United States Patent [19]

Gieringer et al.

[11] **3,775,593**

[45] **Nov. 27, 1973**

[54] **AUTOMATIC FEE DETERMINING SYSTEM FOR PARKING GARAGES**

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[73] Assignee: **Cincinnati Time Recorder Company, Inc.,** Cincinnati, Ohio

[22] Filed: **May 14, 1971**

[21] Appl. No.: **143,300**

[52] **U.S. Cl.. 235/61.8 A,** 194/DIG. 23, 235/92 TC, 235/92 R, 340/51

[51] **Int. Cl.** **G08g 1/65**

[58] **Field of Search**..... 194/4, DIG. 23, DIG. 21, 194/DIG. 22, DIG. 24; 340/51, 43, 80, 82; 235/61.8 A, 92 TC

[56] **References Cited**

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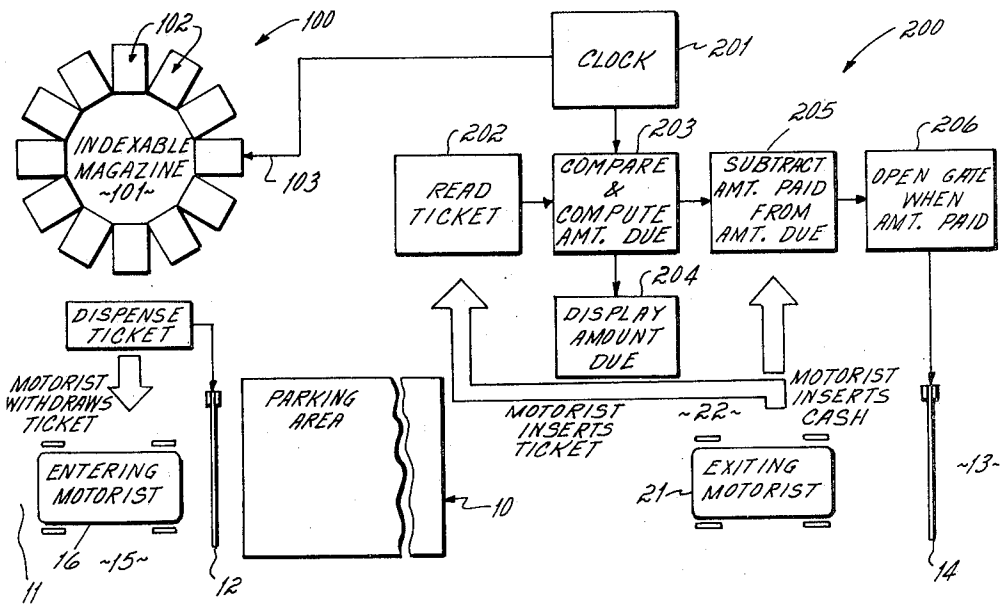
[57] **ABSTRACT**

A parking fee is automatically computed on the basis of elapsed time between the issuing of a ticket to a customer upon entry to the facility and the surrendering of the ticket by the customer upon departure from the facility. The tickets are in the form of reusable plastic cards embossed with permanent encoded information representative of a specified time interval during a given day. The customer is issued, upon entry to the facility, a ticket bearing information corresponding to his time of entry. A ticket dispenser having an indexable magazine with compartments corresponding to different periods of time throughout the day is sequentially indexed by a clock to issue the proper ticket at the proper time. Upon departure, the ticket is surrendered to a card reader which compares the time of surrender with the issue time encoded upon the card and a fee is displayed based on the computed elapsed time. Cash in the amount due when deposited at a pay station adjacent the card reader opens the exit gate. The cards are embossed with bar coded information which is ready by scanning the underside of the card with feeler fingers which engage in the depressions of the underside of the code bars to advance switches to positions which decode the encoded information.

