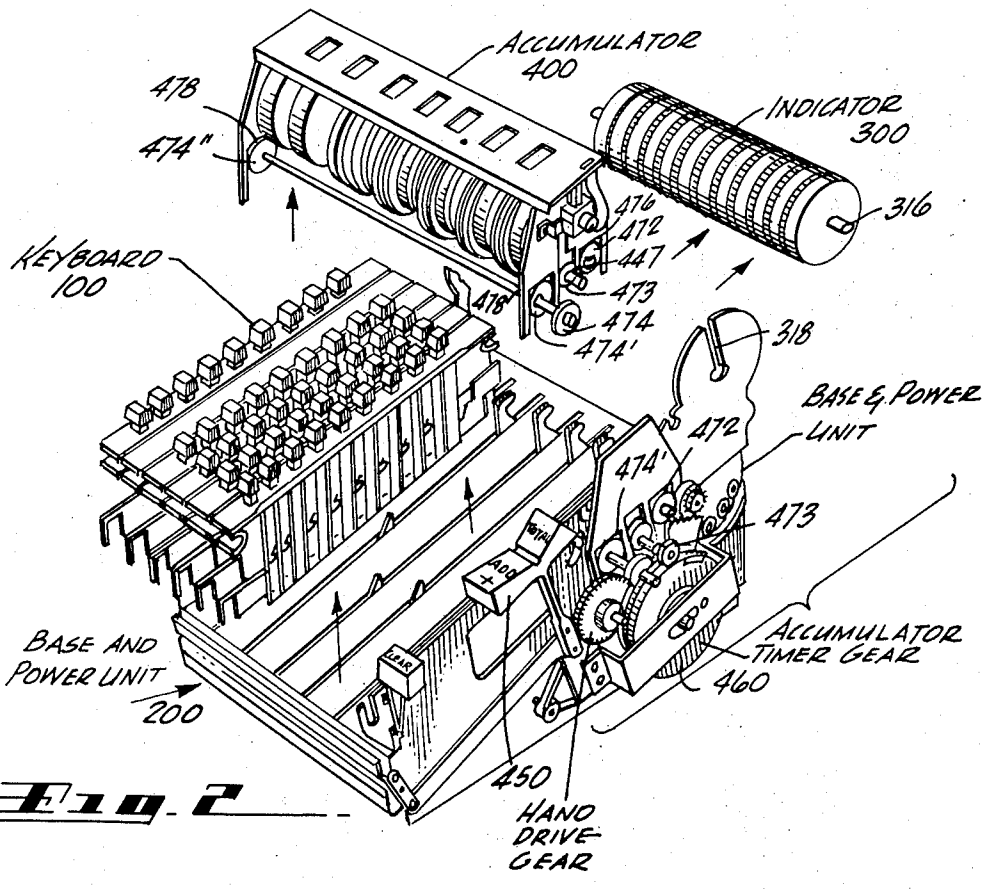


Fig. 2

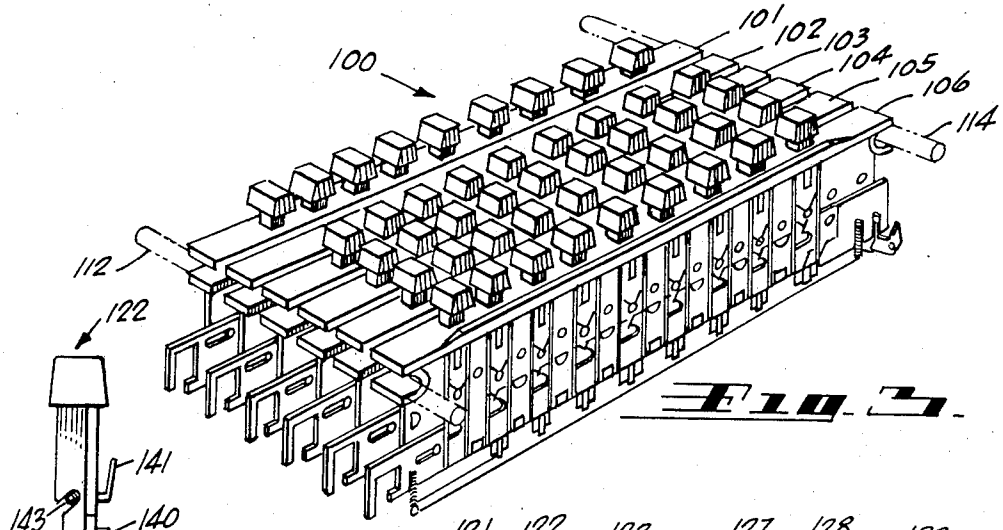


Fig. 3

Fig. 5A

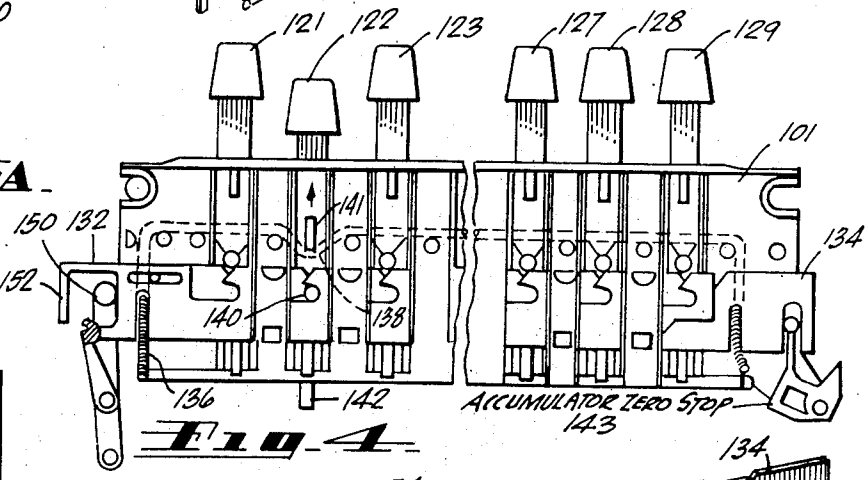


Fig. 4

Fig. 6

Fig. 5

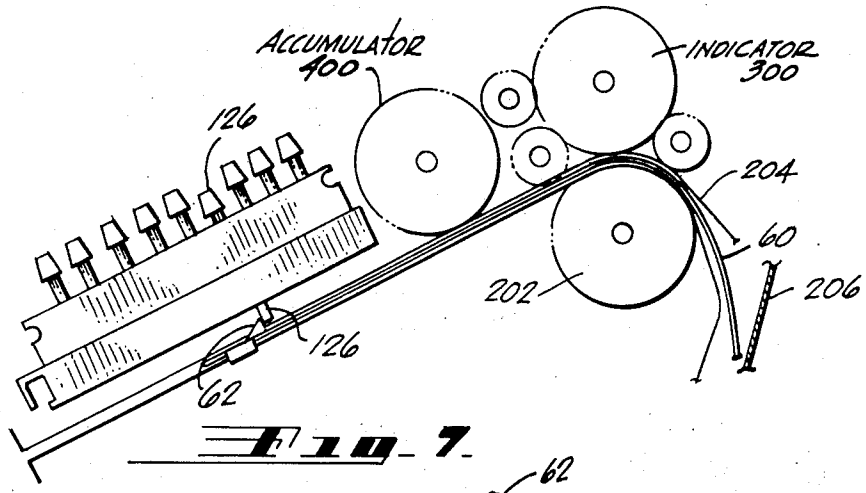


Fig. 7

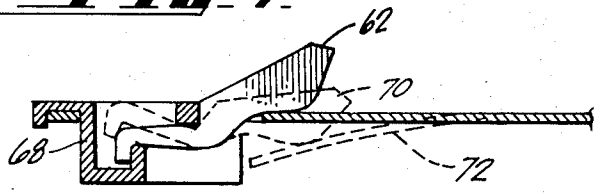


Fig. 8

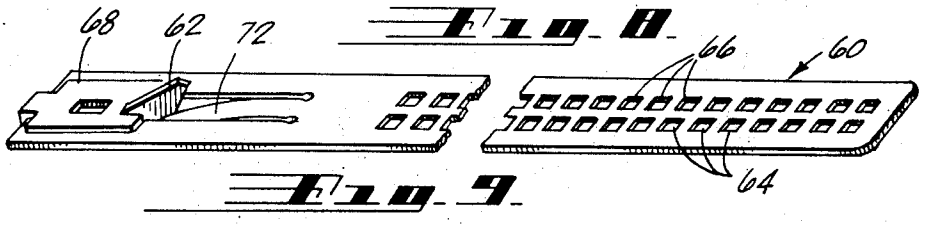


Fig. 9

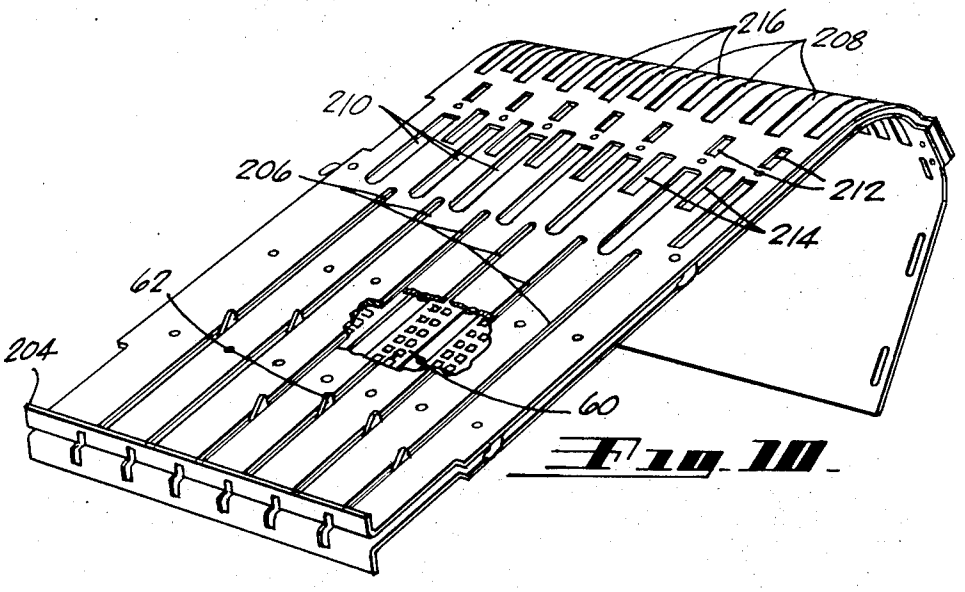


Fig. 10

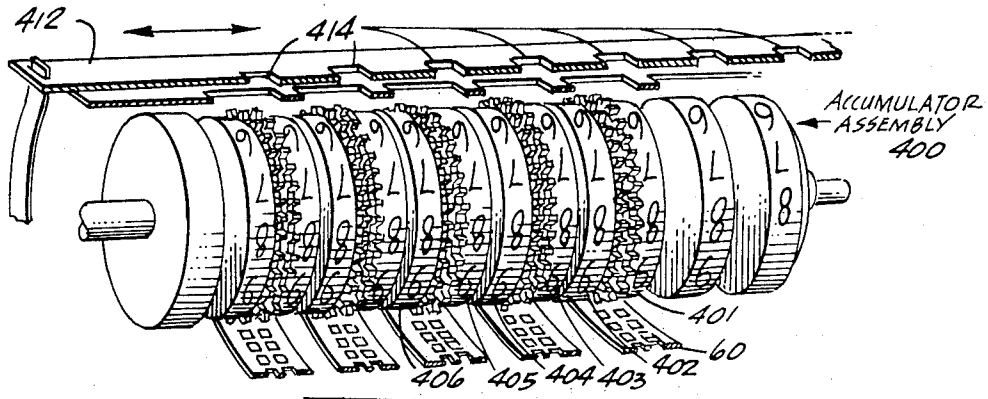


Fig. 11

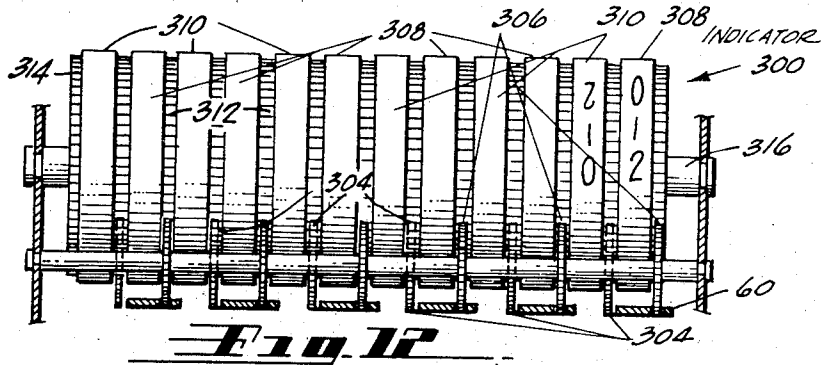


Fig. 12

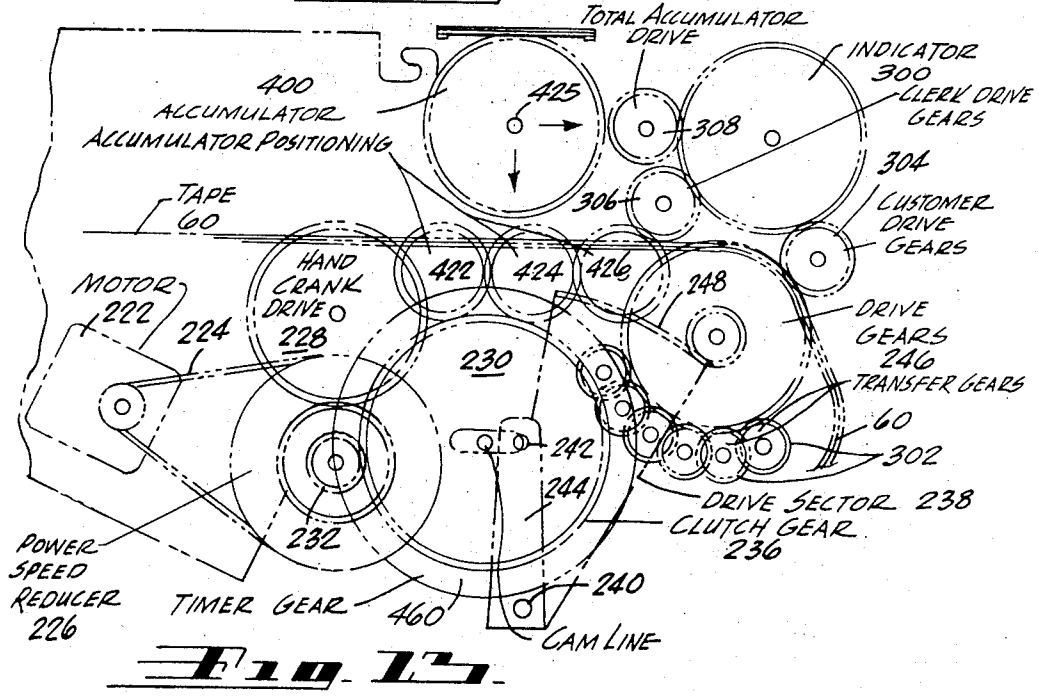


Fig. 13

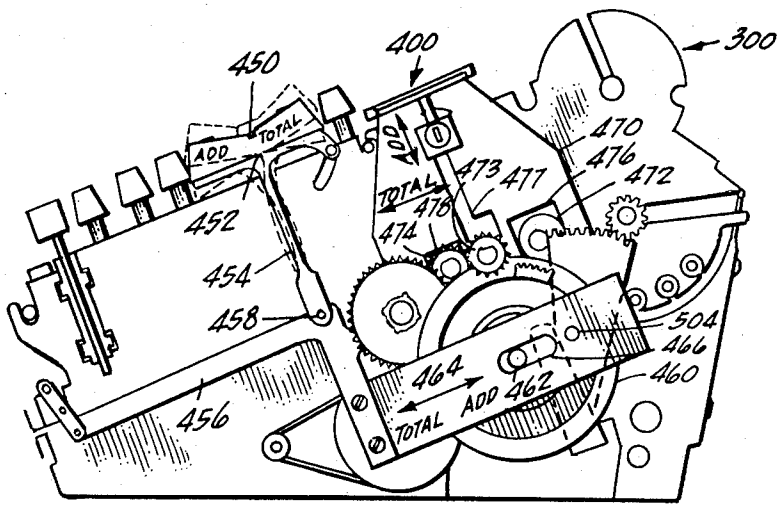


Fig. 14

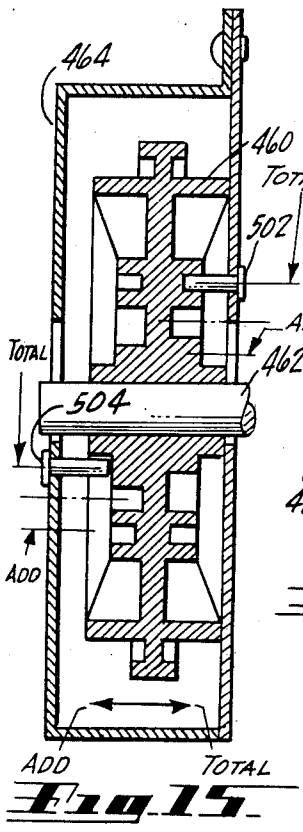


Fig. 15

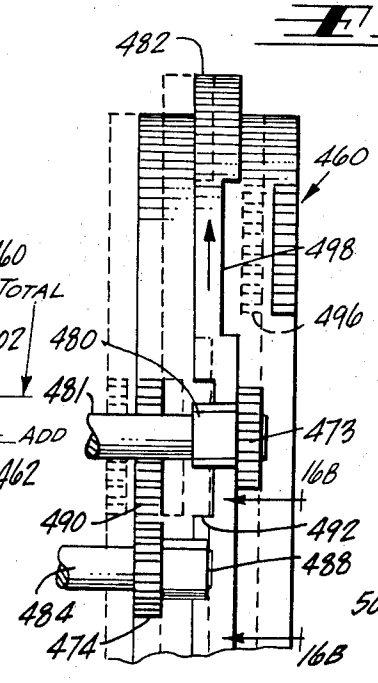


Fig. 16A

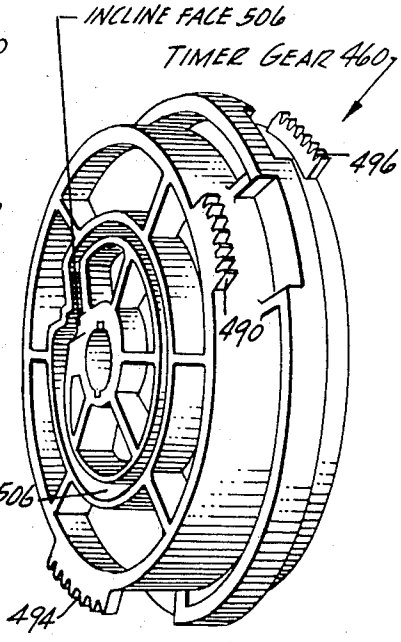


Fig. 16

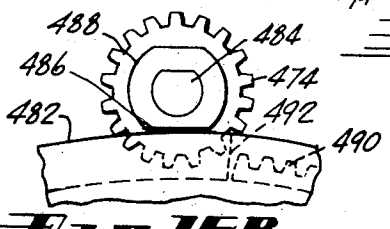


Fig. 16B

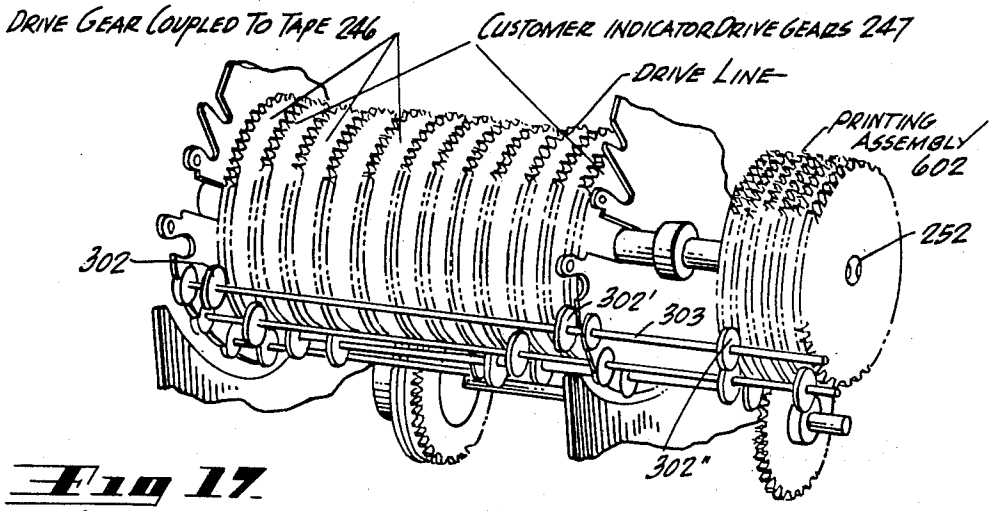


Fig 17

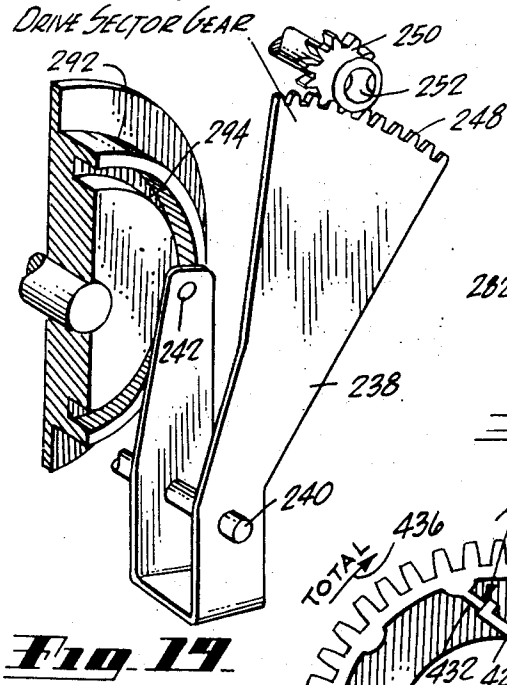


Fig 19

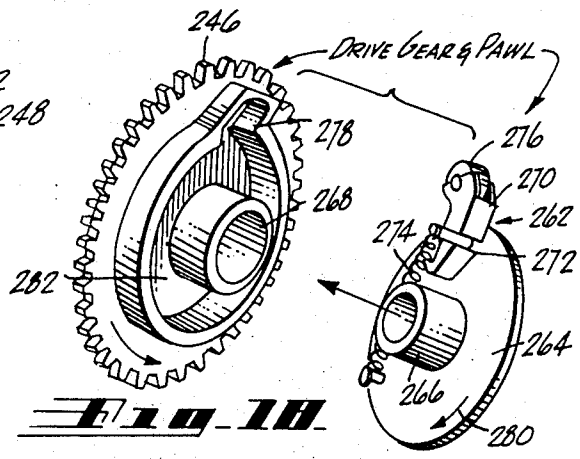


Fig 18

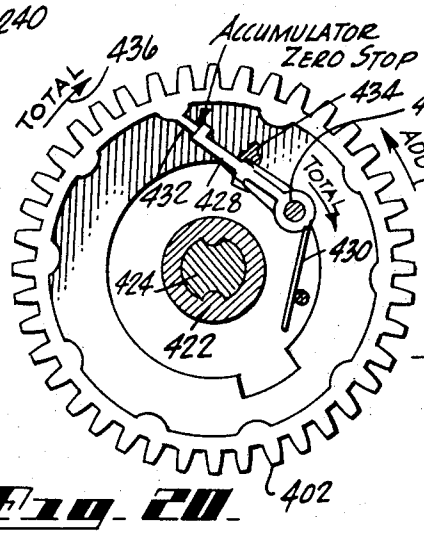


Fig 20

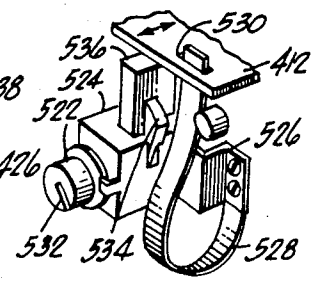


Fig 21

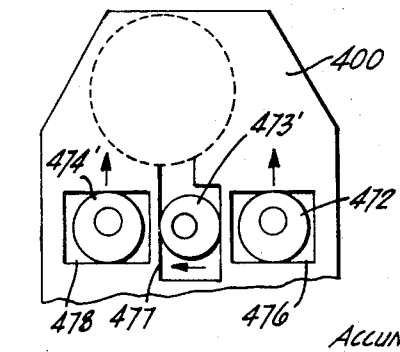


Fig. 24

Fig. 23

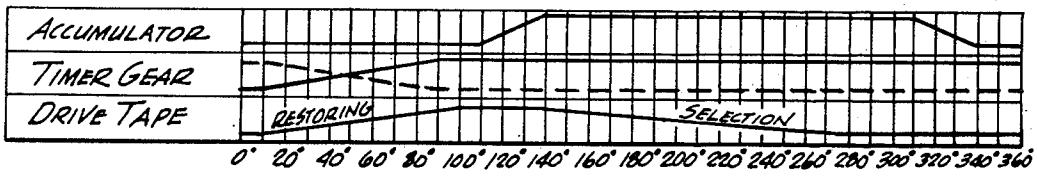


Fig. 22

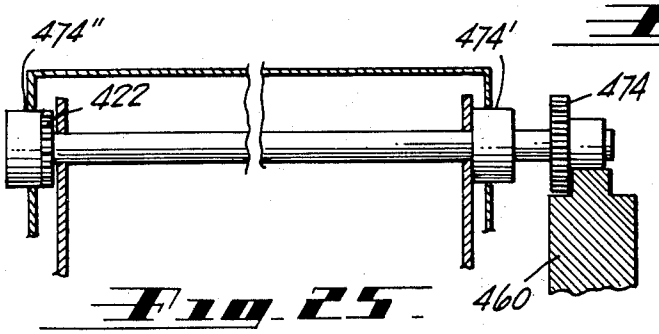


Fig. 25

MECHANICAL MECHANISM

CROSS REFERENCE TO RELATED APPLICATION

This application is a divisional of U.S. Patent Application Ser. No. 50,063 entitled BUSINESS MACHINE filed on June 26, 1970, now U.S. Pat. No. 3,698,628 issued on Oct. 16, 1973.

FIELD OF THE INVENTION

This invention relates to mechanical mechanisms for business machines.

BACKGROUND AND SUMMARY OF THE INVENTION

In the above-identified patent application and in the detailed description which follows, a cash register is described in which the accumulator is moved down into engagement with digit tapes to receive digital input information on ADD cycles, and is moved to the rear to transfer the contents of the accumulator to the display on TOTAL cycles. In the usual supermarket transaction, a number of ADD cycles occur as the clerk enters the value of specific purchases, and the TOTAL cycle occurs after all of the individual purchases have been entered. The present invention involves the mechanism by which the accumulator register is selectively moved either downward and upward, or to the rear and forward, in accordance with the selected ADD or TOTAL cycle of operation of the cash register.

