# United States Patent [19]

**Oldenburg**

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[45] **May 15, 1973**


## [54] RIBBON INKING MEANS IN KEYBOARD CONTROLLED SELECTIVE PRINTING MACHINES


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



[22] Filed: **Dec. 14, 1970**

[21] Appl. No.: **97,812**

[52] **U.S. Cl.** .....**101/96,** 197/171, 101/336, 101/90

[51] **Int. Cl.**.....**B41j 33/16,** B41j 31/14

[58] **Field of Search**.....197/171, 172, 151; 101/93 MM, 66, 288, 96, 336



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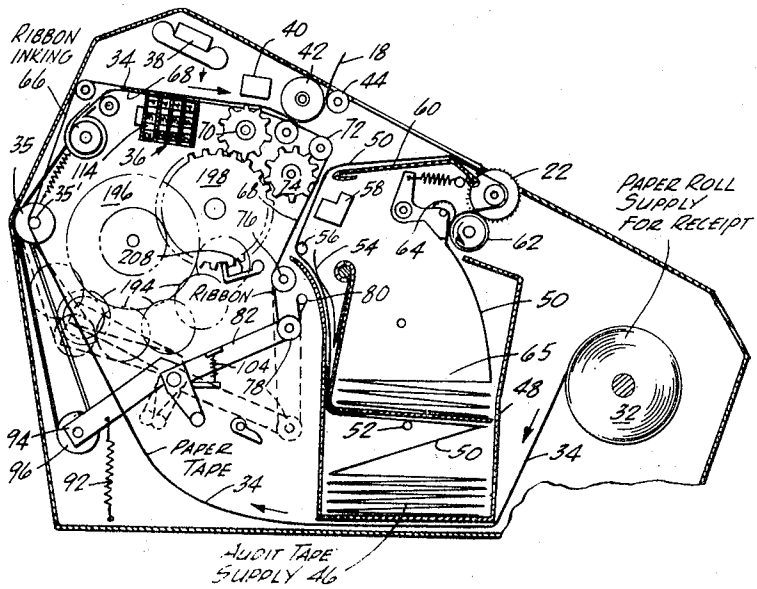
[57] **ABSTRACT**

A simple and compact printer for a cash register or the like includes a long self-inking ribbon arrangement for both the receipt tape printer and the audit tape printer. The ribbon extends for a substantial distance in order to extend past the date wheels which have their axes aligned with the path of the ribbon, past the transaction item printing station and also past the audit printing station. The ribbon actuating mechanism is provided with a lost-motion arrangement whereby ribbon tension is released immediately prior to hammer action to avoid background smudge. Fan fold type paper is employed for the audit tape, and is fed from a supply box to the audit tape printer and then back to storage immediately above the supply box. The alignment of the axes of the date wheels parallel to the ribbon feed and to the side of the machine permits easy changing of dates by the operator without the need for a complex mechanical mechanism. Concerning the physical arrangement of the printer section of the cash register, the supply roll of paper for receipts is located near the keyboard at the end of the cash register toward the clerk. The tape from this roll extends under the fan fold from the ribbon and other print mechanisms, along the bottom and rear of the cash register to the print station located in the upper portion of the cash register.


**5 Claims, 9 Drawing Figures**



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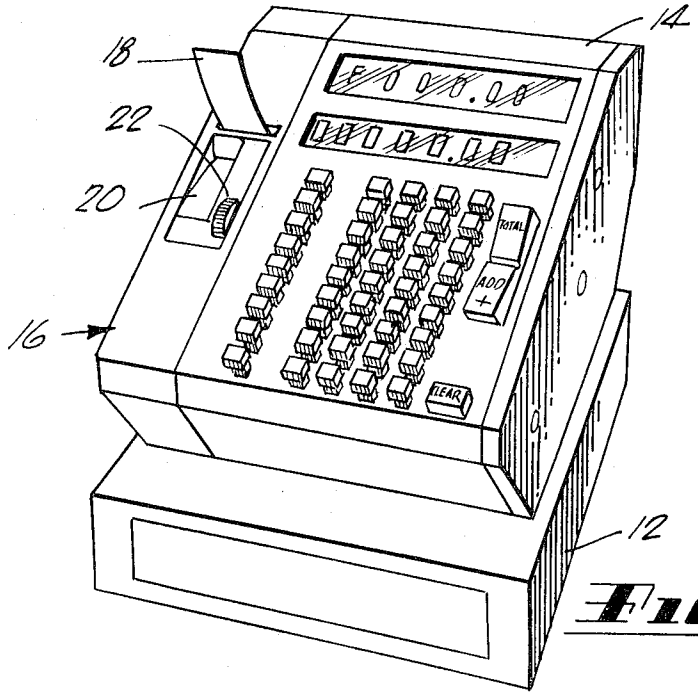