10 Claims, 29 Drawing Figures



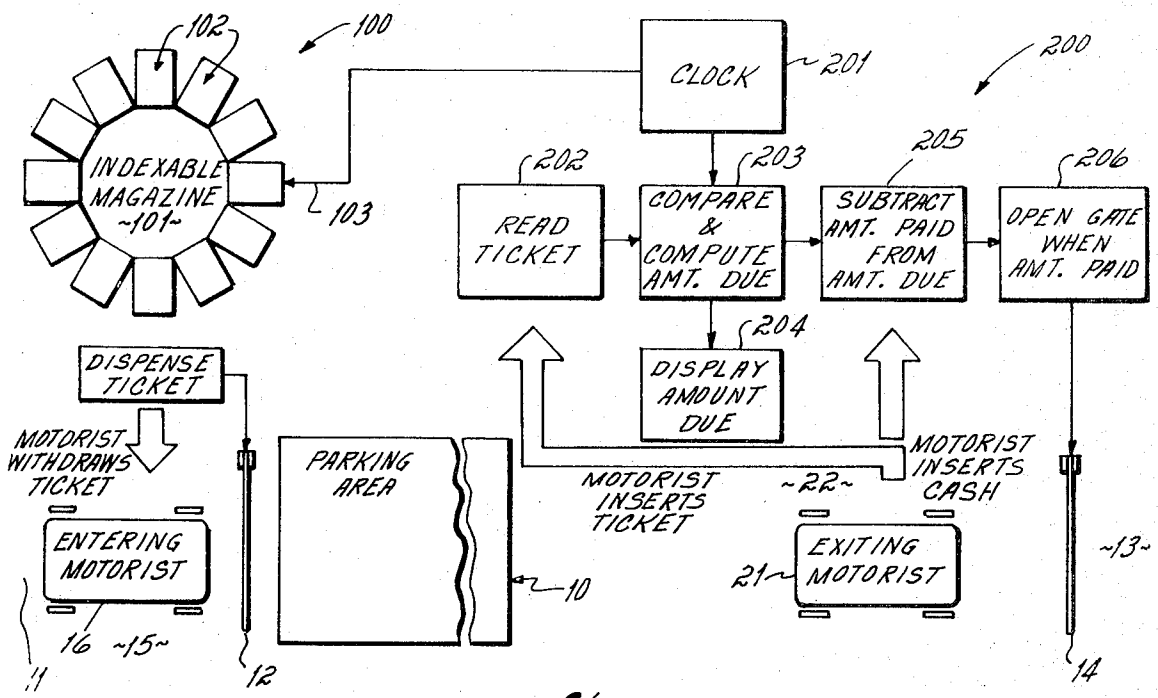


Fig. 1

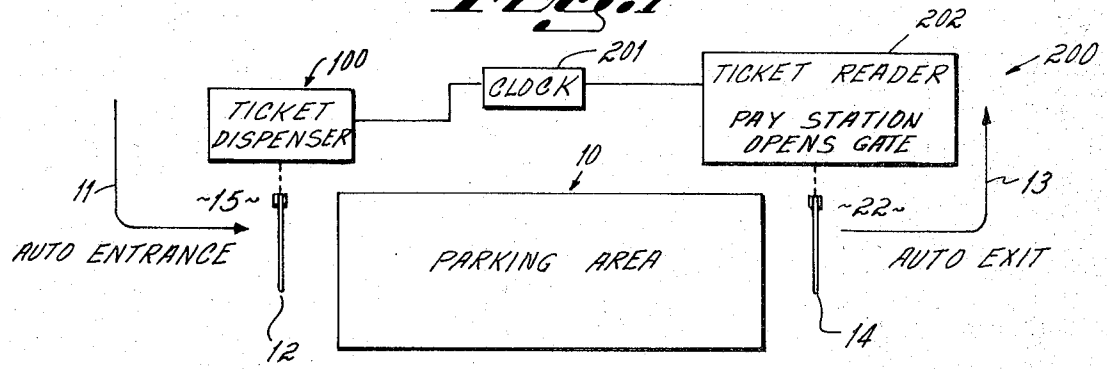


Fig. 2A

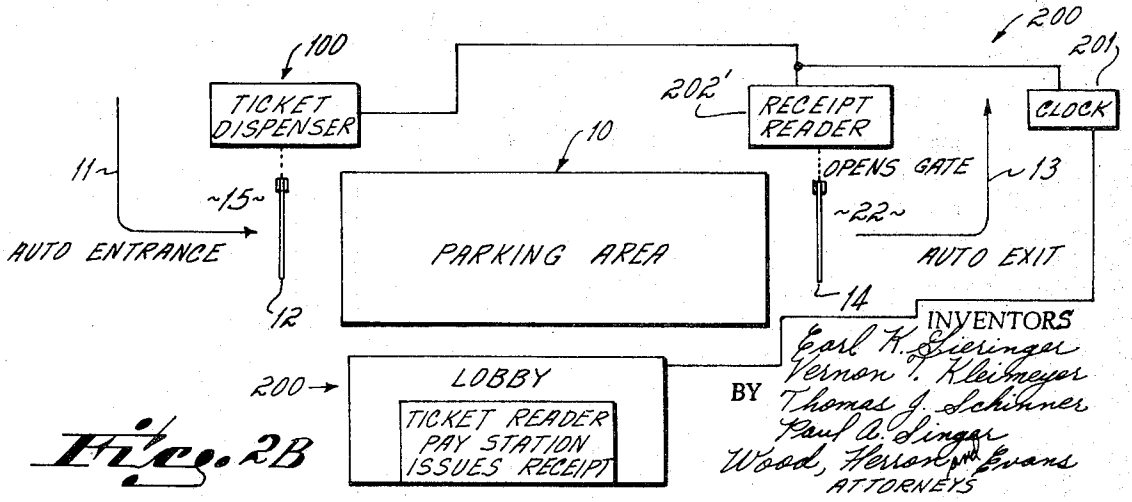


Fig. 2B

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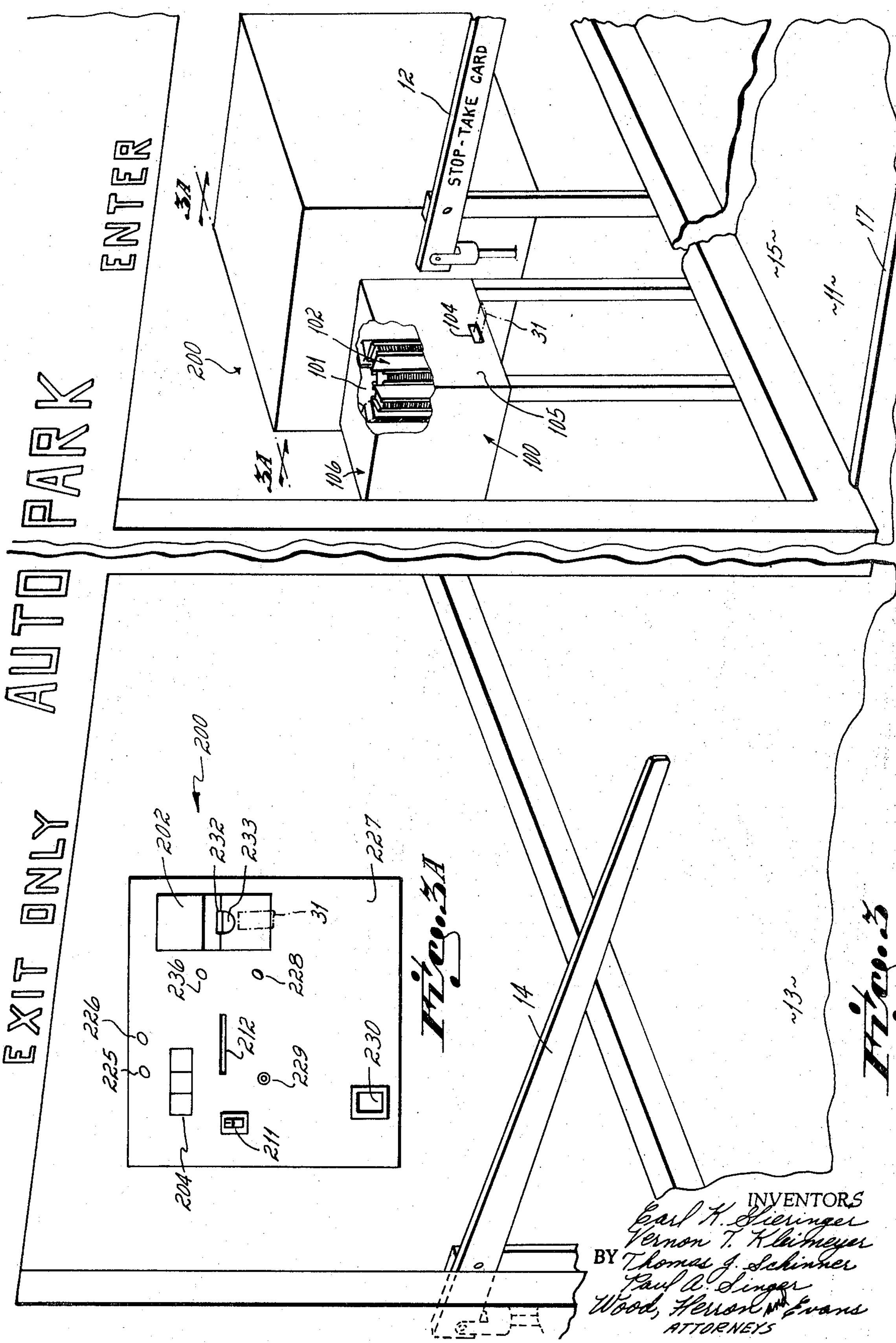

Fig. 3A

Fig. 3

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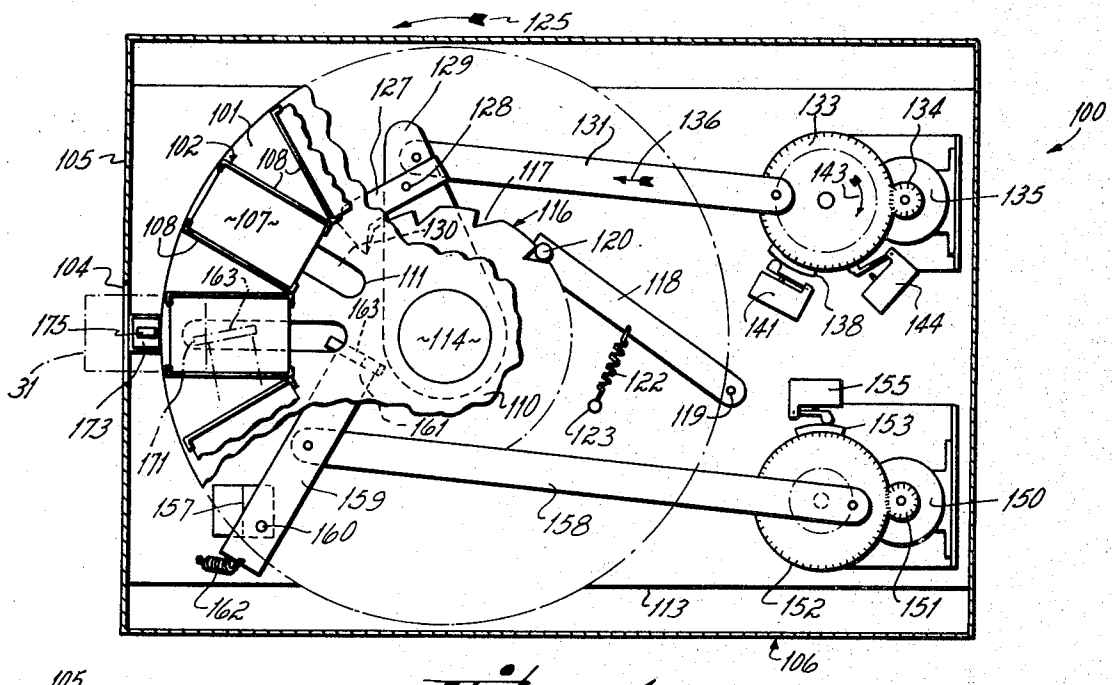

Fig. 4

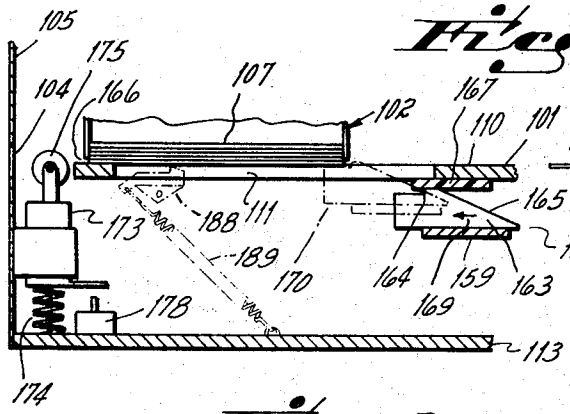

Fig. 5

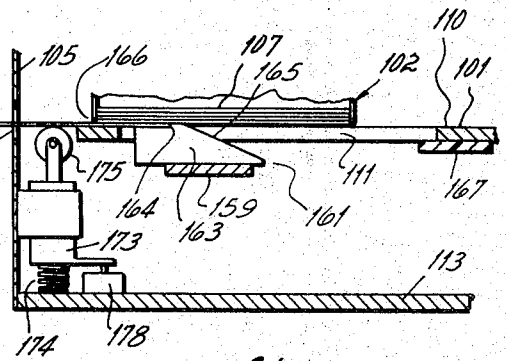

Fig. 6

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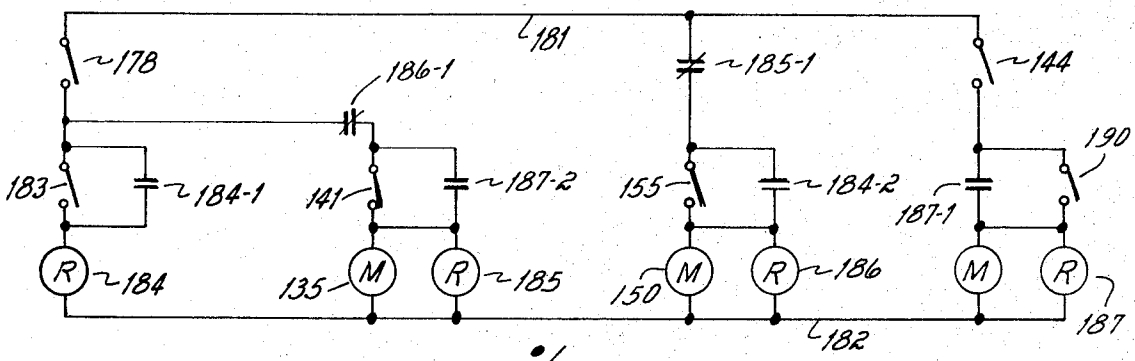