In accordance with one aspect of the invention, this movement is accomplished by two eccentric assemblies. One of the eccentric assemblies includes a pair of eccentrics at each end of the accumulator carriage which are operated in synchronism. The eccentrics are journaled in the main frame of the cash register and their eccentric surfaces engage the carriage of the accumulator. For movement in one direction, one of the eccentric assemblies is held fixed to serve as a guide, while the paired eccentrics are rotated together to move the entire accumulator carriage. For movement in the other direction, the two paired eccentrics are held fixed to guide the motion, while the third eccentric is rotated to provide a positively controlled movement in the other direction for the accumulator carriage.

A modified geneva mechanism is provided to control the movement of the eccentrics. The paired eccentrics are interconnected by gears so that they rotate together. One of the paired eccentrics is mounted on a shaft which is also provided with a gear forming part of the geneva mechanism. The third eccentric, which provides motion in the other direction, is also provided with a gear forming part of the geneva mechanism.

These two gears coact with a timer gear having a central ridge which extends over its entire periphery. This timer gear is axially shifted to permit selective rotation of one of the two gears associated with a corresponding eccentric, or the other.

In one of the two axial positions of the timer gear, a flat portion on the hub of one of the eccentric gears is continually in engagement with the peripheral ridge of the timer gear. The other eccentric gear, however, has the flat portion on its hub in engagement with the timer gear ridge for much of the cash register cycle, but the ridge is relieved to permit rotation of the eccentric gear by mating gear teeth on the timer gear, at two points around the periphery of the timer gear. Similarly, when