Fig. 1

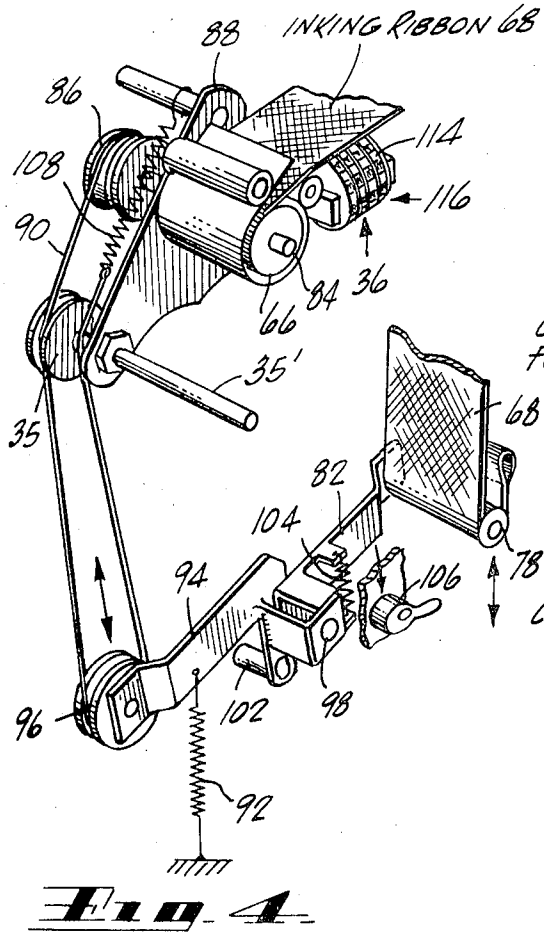


Fig. 4

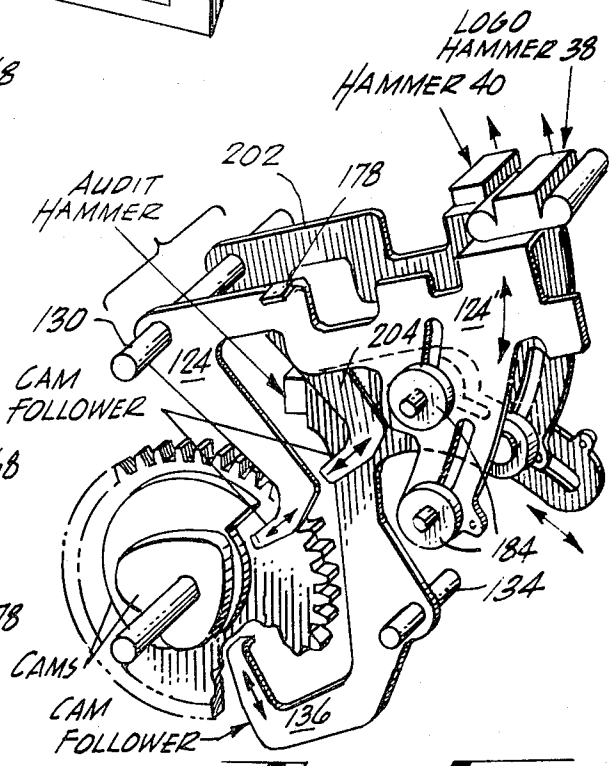


Fig. 6

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Fig. 3