Fig. 7

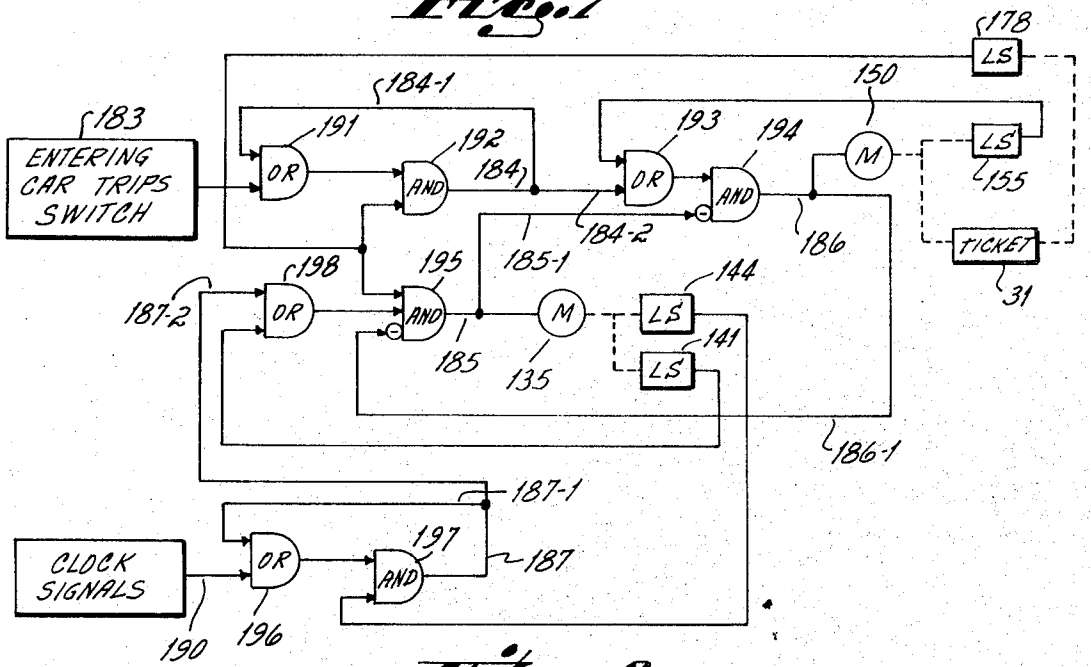

Fig. 8

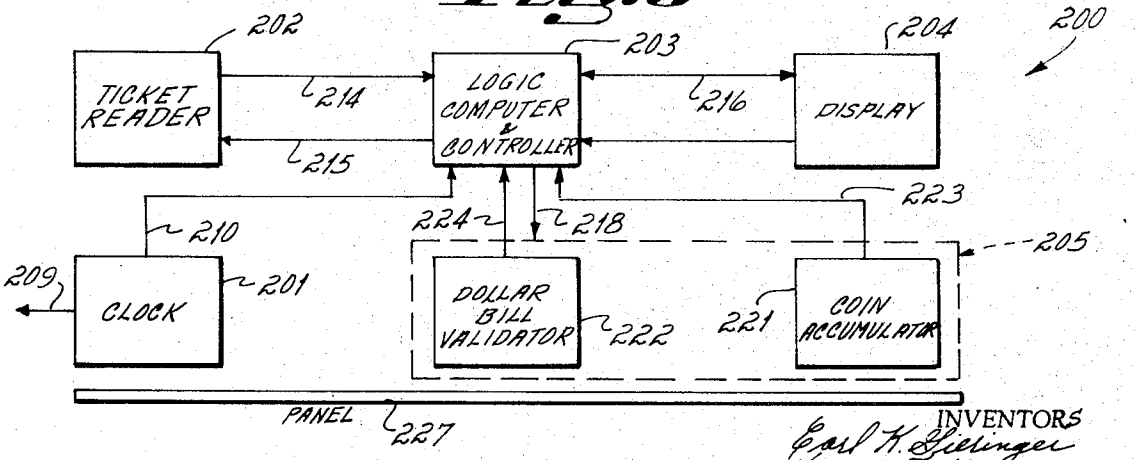

Fig. 9

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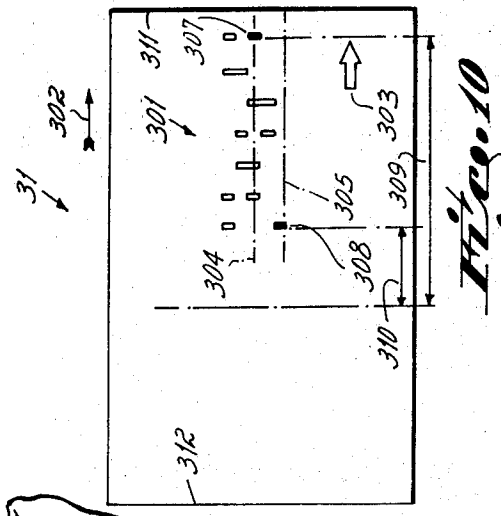