the timer gear is in its other axial position, the other eccentric gear is actuated in a corresponding manner.

The timer gear is axially shifted by a pair of pins mounted on an enclosing housing. These pins are mounted on a frame which moves parallel to a diameter of the timer gear, and in the rest position between cash register cycles, they are located adjacent ramps or inclined surfaces on the timer gear which extend along a diameter of the timer gear. When the enclosing carriage is moved to a position corresponding to the ADD cycle of the cash register, the pins are moved radially on the ramps to push the timer gear to one axial position. When the enclosing housing is moved in the other direction, the pins ride on the ramps in the other direction and push the timer gear to its other axial position. Once a cash register cycle starts and the timer gear starts to rotate, however, at least one of the pins is locked in a groove, thus preventing movement of the enclosing selection housing.

Accordingly, one feature of the invention involves the selective actuation of two eccentric assemblies to provide selective relative motion in different directions when one of the eccentric assemblies is held and the other is moved.

In accordance with another aspect of the invention, the rotation of two shafts may be selectively controlled by a modified geneva-type action in which a timer gear is provided with two axial positions, to selectively move two gears connected respectively to the two shafts. In one of the two axial positions, a first one of two gears is intermittently rotated while the second is held in a fixed position, while in the other axial position of the timer gear, the second gear is rotated while the first is held in a fixed position.

BRIEF DESCRIPTION OF THE DRAWINGS

Other aspects and features of the invention will become apparent from a consideration of the detailed description and from the drawings, in which:

FIG. **1** is an assembly view showing the complete cash register together with the cash drawer on which it stands;

FIG. **1A** is a view of the business machine showing both sets of display windows;