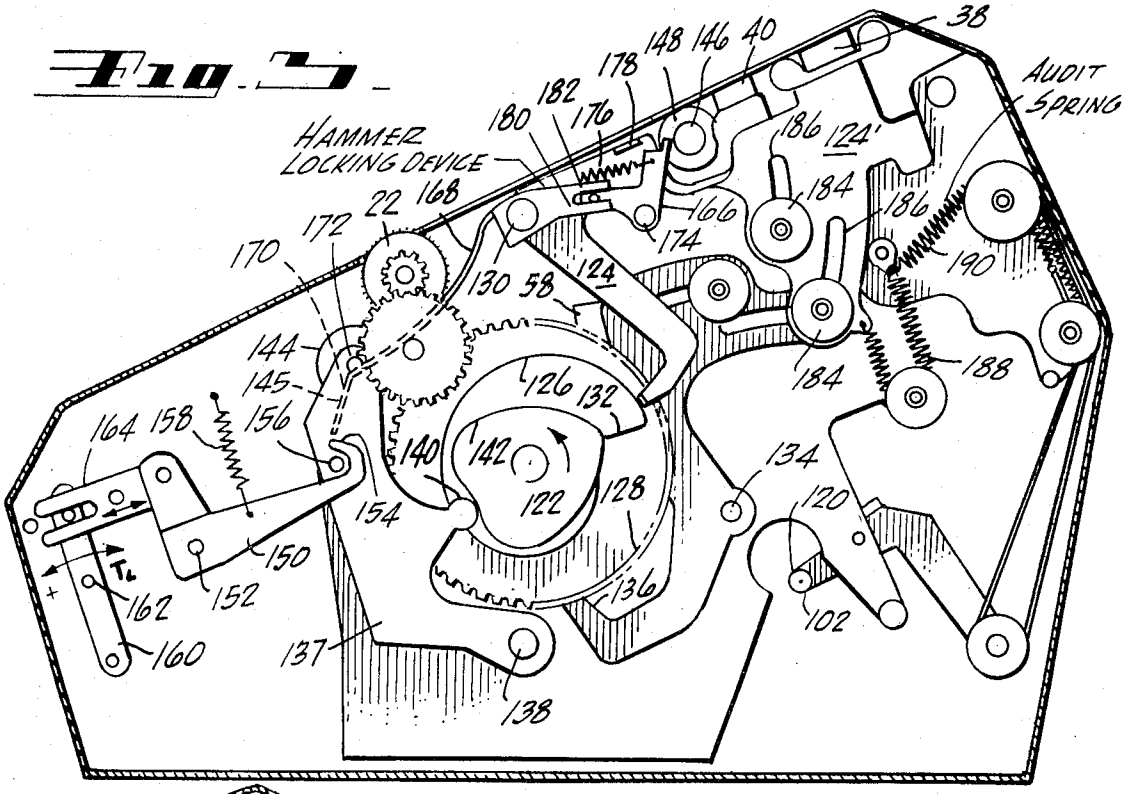
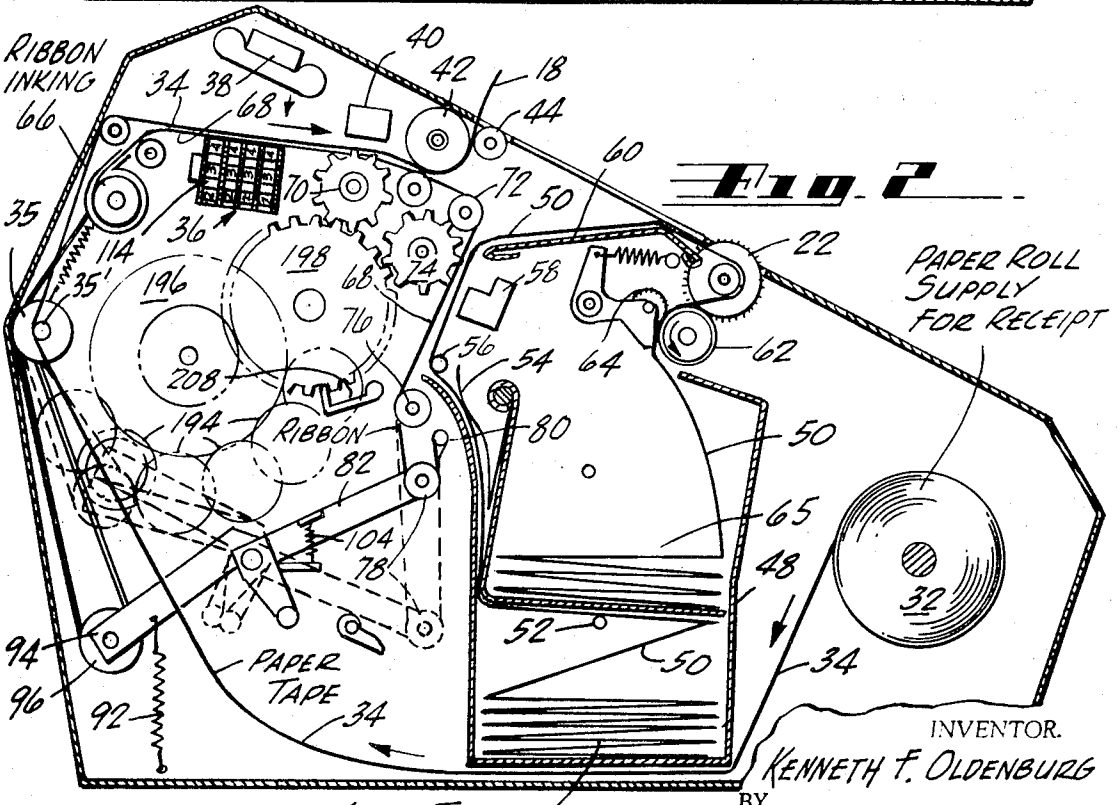



Fig. 2

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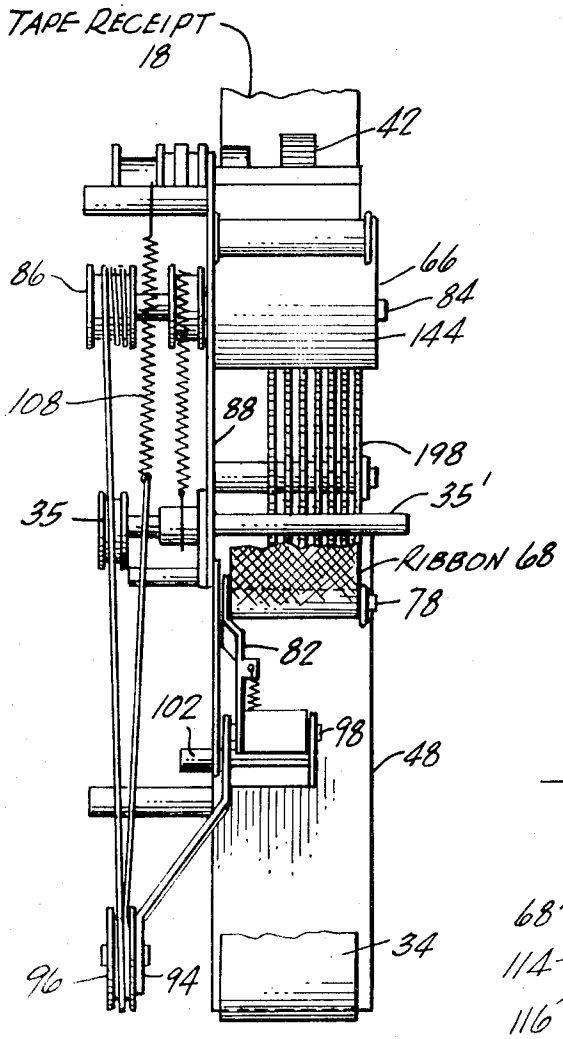