Fig. 10

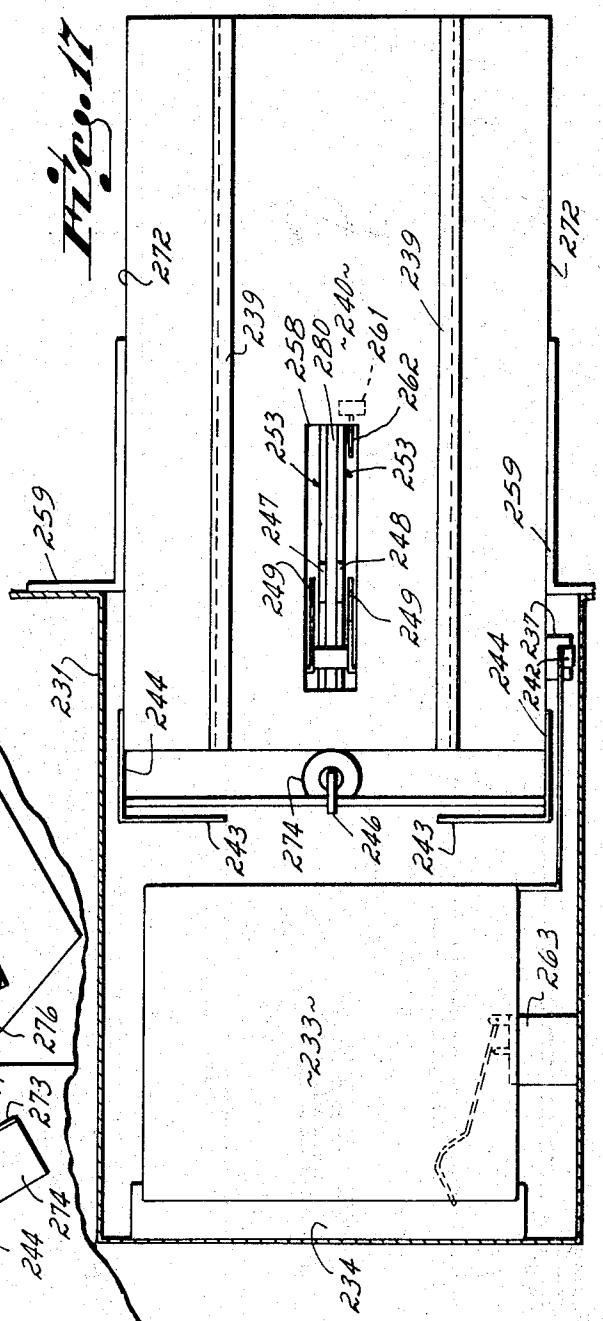

Fig. 11

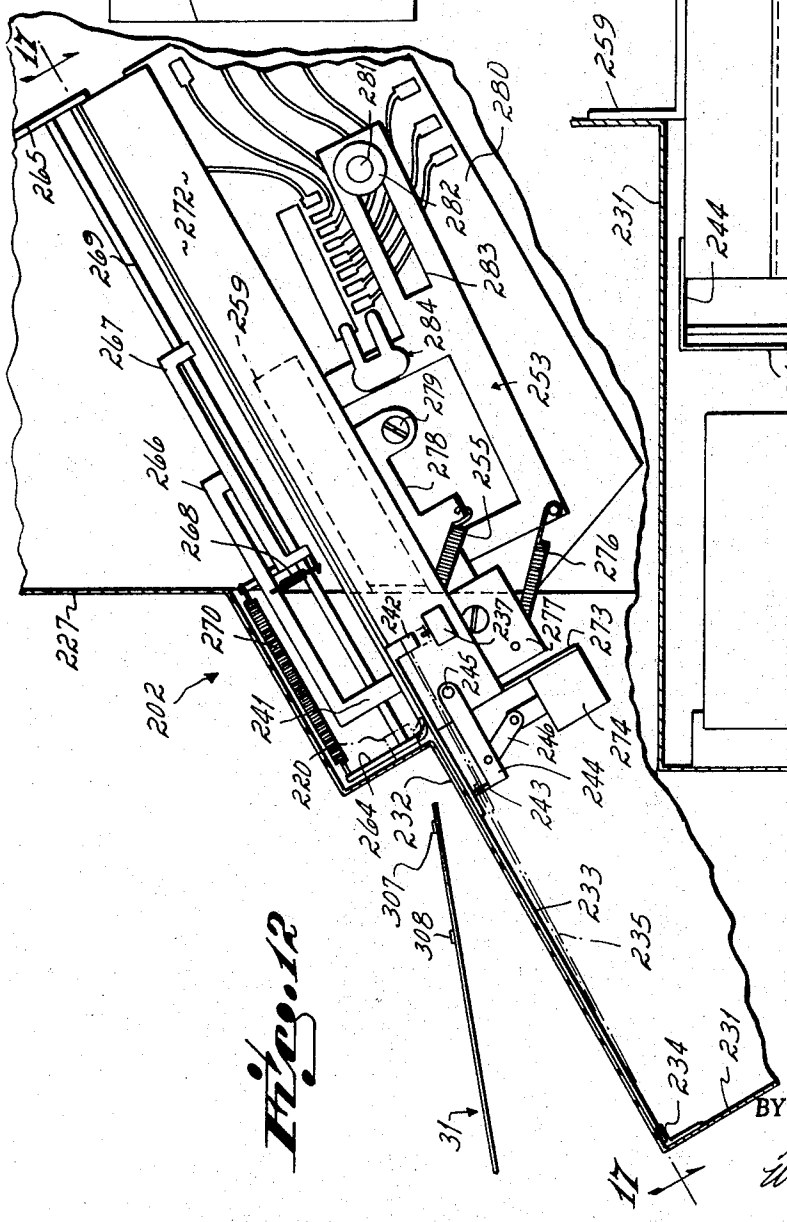

Fig. 12

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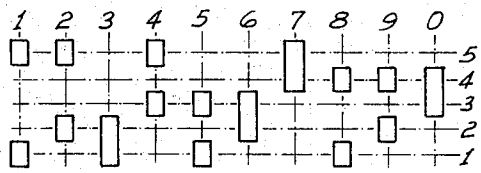

GROUP DIGITS HAVING:
(A) A BIT IN ROW 305 - 1,3,5 & 8
(B) A BIT IN ROW 305 BUT NO BIT IN ROW 304 - 1,3 & 8
(C) A BIT IN ROW 304 - 4,5,6 & 0
(D) A BIT IN ROW 304 BUT NO BIT IN ROW 305 - 4,6 & 0
(E) NO BIT IN ROW 305 - 2,4,6,7,9 & 0
(F) NO BIT IN ROW 304 - 1,2,3,7,8 & 9
(G) ANY NUMBER - 1,2,3,4,5,6,7,8,9 & 0

	GROUP	DIGIT	BAR	SWITCH POSITION	TIME OF DAY
1	GGGGGCB	2916048		289-2, 291-1	6-9 AM
2	GGGGCFB	1674091		289-3, 291-1	9-10 AM
3	GGGCFFB	3626788		289-4, 291-1	10-11 AM
4	GGCFFFB	6001333		289-5, 291-1	11AM-12
5	GCFFFFB	7473918		289-6, 291-1	12-1 PM
6	CFFFFFB	5192211		289-7, 291-1	1-2 PM
7	GGGGGAD	2711086		289-1, 291-2	2-3 PM
8	GGGGAED	9166120		289-1, 291-3	3-4 PM
9	GGGAEED	3845240		289-1, 291-4	4-5 PM
10	GGAEEED	2134094		289-1, 291-5	5-6 PM
11	GAEEEED	7390766		289-1, 291-6	6-7 PM
12	AEEEEED	1409674		289-1, 291-7	7PM-MIDNIGHT

Fig. 11

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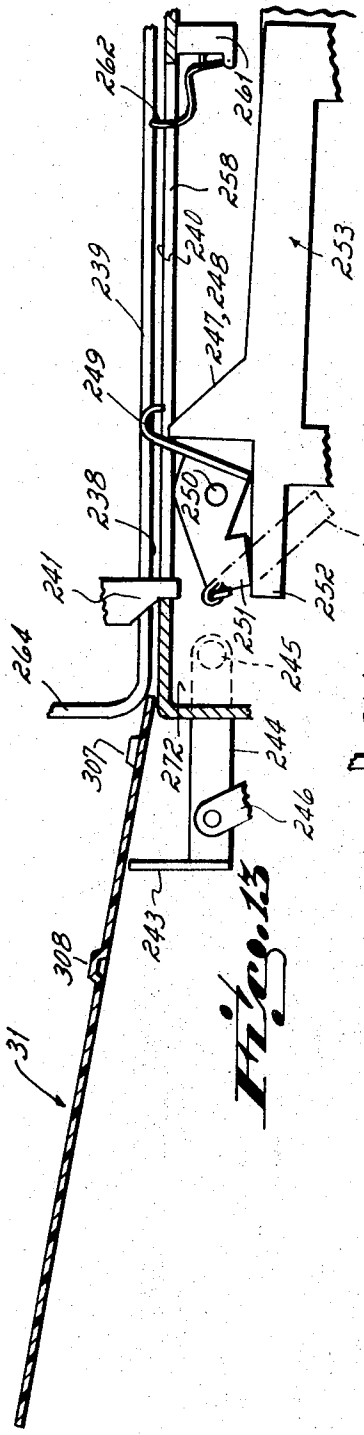