FIG. **2** is an exploded view of the operating portions of the cash register of FIG. **1** without the cash drawer and with the cover removed;

FIG. **3** is a perspective view of the keyboard assembly;

FIG. **4** is a side view of a single key row;

FIG. **5** is an end view of the key row shown in FIG. **4**;

FIG. **5A** shows a single key of the keyboard;

FIG. **6** is a view of the two slides which prevent actuation of any other keys and provide other functions when one cash register key in a given key row is depressed;

FIG. **7** is a side view showing the mode of operation of the flexible digit tapes;

FIG. **8** shows the by-pass stops secured to the ends of each digit tape;

FIG. **9** is an isometric view of the digit tapes and their stops;

FIG. **10** shows the tape constraining frame or assembly cut away to show several of the tapes;

FIG. **11** shows the accumulator assembly and the engagement with the digit tapes;

FIG. 12 is a partial cross-sectional view of the display assembly;

FIG. 13 is a schematic cross-sectional view shwoing the relationships of the principal components of the cash register;

FIG. 14 is a side view of the register which shows the accumulator movement control arrangements to advantage;

FIGS. 15, 16, 16A, and 16B are various views of the accumulator control timing gear and the associated accumulator camming control gears;

FIG. 17 shows the drive line including the gears which engage the perforations in the flexible digit tapes;

FIG. 18 shows a positively driven disc and drive gear pair, which are coupled together by a spring biased pawl;

FIG. 19 shows the drive sector gear and the driven gear at one end of the drive line;

FIG. 20 shows an accumulator gear together with the stop mechanism which come into play as information is being transferred from the accumulator to the display;

FIG. 21 shows the accumulator mask moving mechanism;

FIG. 22 is a timing chart showing the timing of the operation of certain parts of the cash register during an operating cycle;

FIG. 23 is a side view of an alternative cash register construction; and

FIGS. 24 and 25 are side and front views of the details of the accumulator moving and control mechanisms.