Fig. 5

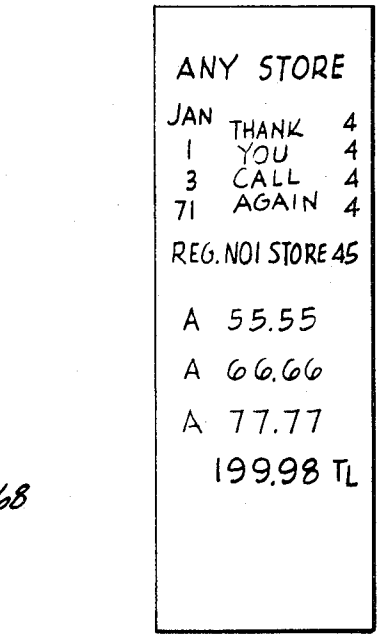


Fig. 6

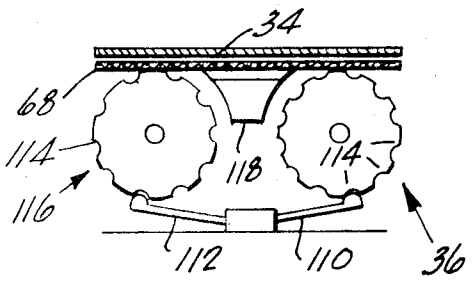


Fig. 7

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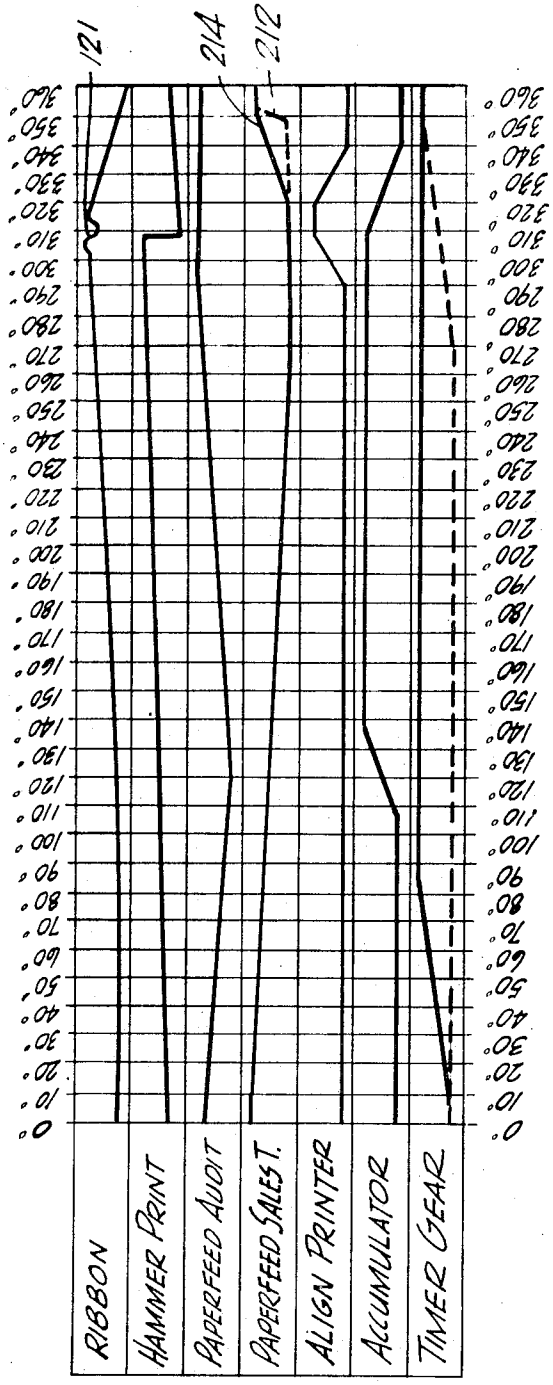


FIG. 4

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# RIBBON INKING MEANS IN KEYBOARD CONTROLLED SELECTIVE PRINTING MACHINES

## CROSS REFERENCES TO RELATED APPLICATIONS

This invention relates to Kenneth F. Oldenburg patent application Ser. No. 50,064 filed June 26, 1970 for "Business Machine". The present invention describes and claims printing arrangements which may be employed with the business machine disclosed in the earlier patent application.