Fig. 13

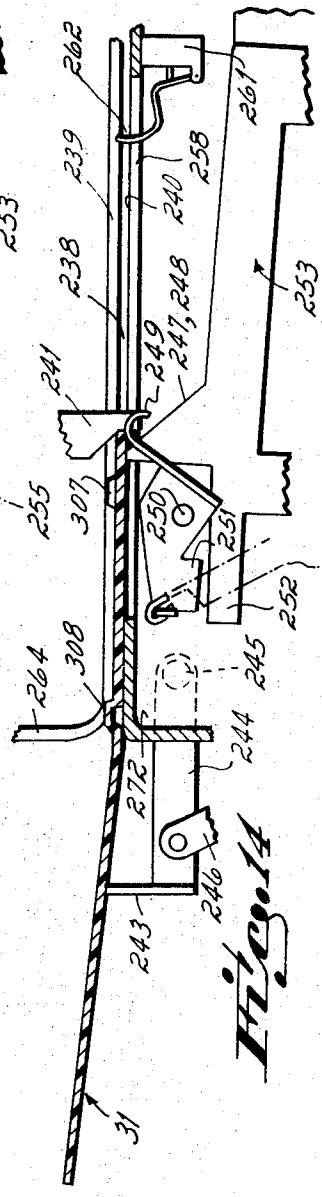

Fig. 14

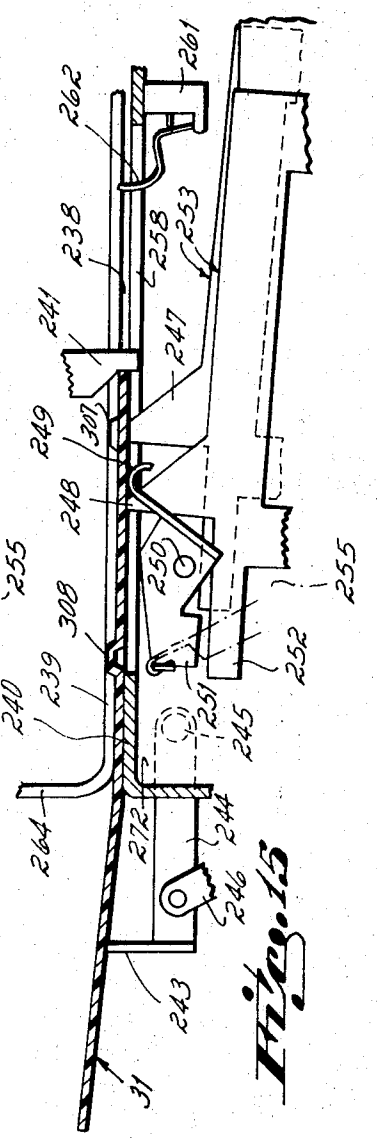

Fig. 15

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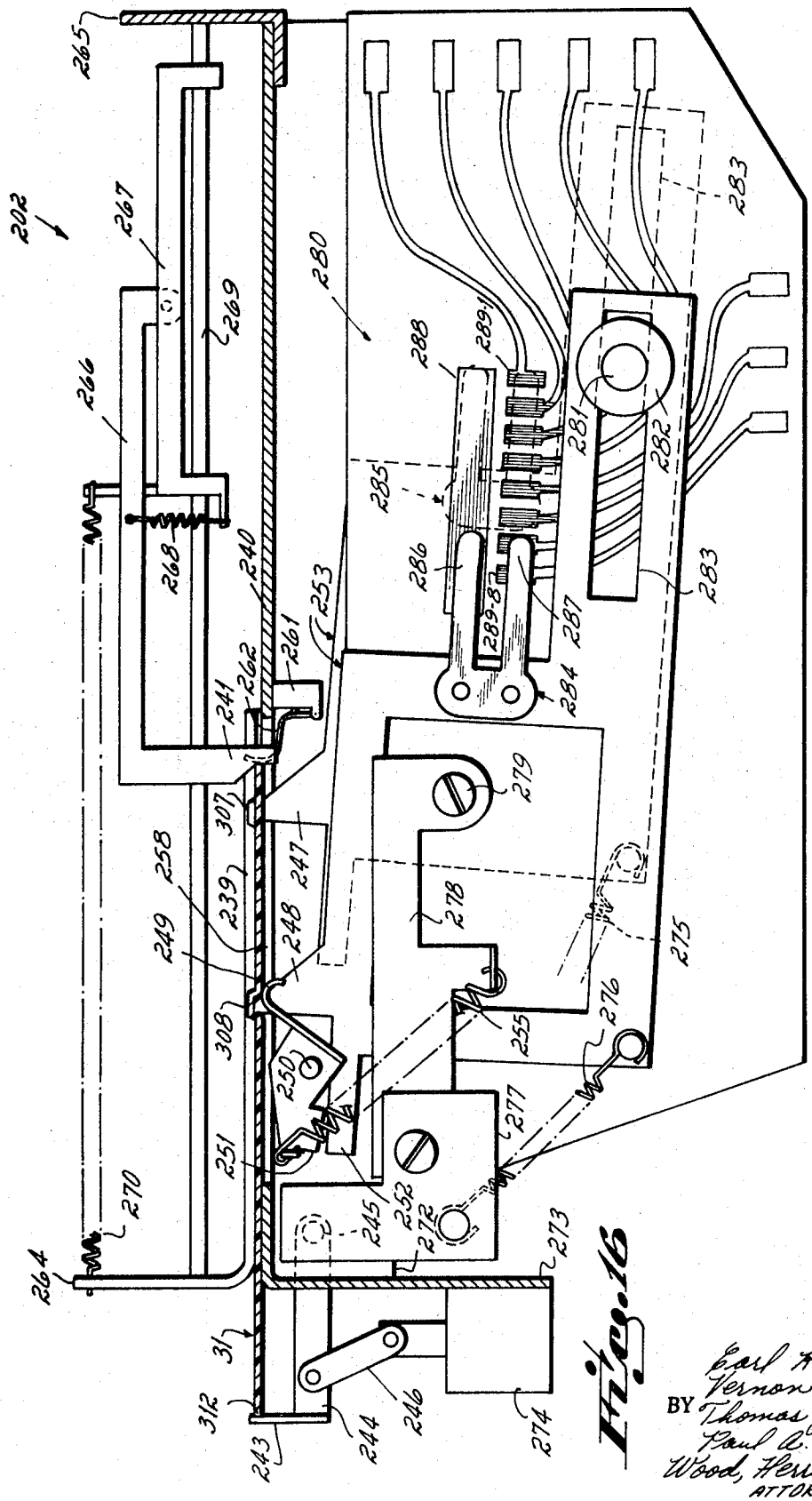

Fig. 16

Fig. 18

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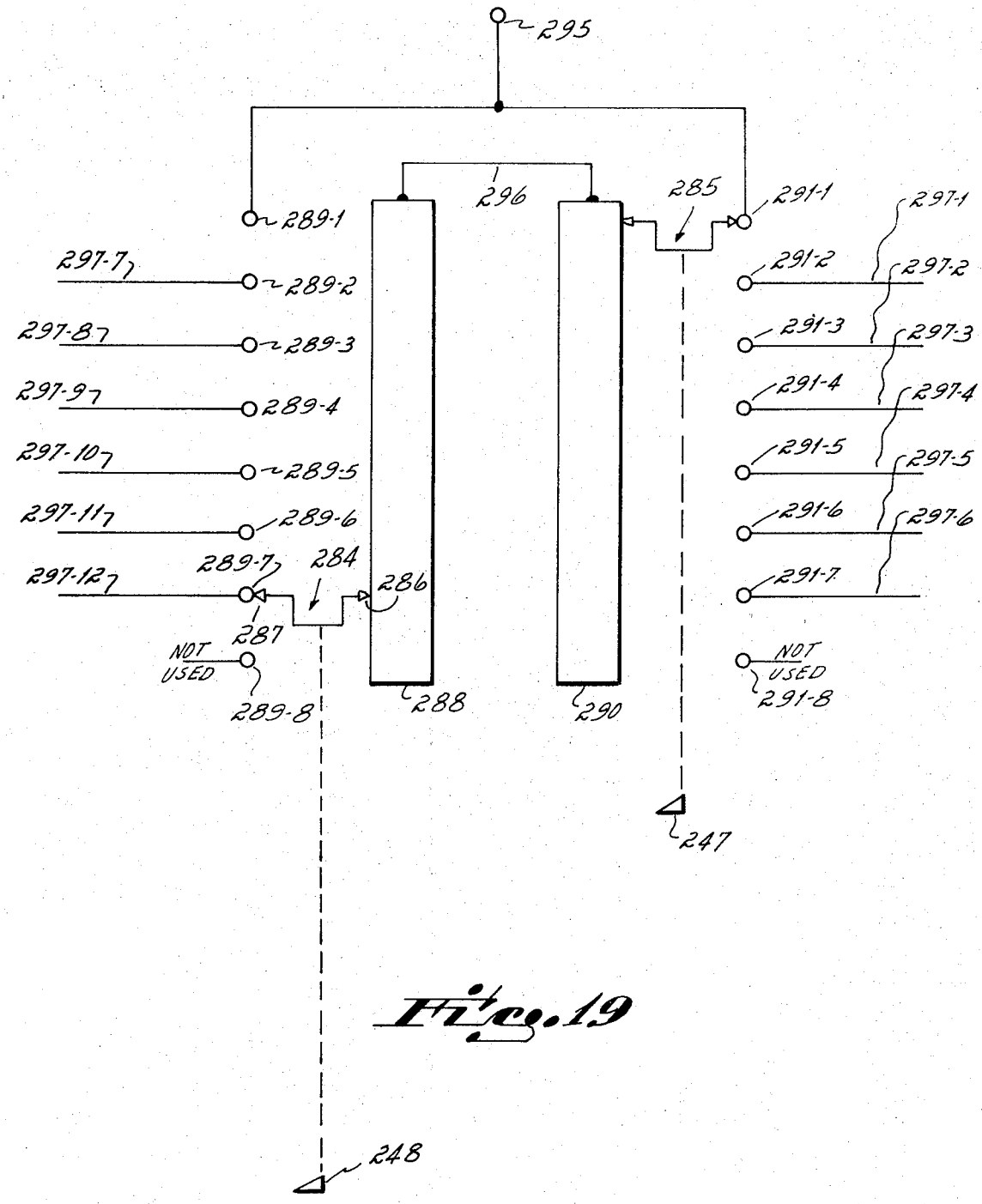