DETAILED DESCRIPTION

Referring more particularly to the drawings, FIG. 1 shows the cash register assembly **40** standing on the cash drawer assembly **42.** The viewing windows **43** for the clerk and **45** for the customer are shown in FIG. 1A. As seen in both FIGS. 1 and 2, the cash register includes a keyboard assembly **100,** a base and power unit **200,** an indicator or display assembly **300** and an accumulator assembly **400.** Also visible in FIG. 2 are the ADD or TOTAL control member **450** which determines the mode of operation of the accumulator **400,** as implemented by the accumulator timing gear **460** and its associated mechanical mechanisms.

With reference to FIG. 3, the keyboard **100** includes a plurality of key rows **101** through **106.** The individual key row moldings are provided with recesses at opposite ends for ease in mounting the key rows side by side on the shafts **112** and **114.** As mentioned above, most of the major subcomponents of the present cash register are mounted on shafts for ready assembly with the side plates of the base unit **200.**

As shown to better advantage in FIGS. 4, 5, 5A and 6, each key row **101** through **106** may be provided with a set of nine keys **121** through **129,** with key **122** being depressed in the illustrative embodiment of FIG. 4. Each key row is also provided with two interlock slides **132** and **134,** shown in FIG. 6. The key row assembly is provided with a single spiral biasing spring **136.** As shown in FIGS. 4 and 5, the biasing spring **136** extends through the interlock slides **132** and **134** to bias them to their normal positions. In addition, the biasing for each of the plastic keys **121** through **129** is provided by the same single spring **136.** As shown in FIG. 4, for example, the spring **136** is extended at **138** to provide upward pressure on the key **122** through the integral recess molded into the rear of the key **122.** FIG. 5A shows a key **122** separately, to indicate the structure of the integral key. The head of the key, the spring **141** which holds the keys in frame **101,** the slide engaging stud **140,** and the spring engaging recess **143** are all molded into the key as it is formed.

The lower end **142** of the key **122** protrudes below the key row assembly **101** and below the interlock slides **132** and **134** to block the movement of the stop which is secured onto one end of the flexible tapes in a manner to be discussed in greater detail below. The lightweight molded plastic keys **122** would normally not have sufficient strength to stop a heavy metal rack as employed in conventional cash registers. However, the flexible tapes which are used instead of racks in the present cash register have such a light weight and such low inertia that there is no problem with the end **142** of the lightweight plastic keys stopping the flexible plastic tapes.

Concerning the operation of the metal slides **132** and **134,** the spring **136** extends through slot **139** in slide **132** at the left-hand end of slide **132** where there is no interference with slide **134.** Similarly, the other end of spring **136** extends through slot **147** in slide **134** at its right-hand end to avoid interference with slide **132** in the biasing or positioning function.

The sole function of slide **134** is to control the accumulator zero stop **143.** When none of the nine keys **121** through **129** of a key row is depressed, the accumulator zero stop **143** is in one position; however, when any key, such as key **122,** is depressed, the slide **134** is shifted to the left and accumulator zero stop **143** is rotated to permit operation of the associated accumulator register.

The slide **132** provides interlocking functions. It is normally biased so that the angle surfaces **144** underlie the key studs **140.** When a key is depressed, the stud **140** initially moves the locking slide **132** to the right and then enters the recess **146** which is below the slanted surface **144.**

Once the ADD or TOTAL key **450** is hit, the keyboard control shaft **150** is actuated to the left to engage the arm **152** which depends from the slide **132.** This moves the slide **132** to the left so that the flat surfaces **154** on slide **132** underlie the studs **140** of the keys, and thus effectively lock them out and prevent further action of the keyboard. Toward the end of each cycle, the shaft **150** is moved to the right to release all the keys.

It is again noted that the entire key row assembly only includes fourteen elements and particularly that only two slides are employed. This is in sharp contrast with fifty-three parts included in the key row assembly of at least one widely used commercial cash register. Further, the single spiral spring **136** not only provides the biasing for all of the keys of each key row but also biases the two slides **132** and **134** to their proper positions.

FIG. 7 shows schematically the mode of operation of the plastic tapes **60** which form a key component in the present invention. In the course of the cycle of operation of the present cash register, the digit tapes are always coupled to the display wheels of the indicator assembly **300.** When cash register operation is initiated by pressing the "ADD" control, the digit tapes are re-

stored to their "zero" state in which the tapes are shifted to the front, or the left of the machine as shown in FIG. 7. The flexible tapes are then driven forward by the drive line gears 202 until the stop 62 which is secured to the end of the tape 60 engages the lower end of a depressed key 126, as shown in FIG. 7. As the flexible digit tape moves forward, the gears of the accumulator 400 are rotated, with the gears of the item total accumulator engaging one of the sets of perforations 64, while the gear teeth on the grand total accumulator engage the other set of perforations 66 in the flexible plastic tape 60. When the stop 62 engages the lower end of the key 126, the drive line 202 releases the force applied to the tape 60, as discussed in greater detail below, the indicator 300 displays the digit corresponding the depressed key 126, and the accumulator 400 adds the digit in both the item total and the grand total registers.

As the flexible tape is driven past the gears of the drive line 202, it is deflected downwardly by the tape constraining enclosure 204 and also engages the rear casing 206 of the cash register. By this technique, the use of additional rearwardly extending space for the cash register to accommodate the tapes is avoided, and the complexity of the step-up and step-down gearing, which is required in present cash registers, is also eliminated. The dual goals of compactness and simplicity are thus achieved primarily by the use of very flexible tapes which are bent around within the small confines of the present compact cash register.

The movable tape is provided with a plastic retaining element 68 for the stop 62. The retainer 68 extends through an opening in the tape 60 and serves as a carrier for the stop 62. When the tapes are driven to the "zero" position so that the stop 62 moves to its extreme left or front position, the stop 62 must pass under a depressed key such as key 126 in FIG. 7. Under these conditions, it pivots downwardly, as indicated at 70 in FIG. 8. Under these conditions, the tongue 72 of the tape 60 resiliently flexes down also, as indicated in FIG. 8.

In FIG. 9, the thickness of the tape is exaggerated to some extent. The tapes are actually about 0.020 inch thick. The tapes are 13-½ inches long and five-eighths inch wide.

FIG. 10 shows the frame 204 which constrains the tapes 60 to follow a rectilinear path in the regions where the stops 62 underlie the keyboard 100. As shown in FIG. 10, the frame 204 is provided with slots 206 through which the stops 62 extend to engage the lower ends of depressed keys. In addition, the drive gears engage the tapes through the long slots 208 which are aligned with one of the sets of perforations in each tape 60. The slots 210 accommodate accumulator transfer bails, which come into play when transfers are made from one register to the next higher order. The accumulator register gears engage the tapes 60 through the slots 214, with the item total gears engaging the right-hand row of perforations, and the grand total gears, the left. The gears for driving the set of indicator wheels which are read by the clerk or the operator of the cash register extend through the front of slots 208. The slots 212 accommodate an accumulator detent. The shorter set of slots 216 which are interleaved with the slots 208 are located between adjacent tapes and accommodate the gears which drive the customer indicator wheels as described below.

In general, the frame 204 provides the support and channeling necessary to constrain the plastic tapes 60 to the paths required for their proper operation. With the indicated physical configuration, the tapes 60 have operated several million times without physical signs of wear and without tape failure.

The accumulator assembly 400 is shown in FIG. 11. The grand total register includes the indicator wheels 401, 403, 405, etc., while the subtotal is displayed on the indicator wheels 402, 404, 406, etc. The gears secured to the indicator wheels 401, 403, 405, etc., associated with the grand total engage the right-hand set of perforations on the digit tapes 60 as shown in FIG. 11, while the gears associated with the subtotal wheels 402, 404, 406 engage the left-hand set of perforations of the tapes 60.

The view of FIG. 11 is taken from the rear of the machine looking down at the tapes 60 between the accumulator and the indicator wheels. Above the accumulator indicator wheels is a mask 412 containing a series of windows 414. The mask 414 is normally positioned so that the operator of the cash register may view the subtotal registered on a particular customer's sale through the windows 414. When the key locking the cash register is employed, however, the mask 412 is shifted laterally to permit the viewing of the grand total register wheels through windows 414 to the exclusion of the subtotal.