## BACKGROUND AND BRIEF SUMMARY OF THE INVENTION

In conventional cash registers, two rolls of paper are employed. One roll provides the customer's receipt. The other roll is used to provide an audit strip for use by the store managers or otherwise to check operations. The inked ribbon which is normally employed to print the receipt and audit tapes is similar in design to a typewriter ribbon in that it is continuously advanced throughout its length and then reversed at the end of its travel. Such arrangements take up a lot of space and include relatively complex mechanisms.

In accordance with one feature of the present invention, a short self-inking ribbon is employed to provide the inked tape needed for the printing of receipts and the audit tape. This self-inking ribbon must necessarily have a long travel to extend past the receipt logo printing station and the receipt item printing station to the audit tape printing station and retract into the re-inking cylinder on each cycle of the machine. The long travel of the ribbon is facilitated by the use of an actuator spool which engages a loop in the ribbon so that the ribbon is pulled out of the reinking cylinder by a distance which is twice the travel of the actuator spool.

One aspect of the invention involves the elimination of smudging by the release of tension in the ribbon immediately prior to actuation of the print hammers. When the tape is maintained under tension, the manners cause smudging by vibration of the taut tape, while this does not occur when the ribbon tension is released just prior to hammer action.

In accordance with another feature of the invention, the date printing wheels are oriented with their axes parallel to the side of the business machine and to the direction of travel of the tape. By this arrangement, the relatively complex coaxial mechanisms normally employed for setting the date wheels may be eliminated. Instead, easy access to the individual wheels from the side of the machine is possible. The receipt serial number may be printed along one edge of the receipt while the date appears on the other edge, and a suitable legend may be entered on the strip between the two sets of changeable indicia. The printing on the date and the serial number wheels may be oriented so that the indicia may be read in columnar fashion with the receipt oriented in a single position. Suitable detent arrangements may be mounted between the serial number and the date wheels to hold them in preset positions, and the detent recesses on the date wheels may be employed by the operator to change the date with a pencil or some other similar manual tool.

The audit tape may be of fan fold paper to simplify both the paper feeding mechanism and also the efforts of auditors who may wish to check the audit strip at some later date. Instead of having to unwind an audit tape from a spool, the fan fold paper may be checked by merely opening folded portions to find the items on the tape which are to be checked. In addition, the supply of fan fold paper may be located in a box immediately below the bin in which the fan fold printed audit tape is stored.



Another aspect of the invention involves the overall organization and configuration of the printer assembly to occupy very little space and to use a minimum of parts. Thus, from the front of the register near the keyboard where the receipt tape paper roll is located, the receipt tape extends along the bottom and back of the register, past the inking station and then forward past the receipt logo and amount printing station, an out the receipt cut-off slot. The fan fold audit tape has its supply and printed tape storage in overlying rectangular bins, and an interconnecting tape path extending through the audit tape printing station. The ribbon actuating mechanism occupies the lower rear portion of the printer, and the lost-motion actuating arm carrying the spool which engages a loop in the inking ribbon, as mentioned above, moves the spool up and down adjacent the fan fold paper storage bins; and a compensating arm which reduces rewind tension is coupled to the ribbon rewind cylinder at the rear of the printer assembly.

Other features of the present novel business machine printing arrangements will become apparent from a consideration of the detailed description of the drawings, in which:

FIG. 1 is an external view of a cash register embodying the principles of the invention and showing the printer section at the left-hand side;

FIG. 2 is a view of the cash register of FIG. 1 from the left-hand side with the printer cover removed;

FIG. 3 is a view of the printer section of the cash register of FIG. 1 looking to the left from the interface between the printer section and the remainder of the cash register;

FIG. 4 is an isometric view showing the ribbon and the controlling mechanism which appear in FIG. 2 in greater detail and separated from the remainder of the printer assembly;

FIG. 5 is a rear view of the printer, from the customer's side of the cash register;

FIG. 6 is an isometric view of the receipt and logo printing hammers and their actuating cams;

FIG. 7 shows the date wheels and serial number wheels, the inked ribbon, the receipt tape, and the detent mechanism for the wheels;

FIG. 8 is a view of a typical receipt produced by the printer of the present invention; and

FIG. 9 is a timing diagram indicating the operation of the printer section of the cash register and their time relationships to other cash register operations.

Referring more particularly to the drawings, in FIG. 1, the complete cash register assembly includes the cash drawer 12, the main mechanical section 14 of the cash register, and the printer 16. Extending from the printer 16 is a customer receipt 18. A window 20 is also provided to permit reading of a portion of the audit tape. The manual audit taper advance wheel 22 is knurled or grooved so that it can be manually rotated by the operator when she wishes to look at items recently printed on the audit tape.

FIG. 2 is a view of the printer assembly as it appears when viewed from the left side of the register of FIG.

1 with the cover removed. In considering the mechanism of the printer as shown in FIG. 2, the main functional parts of the printer will initially be identified.