Fig. 19

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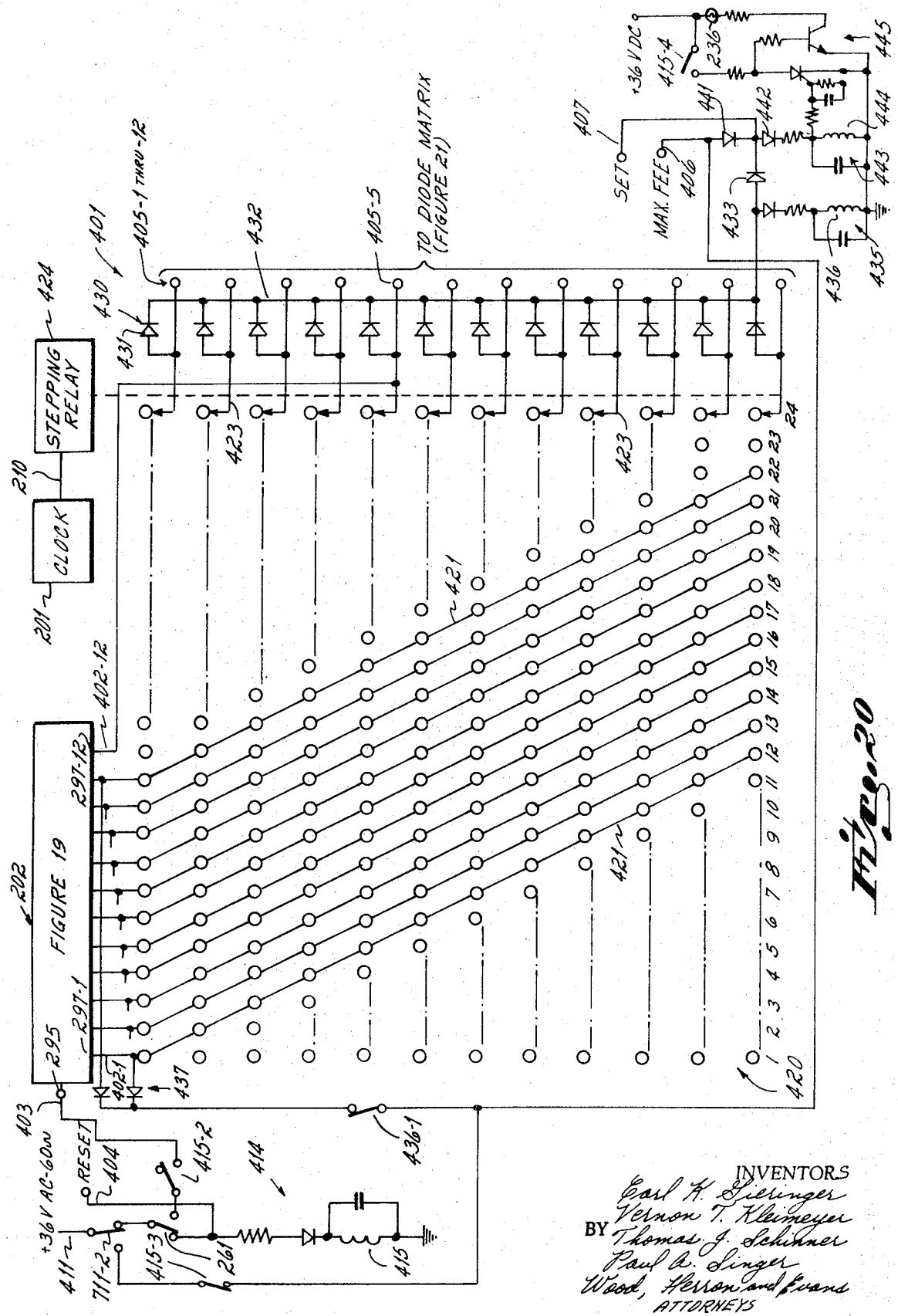

Fig. 20

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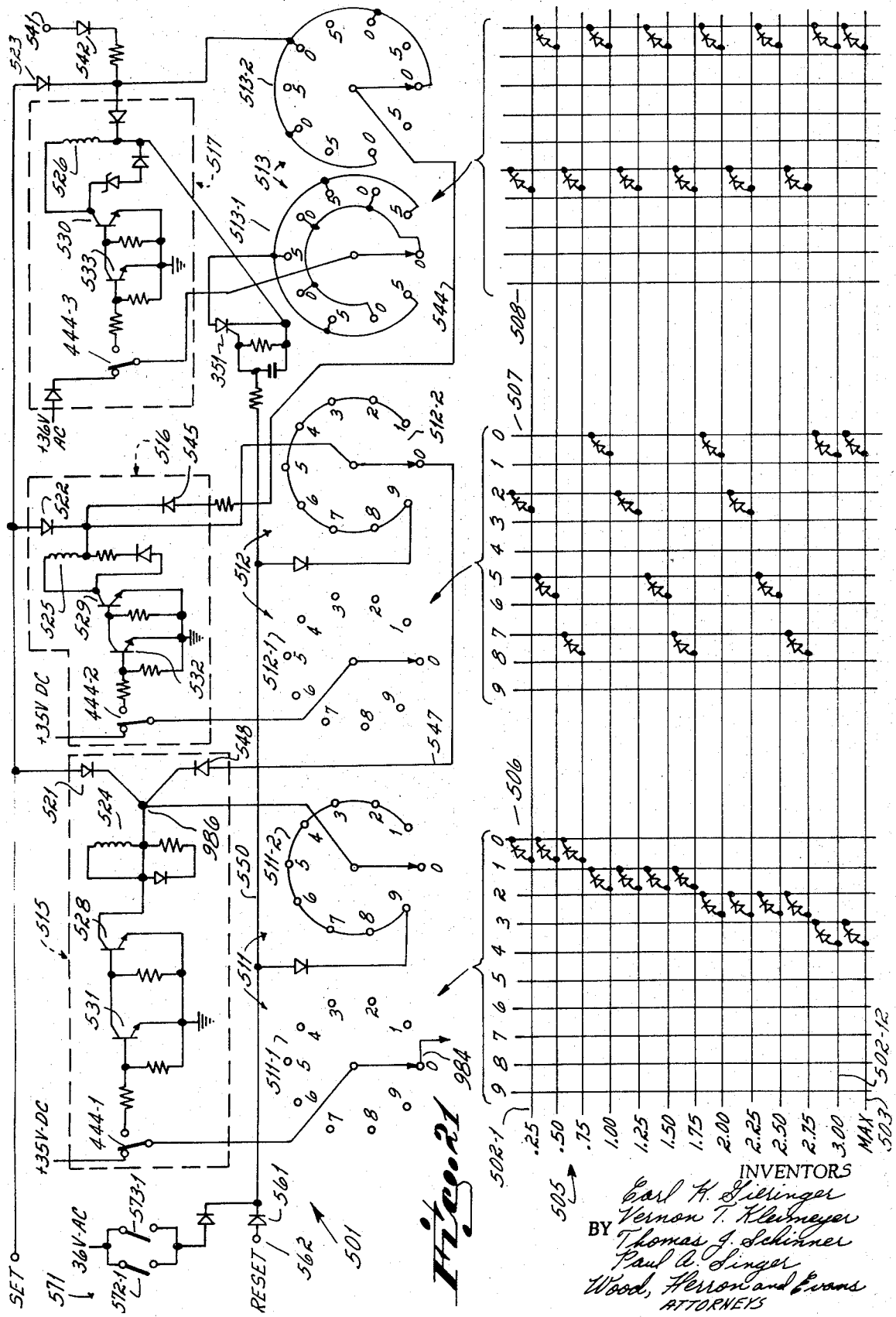