FIG. 12 is a front view of the indicator or display assembly 300. The indicator assembly includes two sets of interleaved indicator wheels, the first set 308 being visible from the front of the machine by the operator, while the second set 310 is observable by the customer from the rear of the machine. In addition, of course, the position of the wheels having more or less significant numbers must be reversed, with the least significant digit appearing to the right in the set of the wheels 308 observed by the clerk while the least significant digit observed by the customer must be on the left-hand indicator wheel 310, as seen in FIG. 12.

As described below in connection with FIG. 13, the gears 306 in the foreground are directly coupled to one of the two rows of perforations in the tape 60. Gears 306 engage gears 312 associated with the clerk indicator wheels 308. The drive for the customer indicator wheels 310 is somewhat more complex as it involves the gears 304 (to the rear in FIG. 12) which mesh with the gear teeth 314 associated with the customer indicator wheels 310. The shaft 316 upon which the indicator wheels 308 and 310 are mounted is supported in the keyhole slot 318 as shown, for example, in FIGS. 2 and 14.

FIG. 13 is a schematic cross sectional view showing the relative positions of most of the main rotatable components or assemblies. Following the application of power to the cash register when the ADD or TOTAL control is pressed, the motor 222 is coupled through a rubber belt 224 to the power speed reducer assembly 226. An auxiliary hand-crank drive coupling is also connected to the power speed reducer 226 through gear 228. The cam line 230 is driven from gear 232 on the speed reducer assembly 226 through gear 236 on the cam line. The clutch gear 236 is mounted on the cam line assembly 230. The metal drive sector gear 238 is pivoted at 240 and is bent into a U-shaped form with a cam pin 242 securely fastened to the inner leg 244 of the drive sector gear assembly. The pin 242 rides in a

groove in a cam in the cam line assembly **230.** The power for the drive gears **246** is provided through the teeth **248** of the metal drive sector gear **238.** These teeth **248** mesh with the gear **250** which is fixed or pinned to the drive line shaft **252.**

As in the case of a number of the assemblies of the present machine, the drive line shaft **252** is cut away in two areas from end to end. The gear **250** is provided with matching protrusions at its center. Accordingly, it is rigidly secured against rotational movement relative to the shaft **252,** and is "pinned" to this shaft. Where it is desired to mount other freely rotatable gears or other mechanisms on the same shaft, they may be formed with a circular opening in the center. Without the keying structure to lock or pin them to the drive shaft **252,** they are free to rotate. Accordingly, a single shaft with longitudinal slots may serve a dual purpose, acting both as a drive shaft and also as an axle for free rotation of other coaxially mounted elements.

From the drive gears **246,** power is transmitted directly to the perforated tapes **60.** As the sector gear follows the programmed camming motion of the cam line assembly **230,** the tapes **60** are initially restored to their "zero" position and are then driven forward by the drive gears **246** until they engage stops such as the lower end of depressed key **126** (see FIG. 7). A clutching mechanism, to be described in greater detail below, then releases the drive to the individual tapes and permits the tape to remain in its position corresponding to the depressed digit key.

The accumulator assembly **400** has its principal axis located at point **425.** As indicated by the arrows, the accumulator may be moved down and up for engagement or disengagement, respectively, with the tapes **60,** or may be moved to the rear toward the indicator assembly **300** to transfer totals stored in the accumulator to the indicator assembly. The circles **422, 424** and **426** in FIG. **13** represent the mechanisms involving gears, camming surfaces and a Geneva-type movement which control the movement of the accumulator registers. These mechanisms will be described in greater detail below.

Included in the indicator assembly **300** are one set of indicator wheels which are visible by the customer and another set of indicator wheels which may be viewed by the clerk. The customer indicator wheels are driven by the transfer gears **302** through a set of gears which are mounted for free rotation on the drive shaft **252** and which mesh with the customer indicator drive gears **304.** The clerk indicator display wheels, however, are driven by the gears **306** directly from the tapes **60.**

When information is being transferred from the accumulator registers to the indicator assembly, the shaft **425** moves to the right and the indicator assembly is energized through the gears **308.** Although the gears **306** are close to gears **308,** there is clearance and no direct interaction between gears **306** and **308.**

Many of the critical details of the structure shown schematically in FIG. **13** will be discussed in greater detail below in connection with other FIGURES in the drawing.

FIGS. **14** through **16** are particularly useful in describing the mode of operation of the accumulator **400.** The accumulator can move either perpendicular to the keyboard or parallel to it. As indicated by the arrows and legends on the face of the accumulator side frame member **470** in FIG. **14,** the accumulator assembly moves up and down for engagement and disengagement with the digit tapes on "ADD" cycles and moves to the rear and forward in the course of "TOTAL" cycles in transferring the contents of its subtotal register to the display unit **300.** An ADD or a TOTAL cycle is initiated by pressing the key **450** in the forward or the rear direction, respectively. The key **450** is pivoted at point **452** and has a flexible arm **454** which is pivotally connected to the control linkage **456** at point **458.**

The central shaft **462,** to which the timer gear **460** is secured, is fixed in position. When the ADD or TOTAL control lever **450** is pressed, the linkage **456,** which includes the frame **464** enclosing the timer gear **460,** is moved to the front or the rear as indicated by the arrows adjacent the numeral **464** in FIG. **14.** On ADD cycles the frame **464** moves to the rear and on TOTAL cycles the frame **464** moves toward the front of the machine. Between cycles the frame **464** is maintained in a position such that the shaft **462** if centrally located with respect to the slot **466.** In the arrangement shown in FIG. **14,** the relationship of the parts indicates that an ADD cycle is underway.

The movement of the accumulator is controlled by three eccentrics **472, 473'** and **474'.** In FIG. **14,** the numerals **473** and **474** are directed to gears which conceal the eccentrics **473'** and **474',** which are located directly behind them. As clearly shown in FIGS. **24** and **25,** the eccentrics are mounted to rotate in the rectangular slots **476, 477** and **478.** A corresponding set of three eccentrics mounted on corresponding shafts are located at the other side of the register. One of these eccentrics **474''** is shown in FIG. **25.**

The eccentric **472** and **474',** which rotate in slots **476** and **478** control the upward and downward movement of the accumulator register, while the eccentric **473** in slot **477** controls the forward and backward movement of the accumulator register on TOTAL cycles. During ADD cycles the eccentric **473'** is held against rotation while the gear **474** and associated eccentric **474'** and eccentric **472** (which is geared to **474**) are rotated to raise and lower the accumulator. Similarly, on TOTAL cycles the gear **473** and its associated eccentric **473'** are rotated to move the accumulator assembly to the rear and forward while the gear **474** and its associated eccentric **474'** and the paired eccentric **472** are held against rotation to provide guiding action. Eccentrics **474'** and **472** are geared to rotate together by gear **422** formed as part of a single molding with eccentric **474''** (see FIG. **25**) and gears **424** and **426** (see FIG. **13**). Gears **422** and **426** are pinned to the shafts on which they are mounted, but idler gear **424** is free to rotate on the shaft on which eccentrics **473'** and **473''** are fixedly secured.

The implementation of the described motion of the gears **474** may be better understood by reference to FIGS. **16, 16A** and **16B.** In FIG. **16A,** the timer gear **460** is shown in solid lines in the ADD position. Under these circumstances the gear **473** has two flat portions on its hub **480** which engage the periphery of the ridge **482** on the timer gear to preclude rotation of the shaft **481** and its associated eccentric. Gear **474,** however, which controls the movement of an associated eccentric on shaft **484,** and the mechanically coupled eccentric **472,** are intermittently rotated. FIG. **16B** shows the arrangements for selectively and intermittently locking and rotating the gears **473** and **474.** In FIG. **16B,** the gear **474** is shown with the flat portion **486** of its hub

488 engaging a flat portion of the ridge 482. As the timer gear is rotated, the gear teeth 474 engage the teeth 490 on the timer gear. The ridge 482 is cut away as indicated by the dashed lines 492 to permit rotation of the shaft 484 under the control of the meshing gears 474 and 490. This arrangement is shown as viewed from above in FIG. 16A.