The path of the receipt tape and its printing will be considered first. The paper roll supply 32 for the cash register receipts is located toward the right in FIG. 2, and toward the part of the cash reigster which would normally be near the clerk, and which will be designated the front the of the cash reigster in the present specification. The paper strip 34 from roll 32 is fed along the bottom of the machine and is routed around several guides (including shaft 35' on which roller 35 is mounted) until it passes between the date wheels 36 and the receipt logo hammer 38. It then passes under the amount hammer 40 and is fed between the rollers 42 and 44 out of the cash registers where the receipt 18 may be torn off following the completion of each transaction.

The audit tape 50 in fan fold form is drawn from the lower portion 46 of bin 48 and is fed around pin 52 which is located approximately in the center of the bin 48. Audit tape 50 is then guided under a leaf spring 54, around a guide member 56, under the audit tape hammer 58, past guide 60, manual feed roller drive 22, and between the feed roller 62 and its resilient frictional opposing mechanism including roller 64, before being returned to the approximate center of the upper portion 65 of bin 48.

The ribbon inking cylinder 66 is located close to the path of travel of the receipt tape 34 at the rear or left-hand side of the assembly as shown in FIG. 2. The ribbon 68 extends between the date wheel assembly 36 and the receipt tape 34. It also extends between the receipt amount printing wheels 70 and the receipt amount hammer 40, below the paper tape 34. It then extends over a roller 72 and down between the audit tape amount printing assembly 74 so that the audit tape 50 may be suitably marked when the audit tape hammer 58 is actuated. The ribbon 68 then extends past a guide roller 76, around a movable roller 78, and its end is secured to a fixed pin 80.

Between cycles of cash register operation, the movable roller 78 is carried upward to the solid line position by a mechanical linkage including arm 82. This permits the section of the ribbon which is struck by the hammers 38, 40 and 58 to retract into the ribbon inking cylinder 68, with the length of ribbon which is drawn from the inking cylinder being twice the distance of travel of spool 78. When the cash register is actuated, the linkage 82 moves the roller 78 down so that freshly inked portions of the ribbon are opposite the various printing mechanisms of the machine. As mentioned above, the tension of the ribbon is released immediately prior to the actuation of the various hammers.

Now that the overall mode of operation of the printer and the paths of movement of the receipt and audit tapes have been described in a general way, consideration will be given to the detailed mechanism by which these functions and modes of operation are achieved.

Initially, consideration will be given to the mode of operation of the ribbon inking mechanism, as shown to advantage in FIG. 4 as well as FIGS. 2 and 5. The ribbon inking cylinder 66 has an inner shaft 84 upon which the inking ribbon 68 is wound. This inner shaft 84 is pinned to a spool 86 which is located on the other side of the rigid mounting plate 88 upon which the printer mechanism is mounted. The spool 86 is biased toward returning the inking ribbon 68 into the inking cylinder 66 by the cable 90, and a biasing spring 92 which urges the linkage arm 94 and the roller 96 in the counterclockwise direction about 98, thus applying a downward tension to the cable 90 as it engages the spool 86. During that portion of the cash register cycle when the newly inked ribbon is to be extended, a cam (not shown) engages the cam follower 102 and rotates the arm 94 in the clockwise direction. The arm 82 is normally biased to arm 94 while arm 82 remains the movement of the arm 94 and is pivoted on the same shaft. As the arm 94 is raised, therefore, the arm 82 rotates downwardly carrying the spool 78 and the ribbon 68 down. As this extension of the ribbon occurs, the shaft 84 will rotate and cable 90 will wind up onto spool 86, with upward motion of pulley wheel 96 permitting this action.

Toward the end of the cycle, immediately before cash register printing, the arm 82, which is normally biased to follow the movement of the arm 94 by a spring 104, will engage a fixed stop 106. Lost-motion between arms 94 and 82, will then permit further movement in the clockwise direction of arm 94 while arm 82 remains in engagement with stop 106. This movement releases the tension applied to the ribbon except for the small amount of tension which is supplied by the very weak coil spring 108. The hammers are then actuated while the tape tension is released, permitting clean printing action without the smudges and background inking which was found to accompany printing when the ribbon is under tension.

Attention is now directed to the date wheel assembly 36 as shown in FIGS. 2, 4 and 7 and the receipt itself as shown in FIG. 8. First, with reference to FIG. 8, it may be noted that the date appears along the left-hand edge of the sales receipt and that it appears in columnar form so that it may be read while holding the cash receipt in the normal manner.

The relative positions of the date wheel assembly 36, the inking ribbon 68 and the receipt tape 34 are shown to advantage in FIG. 7. A detent mechanism with a series of detent arms 110 and 112 is shown with a detent arm 110 engaging one of the detent recesses 114 in the date wheel assembly 36. With the axes of the date wheels oriented parallel to the movement of the tape into the side of the register, the date may be readily changed by removing the cover from the printing mechanism and rotating the date with a pencil or the like. As mentioned above, this is in contrast with the complex coaxial date setting mechanisms previously used. The detent arms 112 engage detent recesses on the serial number assembly 116 to hold it in its preset position during each cycle of the cash register. An additional printing element 118 may be provided to print legends such as "Thank You, Call Again" which appears toward the center of the receipt of FIG. 8.