Fig. 21

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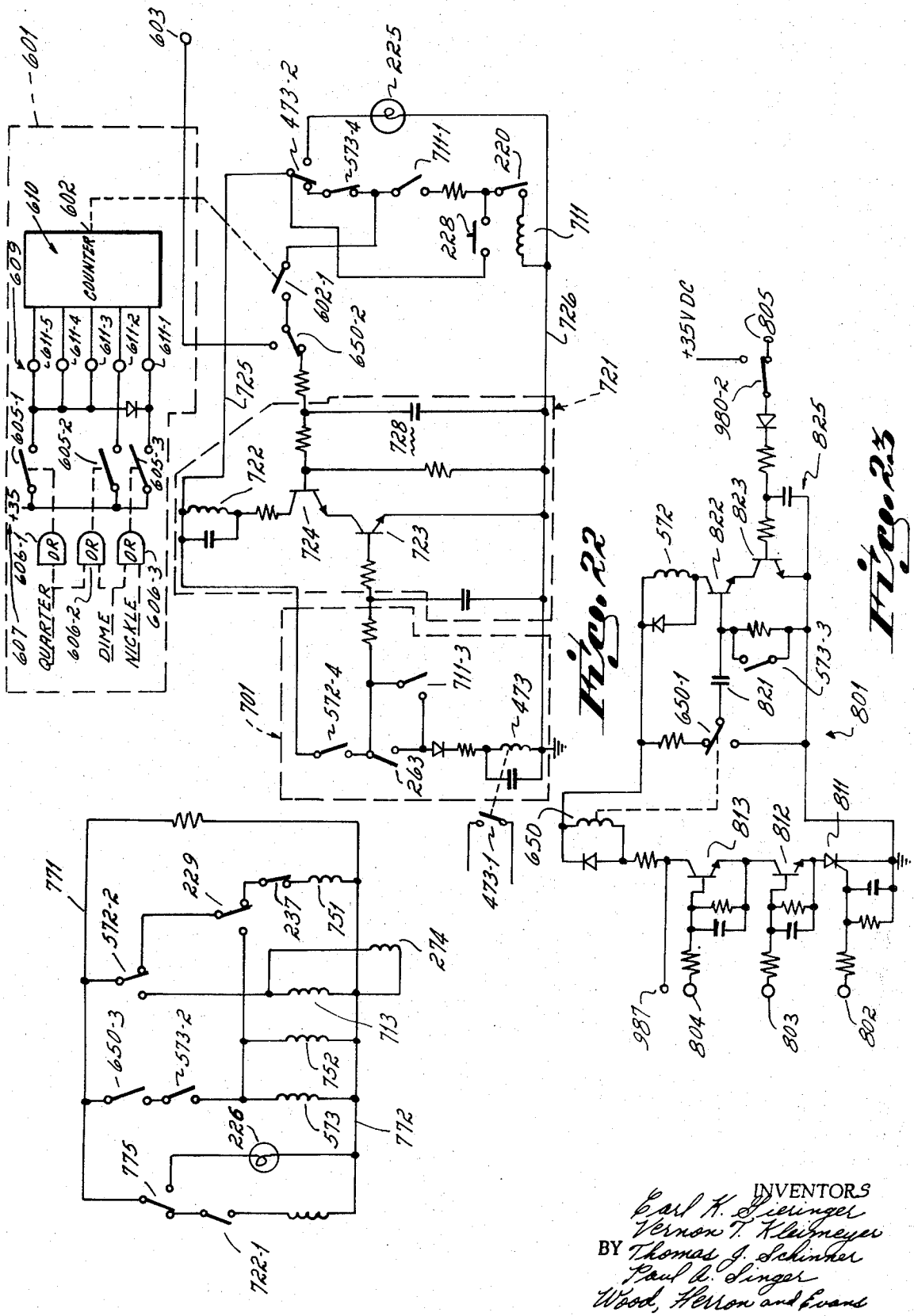

Fig. 22

Fig. 23

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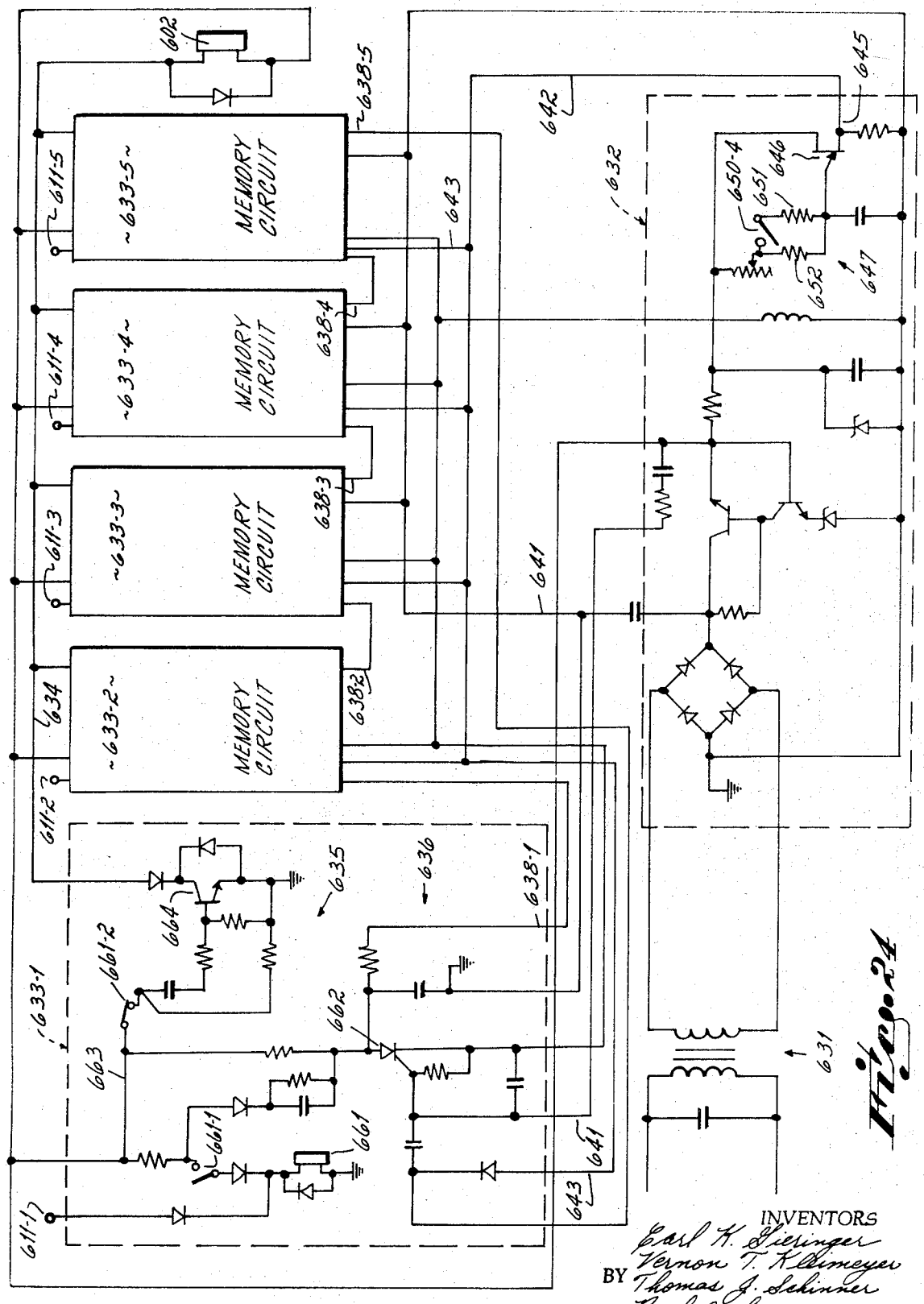

Fig. 24

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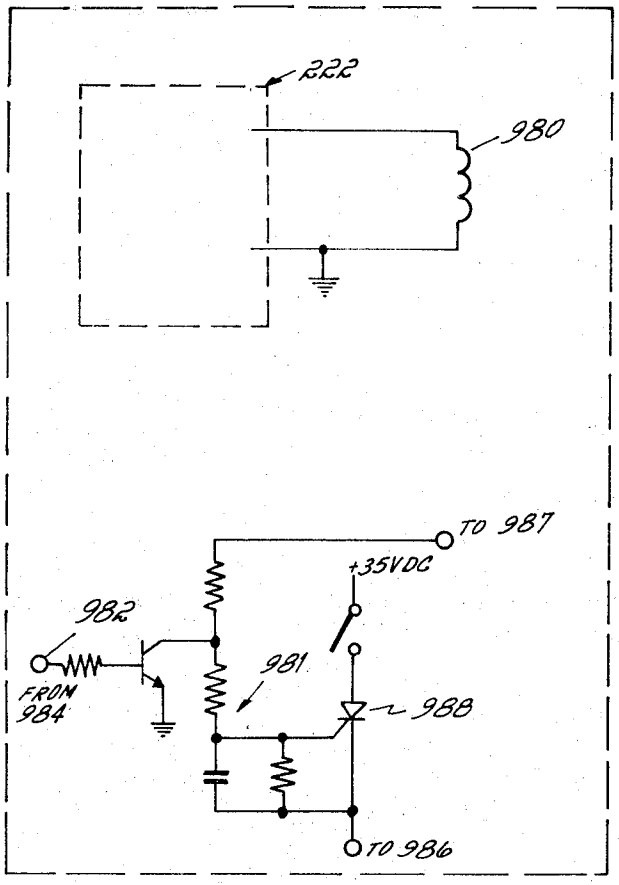