As shown in FIG. 16, the timer gear 460 has two sets of gear teeth 490 and 494 which engage the gear teeth 474 to first rotate the accumulator down for engagement with the tapes and subsequently shift the accumulator up to the disengaged rest position which it maintains between cycles. During this complete ADD cycle, the central shaft 481 and the eccentric which is associated with it and the gear 473 is held against rotation by the flat portion on hub 480 being in continuous engagement with the periphery of ridge 482.

On TOTAL cycles, however, the function of gears 473 and 474 are interchanged. This is accomplished by shifting the timing gear wheel 460 to the position, as shown in dashed lines, in FIG. 16A. The flat portions on the hub 488 of gear 474 are continuously in engagement with the periphery of ridge 482 when the timer gear is in this shifted position. However, the gear teeth 473 are now aligned with teeth 496 of the timer wheel 460 and gear 473 is permitted to rotate as a result of the displacement and the presence of the recess 498 in the ridge 482 adjacent the gear teeth 496.

The timer gear 460 is keyed to the shaft 462 but is permitted to slide back and forth as indicated by the solid and the dashed line showings of FIG. 16A. In the neutral position, between cycles, the pins 502 and 504 are located in contact with inclined faces on the timer gear wheel surfaces shown at 506 in FIG. 16 of the drawings. When the ADD or TOTAL control 450 is pressed, the slide 464 moves from its neutral position so that one of the pins such as 504 which is visible in FIG. 14 is permitted to ride in a track such as track 506 as shown in FIG. 16. The other pin will then be located close to the hub of the timer gear 460 and will rotate on a raised surface in this location and will maintain pressure on the timer gear wheel 460 forcing it in the desired "in" or "out" position for TOTAL or ADD cycle operations, respectively.

Incidentally, for completeness, it should be noted that the showing of FIG. 15 is from above with the timer gear in the "in" position for a TOTAL cycle. This is in contrast to the showing of FIG. 16A in which the solid line position is the ADD position.

FIG. 17 is a rear view of the drive line including the various gears which are mounted on the central shaft 252 of the drive line assembly. As may be seen from FIG. 13, the drive shaft is located below the tapes 60 so that the drive gears 246 may readily engage the tape toward the rear of the cash register as its path is deflected downward. As discussed above in connection with FIG. 13, it is only alternate gear assemblies 246 which have inner hubs which are pinned to the shaft 252 and which rotate with it. The alternate gears 247 are mounted on the same shaft as the drive gear assemblies 246 but are not pinned to it, so are free to rotate about shaft 252.

As mentioned above, the customer indicator display wheels must be rotated in synchronism with the clerk indicator display wheels, but the digits are reversed in their position. To accommodate this purpose, transfer gears 302 are provided. Three transfer gears 302 are shown mounted on and pinned to shaft 303. The gear 302 is rotated with the drive gear 246 and constrains the two other gears 302′ and 302″ to rotate in synchronism with it. This causes the right-hand customer indicator drive gear 247 to rotate in step with the left-hand gear 246 as shown in FIG. 17. Similarly, the printer gear wheel 602 is driven by transfer gear 302″ to establish proper information relating to the least significant digit of the information registered by the left-hand drive gear 246.

As shown in FIG. 18, the drive gears 246 are driven from the drive shaft 252 through a drive hub 262 which is provided with a disc portion 264 and a central cylindrical portion 266 which is keyed to the drive shaft 252. The cylindrical central hub 268 of the drive gear assembly 246 rotates on the cylinder 266. The pawl 270 is pivoted at 272 and is biased to the indicated position by spring 274. This normally holds the bearing member 276 of the pawl assembly 270 in the pocket 278 of the drive gear assembly.

Under normal conditions as an ADD cycle of the cash register is initiated, the drive shaft 252 drives the drive hub 262 in the direction indicated by the arrow 280, in restoring the tapes to the "0" position. During this operation, of course, the teeth of drive gears 246 are in engagement with one of the sets of perforations in the digit tape 60. The direction is reversed as the tapes move toward engagement with depressed keys. When the stop on the tape 60 engages a depressed key, the tape immediately stops. This stops the drive gear 246 and the bias of spring 274 is overcome, permitting the pawl 270 to come out of the pocket 278 and freely rotate in the recess 282 of the drive gear assembly 246. In this way, each drive gear 246 stops at an angular position determined by the depressed keys on the keyboard.

With reference to FIG. 19, the metal drive sector gear 238 is shown pivotally mounted about the shaft 240 for movement under the control of the cam 292 having a cam slot 294 with which the pin 242 coacts. The plastic main drive gear 250 is mounted on the drive shaft 252 for rotation in accordance with the movement of the drive sector gear 238, causing, for example, initial restoration of the tapes to the zero position and subsequent rearward movement of the tapes on the power portion of the cycle.

FIG. 20 shows one of the accumulator gears 402 associated with the accumulator indicator wheel as described above in connection with FIG. 11. Within the indicator and gear wheel assembly 402 is a central hub 422 pinned to the central accumulator shaft 424. On normal ADD cycles, the gear 402 rotates in the counterclockwise direction as indicated by arrow 426. With this direction of rotation, the pawl 428 is pivoted against the pressure of spring 430 when it is engaged by the accumulator zero stop 432. The pawl 428 then swings away from its restrained stop 434 toward the center hub 422 of the assembly, permitting continued rotation of the accumulator wheel assembly 402.

On TOTAL cycles, however, when the contents of the accumulator register are being transferred to the display or indicator assembly 300, the accumulator gear assembly 402 rotates in the clockwise direction as indicated by arrow 436. The pawl 428 is mounted on pivot point 438 which is fixed to the stationary center assembly mounted on and pinned to shaft 424. This is in contrast to the gear and indicator assemblies 402

which are mounted for free rotation on the same shaft **424.** Accordingly, when the accumulator register is shifted to the rear and driven through gear **308** from power supplied through the indicator assembly gearing, the gears **402** rotate in the clockwise direction unitl the zero stop **432** engages the pawl **428.** When this occurs, the release of the drive gears from the drive line, as discussed in detail above in connection with FIG. **18,** occurs. Accordingly, the indicator wheels will stop in a position corresponding to that which has been registered in the accumulator TOTAL registers.

FIG. **21** shows the mechanism for shifting the mask **412** as shown in FIG. **11.** In FIG. **21,** the lock **522** controls the movement of the mask **412.** The block **524** is fixed in position as is the support **526** for the spring **528.** Incidentally, the spring **528** is secured in an opening **530** in the mask **412** to bias the mask to its position in which the subtotal rather than the grand total is revealed. When a key is inserted into the key slot **532,** the cylindrical member **522** together with the cam **534** and the fork member **536** secured to the mask **412** may be moved to the right rear as shown in FIG. **21.** This shifting of the mask **412** serves to reveal the grand total set of indicator wheels instead of the subtotal, as described in some detail in connection with FIG. **11.** When pressure is released from the key, the slide is returned to the front left position as shown in FIG. **21** by the force of the leaf spring **528.** Removal of the key locks the mask in place.

FIG. **22** is a timing diagram showing the relative time of operation of the accumulator movement, the timer gear shifting, and the drive rack motion. In reviewing the cycle from 0° to the 360° termination of the cycle, with the degrees referring to the angular orientation of the timer gear **460** and the cam **292** of FIG. **19,** it may be noted that the drive racks are initially restored, are held in the O position from about 100° to about 140°, and digit selection takes place from about 140° to 280°. The cam slot **294** (See FIG. **19**) of course follows the displacements indicated in the "Drive Tape" plot of FIG. **22.**

When it occurs, the timer gear shifting takes place at an early point in the cycle. However, the timer gear does not shift on successive ADD cycles, for example. When an ADD cycle is followed by a TOTAL cycle, or vice-verse, the timer gear is shifted from one position to the other as indicated by the solid line or the dash line plots.

The accumulator movement occurs between 110° and 140°. This is the time when the accumulator is either moved down into engagement with the racks (now in their O position) or to the rear into driving engagement with the display assembly. Following completion of the drive rack selection (which occurs at about 280°) the accumulator is restored to its regular position. This occurs from about 310° to 340°.

An alternate embodiment of the invention is disclosed in FIG. **23.** The cash register as shown in FIG. **23** is generally patterned after the cash register described hereinabove, but has two of the main assemblies shifted in a manner which provides certain economies in parts.