As explained in some detail in connection with the specification of my patent application, Ser. No. 50,064, referenced above, the sequence of operation of the cash register is controlled by cams mounted on a cam line and by cam surfaces on various cams secured to the cam line or which rotate in synchronism with it. The cam follower 102, shown in FIG. 4 and FIG. 3, is mounted for actuation by a camming surface on a cam, not shown, which is mounted on the cam line, which has its center at point 120 of FIG. 3. The nature of the camming surface is shown in the first plot designated

"RIBBON" in FIG. 9. As indicated in this plot, the camming surface increases in its distance from the center of the cam line 120 gradually, thereby rotating the arm 94 clockwise for a large portion of the cycle of the machine, as shown in FIG. 9, and then releasing the ribbon for rewinding into the cylinder 66 rapidly at the end of the cycle. The relationship of camming surfaces an cam followers to implement the cycle shown in the timing chart of FIG. 9 are described in some considerable detail in my earlier copending patent application cited above, and will also be evident from the description of other cams and plots as described below. The release of ribbon tension which occurs when arm 82 engages stop 106 (see FIG. 4) is indicated in FIG. 9 by the section 121 of the "RIBBON" plot.

Referring again to FIG. 3, an additional cam 122 is mounted to rotate in precise synchronism with the cams on the cam line on axis 120. The logo hammer cam follower 124 rides on the surface 126 of cam 122. Immediately behind the logo hammer cam follower 124 is a similar cam follower riding on a cam surface substantially identical to cam 126 on the other side of the gear teeth 128. This additional cam follower controls the receipt amount hammer. Both of these two cam followers pivot about point 130. The sharp discontinuity 132 in the cam surface 126 indicates the point at the cycle at which the hammers are actuated. From the "HAMMER" plot in the timing diagram of FIG. 9, it may be seen that this occurs during the interval when ribbon tension has been released. This occurs at approximately 310° of cam line rotation, with 360° corresponding to one revolution of the cams, including cam 122.

The audit hammer linkage is pivoted about shaft 134. It includes a cam follower 136 which rests on a cam surface (not shown) and extends upwardly to carry the audit hammer 58 which is partially concealed in the showing of FIG. 3.

Still referring to FIG. 3, the receipt paper feed follower 137 is pivoted about point 138 and includes a cam follower stud 140 which bears against the outer surface of a generally heart-shaped cam surface 142. The paper feed idler 144 is connected to a slip clutch on a cylinder 146 on which the receipt paper feed roller 148 is mounted. The paper feed follower normally advances by a small increment on ADD cycles and by a substantial increment on TOTAL cycles to allow sufficient space to permit tearing off of the receipt with the proper logo and other printing on it.

The amount of travel of the receipt paper feed follower 137 is controlled by paper space control lever 150 which is pivoted about fixed point 152. The lever 150 is provided with a hook 154 which selectively engages the pin 156 mounted on the follower 137. The lever 150 is normally biased by spring 158 to its counterclockwise position. The keyboard control lever 160 is pivoted about point 162 and its upper end moves to the left on ADD cycles, and to the right on TOTAL cycles, as viewed in FIG. 3. Through linkage 164, the position of lever 150 is controlled by keyboard control lever 160. When the upper end of lever 160 is in the left-hand position, indicating an ADD cycle, the lever 150 is tilted to its counterclockwise position so that hook 154 overlies the path of travel of pin 156. This limits the travel of the paper feed follower 137 to that required for item spacing on the receipt. However, on TOTAL cycles, the lever 160 and linkage 164 force rotation of lever 150 in the clockwise direction so that hook 154 does not engage pin 156 and the full travel of follower 137 is permitted. This provides for the greater advance of the paper which is required for TOTAL cycles.

The selective actuation of the logo hammer on TOTAL cycles but not on ADD cycles, will now be considered. As mentioned above, the logo hammer cam follower 124 will control the logo hammer and will normally cause it to operate when the discontinuity 132 in cam surface 126 is reached. However, on ADD cycles it is disabled from actuation by the mechanism including logo hammer latch 166 and the logo hammer latch actuator 168. The actuator 168 includes a tail 170. Shaft 172, upon which idler wheel 144 is mounted, also serves to engage the tail 170 of the logo hammer latch actuator 168 only on the TOTAL cycles. The latch 166 is pivoted about point 174 and is normally biased by spring 176 so that its upper surface underlies the surface 178 of the logo hammer mechanism. However, when the latch actuating member 168 is rotated in the counterclockwise direction, the two arms 180 which encompass pin 182 on the latch 166 rotate latch 166 in the clockwise direction to remove the latch from engagement with the latch surface 178. This permits actuation of the logo hammer on "TOTAL" cycles.

The logo hammer actuating mechanism extends to the area 124' and is guided laterally by washers 184 which are mounted on shafts which extend through slots 186. Power for the actuation of the logo hammer is provided by spring 188, which is gradually extended by cam action and then released at the cam discontinuity. The receipt amount hammer 40 is provided with a similar energizing spring and carrier. The audit print hammer is energized by spring 190, and has a generally similar mechanical mode of actuation.