Referring to FIG. **23** in greater detail, it shows the main frame structure **702** of the cash register, the keyboard **704,** the accumulator register **706,** the drive assembly **708** and the indicator assembly **710.** As in the case of the cash register described in connection with FIGS. **1** through **22** of the drawings, the present cash register includes a series of flexible digit tapes **712.** By shifting the drive line **708** from a position below the digit tapes **712** to a position above the digit tapes, the indicator assembly **710** is raised for better visibility, and certain transfer gearing is eliminated. The transfer gears **714** serve the same functions as described above in connection with the transfer gears **302,** but some of the gear assemblies such as gears **304, 306** and **308** may be eliminated. As in the case of the other embodiment of the cash register, the accumulator **706** is shifted both up and down for ADD cycles and to the rear and forward for TOTAL cycles. Apart from the shifting of the position of the drive line and the concomitant changes in structure such as those mentioned above, the embodiment of FIG. **23** operates in substantially the same manner as that of the other embodiment of the invention.

Concerning the materials which may be employed in the implementation of the illustrated cash register, wide use is made of plastics. One of the preferred plastic materials is a DuPont material known as DELRIN. This is a homopolymer of formaldehyde with a very low coefficient of friction, good flexibility and high strength. DELRIN is described, for example, in the March 1970 issue of Materials Engineering. The digit tapes may be made of DELRIN of a thickness of about 0.020 inch as noted above. CELCON is a copolymer of formaldehyde and could also be used for many other parts of the cash register. Fiberglass-filled nylon is also employed for various parts, for example, for the drive hubs. It is, of course, undesirable to have two parts of the same material having surfaces which slide on one another, as this tends toward increased friction and possible binding. Another material which may be used in the cash register, for example in the key row, is NORYL, which is a fiberglass-filled polyphenol oxide. Of course, a number of parts of the register are made of steel, where high strength is required. These principally include the frame of the machine, the shafts, and certain key high-strength parts such as the drive sector gear.

The foregoing description has been focused primarily on the structural features and interrelationships which are different from those found in conventional cash registers. Details of well-known structures and relationships, and arrangements known to those skilled in the art have been eliminated for purposes of brevity and clarity.

In the course of the present description of the invention, the compactness of the cash register has been mentioned at several points. As a matter of completeness, it may be noted that the overall dimensions of the base or cash drawer upon which the rest of the cash register sits, are approximately 15-½ inches wide, by 17 inches deep, by 4 inches high. The cash register apparatus excluding the cash drawer assembly is approximately 14 inches wide, by 16 inches deep, by 11 inches high.

In closing it is noted that other known arrangements may be substituted for specific components disclosed in the present description, and various alternative constructions may be employed. For example, in connection with the eccentrics, a set of six eccentrics has been disclosed for moving the accumulator. However, the relative positioning of two plates may be accomplished merely by using the three eccentrics located at one side

of the cash register. In that event, the pair of eccentrics would control movement in one direction while the single eccentric would provide movement in the other direction. Further, controlled differential movement may be accomplished using only two eccentrics with clearance being provided only on one side of each eccentric. Under these circumstances, the fixed eccentric would serve as a pivot point while the moving eccentric would rotate one member relative to the other. In such arrangements, limitations on the angular rotation of the eccentrics would be appropriate to avoid mechanical interferences. Concerning the timer gear and the modified geneva gear mechanism, instead of axially shifting the timer gear, both of the two smaller gears could be shifted on their shafts with respect to the position of the timer gear to select the desired cash register cycle.

Other similar variations within the scope of one skilled in the art would also be possible.

What is claimed is:

1. A business machine having a chassis, the machine comprising:

an accumulator;

displaceable support means for the accumulator;

first eccentric means rotatable about a first axis, which is stationary with respect to the chassis, and operatively coupled to said support means for selectively driving said support means in a first direction with respect to the chassis; and

second eccentric means rotatable about a second different axis, which is also stationary with respect to the chassis, and operatively coupled to said support means for selectively driving said support means in a second direction with respect to the chassis.

2. The invention of claim **1** wherein said first eccentric means is operatively coupled to said support means by means cooperating with said first eccentric means to guide said support means in said second direction when selectively driven by said second eccentric means.

3. The invention of claim **2** wherein said first eccentric means comprises at least one eccentrically mounted drive member, and said support means includes at least one surface of an opening in said support means and engaging an associated drive member.

4. The invention of claim **3** wherein each surface is oriented perpendicular to said first direction, and each opening further providing a clearance with respect to its corresponding drive member in the second direction.

5. The invention of claim **1** wherein said second eccentric means is operatively coupled to said support means by means cooperating with said second eccentric means to guide said support means in said first direction when selectively driven by said first eccentric means.

6. The invention of claim **5** wherein said second eccentric means comprises at least one eccentrically mounted drive member, and said support means includes at least one surface engaging each drive member.

7. The invention of claim **6** wherein each surface is oriented perpendicular to said second direction, and each opening further providing a clearance with respect to its corresponding drive member in the first direction.

8. The invention of claim **5** wherein said second eccentric means comprises at least one eccentrically mounted drive member, and said support means includes openings each opening receiving an associated drive member, each opening having a pair of oppositely oriented surfaces contacting said associated drive member.

9. The invention of claim **8** wherein each pair of said surfaces is oriented perpendicular to said second direction, and each opening further providing a clearance with respect to its associated drive member in the first direction.

10. The invention of claim **2** wehrein said first eccentric means comprises at least one eccentrically mounted drive member, and said support means includes openings each opening receiving an associated drive member, each opening having a pair of oppositely oriented surfaces for contacting said associated drive member.

11. The invention of claim **10** wherein each pair of said cam surfaces is oriented perpendicular to said first direction, and each opening further providing a clearance with respect to its associated drive member in the second direction.

12. The invention of claim **1** further comprising means for selectively rotating said first eccentric means while holding said second eccentric means fixed, and for selectively rotating said second eccentric means while holding the first eccentric means fixed, to selectively provide displacement of said support means in one of two different directions with respect to said chassis.

13. The invention of claim **12** wherein said rotating means comprises first and second arcuate gear racks operatively coupled to first and second gears secured to said first and second eccentric means respectively.

14. The invention of claim **13** wherein said rotating means further comprises means including a timer gear of the machine for controlling the motion of said first and second arcuate gear racks to hold one of them against rotation and to intermittently rotate the other.

15. The invention of claim **14** wherein said rotating means further comprises means for axially shifting said timer gear to hold said first arcuate gear rack fixed while rotating the second, or to hold the second arcuate gear rack fixed while intermittently rotating the first.

16. In combination:

first and second shafts;

first and second gears secured respectively to said first and second shafts; and

means including an axially shiftable timer gear for selectively holding a first one of said gears against rotation while intermittently rotating the second, and for holding said second gear fixed while intermittently rotating said first gear.

17. In combination:

a first, stationary member;

a second member displaceably mounted with respect to the first member;

first and second eccentric assemblies each mounted for rotation about a respectively different axis fixed with respect to the first member and operatively interconnecting said first and second members; and

means for selectively rotating said first eccentric assembly while holding the second assembly fixed, and means for selectively rotating said second eccentric assembly while holding the first assembly

fixed, to selectively provide displacement of said second member in one of two different directions with respect to the first member.

18. The combination as defined in claim **17** for providing relative movement between two members either in a first predetermined direction or in a different direction, said members having openings, wherein:

said first eccentric assembly includes a pair of eccentrics each having its shaft journaled in one of said members and the eccentric portion confined in an opening in the other member, said openings each having one side extending in said first direction and engaging each said eccentric for producing movement in a direction generally perpendicular to said side when said eccentrics are rotated, said openings having clearance for said eccentrics in other directions; and

said second eccentric assembly includes a thrid eccentric mounted to coact with said two members, said third eccentric being journaled in one of said members and being enclosed by an opening in the other member, said opening having opposed parallel sides extending in a different direction from said first direction to produce relative motion of said members in said first direction when said second eccentric assembly is rotated.

19. The combination as defined in claim **17**, comprising:

means for positively restraining rotation of the first eccentric assembly during operation of said means for rotating the second eccentric assembly; and

means for positively restraining rotation of the second eccentric assembly during operation of said means for rotating the first eccentric assembly.

* * * * *