The mode of actuation of the receipt print wheels 70 and the audit print wheels 74 to the proper numerical values will now be briefly mentioned with reference primarily to FIG. 2 of the drawings. In the above-cited copending patent application of Kenneth F. Oldenburg, the transfer idler gears 194 and the method of actuating them were described. Specifically, they are secured to shafts carrying other idler wheels which control the position of the indicator wheels of the cash register. In the printer assembly, these transfer idlers engage corresponding print idler gears 196 which are mounted behind one another in FIG. 2. An additional set of idler gears 198 provide a 2-to-1 reduction from the idler gears 196 to the printing wheels 70 and 74. Accordingly, the printing wheels 70 and 74 will provide printing indications facing their respective hammers 40 and 58 which correspond to the amounts shown on the indicator or display wheels of the cash register.

The rear view of FIG. 5 and the isometric view of FIG. 6 show certain portions of the printer mechanism to better advantage than the other figures. Thus, in the isometric view of FIG. 6, the receipt amount hammer 40 and its carrier 202 are clearly shown, whereas in FIG. 3, they were concealed. The cam follower 204 for the receipt hammer carrier 202 may also be seen in FIG. 6.

FIG. 9 is a timing diagram which shows the relative timing of the various operations of the printer. It includes a plot of the timer gear operation and that of the movement of the accumulator, which were key opera-

tions described in detail in the copending patent application of Kenneth F. Oldenburg cited above. The "Align Printer" plot indicates the operation of lever **208** Which moves into engagement with the gear teeth **198** and removes any minor angular misalignment which might otherwise arise from gearing play or the like. This assures the alignment of the print on printing wheels **70** and **74** so that the sales tickets and the audit tape will be printed with properly aligned numerals.

The plot of ribbon actuation mentioned above should be compared with the "HAMMER" print plot. It is particularly to be noted that the hammer print actuation occurs at 310° during the interval from 300° to 320° (of rotation of the cam line) while the ribbon is in a relatively slack condition. The timing of the paper feed of the audit strip and that of the sales ticket are also shown in separate plots in FIG. **9.** The upward portion of the plot represents the paper feed. With reference to the sales ticket feed, the line **214** represents the feed on "TOTAL" cycles, as it extends for a longer time period than the dashed line **212** for "ADD" cycles, which only require a short time of actuation.

In the foregoing description, a novel printer arrangement has been described. It is understood that minor mechanical departures from the described arrangements are possible. Thus, by way of one specific example but not of limitation, a roll audit tape may be employed instead of fan fold audit tape, although somewhat more complex mechanisms would be required for controlling and rewinding the tape.

What is claimed is:

**1.** A printer for a cash register having a keyboard and indicator wheels comprising:

a support panel extending generally parallel to the main frame of a cash register along one side thereof, and having a front portion in proximity to the keyboard of the cash register and a rear portion in proximity of the indicator wheels of the cash register;

a self-inking ribbon assembly having an inking cylinder mounted on the upper rear portion of the said panel;

a date-printing station comprising a plurality of date wheels mounted on the upper rear portion of said panel with their axes extending generally parallel to said panel, and a first hammer;

a transaction item printing station including a plurality of number wheels and a second hammer;

an audit printing station also having a plurality of number wheels and a third hammer;

means for rotating said item and audit printing wheels in synchronism with the indicator wheels of said cash register;

a receipt paper tape supply for extending past said date wheels and item printing wheels;

an audit paper tape supply extending past said audit print wheels; and

ribbon actuator means for withdrawing freshly inked ribbon from said inking cylinder during each cycle of operation of the cash register, to extend beyond the date wheels, the item print wheels and the audit print wheels with freshly inked ribbon, said hammers adapted to respectively strike the receipt and audit paper tapes against the ribbon at the respective date, item and audit wheel locations, means for applying a tension to said ribbon during said withdrawal and means for releasing the tension in said ribbon immediately prior to the ribbon being struck by said hammers.

**2.** A printer as defined in claim **1** wherein one end of said ribbon is secured within said inking cylinder, the other end of said ribbon is secured to a fixed point, and said ribbon actuating means includes a roller engaging said ribbon between said audit print wheels and said fixed point, and a linkage carrying said roller downward below said fixed point to extend the ribbon by a distance equal to approximately twice the movement of said roller.

**3.** The invention of claim **2** wherein said means for applying tension to said ribbon comprises:

a first pulley coaxially mounted and attached to said inking cylinder;

a second linkage carrying a second pulley; and

a cable resiliently attached to a fixed point and extending therefrom around said second pulley to be attached to said first pulley whereby said cable applies a biasing force on said first pulley.

**4.** The invention of claim **3** wherein said tension-releasing means comprises said second linkage being movable with said first linkage to enable said second pulley to move toward said first pulley to release the tension in said cable.

**5.** The invention of claim **4** further including a stop to prevent further movement of said first linkage while said second linkage is free to move further to release the tension on the ribbon.

* * * * *