Fig. 25

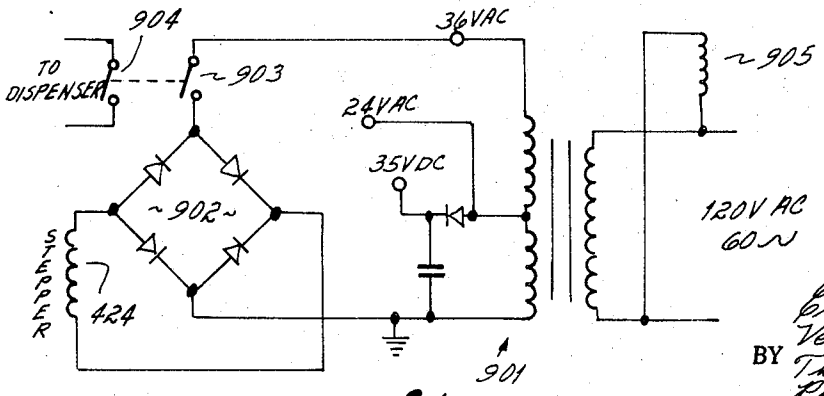

Fig. 26

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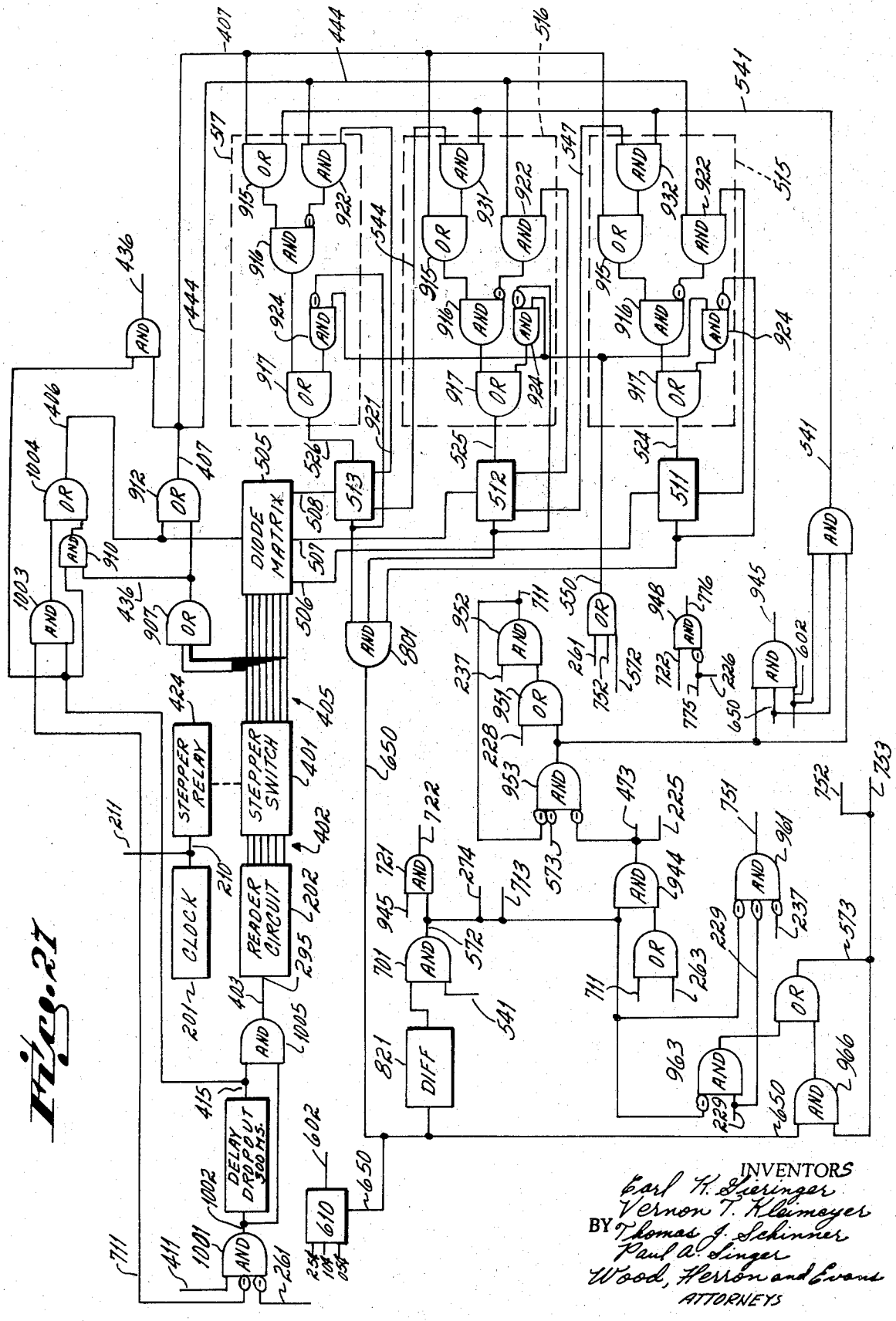

Fig. 21

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AUTOMATIC FEE DETERMINING SYSTEM FOR PARKING GARAGES

The present invention relates to automatic time basis charging systems particularly useful in unattended parking garages and the like. More particularly, the present invention relates to systems in which a ticket is issued to a customer and, upon surrender of the ticket, the customer is charged on the basis of the time elapsed between the issuing and surrender of the ticket.

Systems to which the present invention relates are particularly useful in parking lots and garages for automatically charging a customer of the garage for the elapsed time between entry and departure. According to many systems of the prior art, a ticket is issued to a customer upon his entry to the parking facility. This ticket is imprinted as it is issued with numerals indicative of its time of issuance. Upon leaving the parking facility, the customer surrenders his ticket and the time recorded upon the ticket is subtracted from the time of its surrender to arrive at an elapsed time. The elapsed time is used as the basis for computing the amount the customer is to be charged.

In many variable fee systems, these tickets are issued by, and surrendered to, an attendant who computes the elapsed time based upon a visual reading of a clock and printed information recorded on the ticket to determine the fee to be charged. In some semi-automated systems, the ticket is automatically issued with visual information indicating the time of issue recorded upon the ticket, but the ticket is still surrendered to an attendant who manually computes the charge. As a further degree of sophistication, there are prior art systems in which tickets are printed at the time of issue, and again at the time of surrender in a manner which results in an imprinting of the nomograph which indicates to an attendant the amount due.

In the more fully automated systems, a ticket is encoded and issued to the entering customer. The ticket is automatically read by a special reading device upon its surrender. This device often includes means for automatically computing the amount due. In one recently developed completely unattended system, means are also provided to automatically receive the amount due from the customer in the form of cash, and to permit the customer to leave the facility only when the amount due has been paid.

One major factor in designing the automated systems of the prior art has been in selecting a method for coding information upon the tickets indicative of the time of issue, which information can be read by a suitable reading device upon surrender of the ticket. As a consequence, many methods have been employed. Typically, the prior art devices have been complex and expensive. Some such systems have provided for the printing of visual information upon the tickets, and then the reading of the printed visual coded information through optical means in order to derive the information indicative of the time of issue of the ticket. Other systems have issued punched tickets which are readable by suitable reading devices for such tickets. Other systems have employed magnetically coded information upon cards or tickets which are then read at the time of surrender by suitable magnetic reading means. All of these devices have operated on the principle of encoding blank tickets at the time of their issue.

The devices available for coding blank tickets at the time of issue, and the devices for reading, at the time of surrender of the ticket, the information, which is in those fomrs which can be readily printed upon the ticket at the time of issue, are generally responsible for the complexity and expense of the systems which comprise them, and this has been a major disadvantage of such systems. Another disadvantage of such systems has been in the expense of issuing tickets in large numbers. Typically, large parking lots and garages may use thousands of tickets a day, at a substantial total cost over long periods of time.

Accordingly, it is a principle objective of the present invention to provide the automatic dispensing of tickets with automatically readable encoded information contained thereon which is indicative of the time of issue of the ticket, without the need of complex and expensive ticket encoding apparatus at the point of issue.

A further objective of the present invention is to provide in an automatic system of this type an easily readable coding system in which the information is encoded upon the tickets, and to provide means for reading this information from cards coded in this manner.

A further objective of the present invention is to provide automatic systems of this type in which the amount due may be paid at a station which, in response to receipt of the payment, performs a function such as the opening of an exit gate to allow the customer to leave, or the issuing of a receipt which the customer may use to actuate the opening of an exit gate upon his departure.

It is still another objective of the present invention to reduce the consumption of tickets providing resusable tickets. The present invention is predicated on the concept of providing a parking system which utilizes precoded tickets. Due to the fact that they have been precoded, the tickets can be in the form of durable plastic cards having embossed time codes thereon. Embossed cards of this type are easily and accurately read in rugged electromechanical readers, which cost only a small fraction of the cost of magnetic or optical readers.

More particularly, a system of the present invention utilizes permanently encoded reusable tickets which are dispensed from a magazine having a plurality of compartments, each containing a supply of reusable tickets with pre-recorded automatically readable information contained thereon corresponding to the specific period of time during which the ticket was issued. The dispenser is synchronized with a timer to cause the automatic dispensing of tickets from the selected compartment which contains tickets having the appropriate pre-recorded information indicative of the time of issue of the ticket. Each of the supplies of tickets within the magazine contains only tickets indicative of a given period of time, and each of the supplies corresponds to a different period of time.

In the preferred coding method utilized with the system, information is embossed upon tickets, which are in the form of plastic cards. Conveniently, the coding may be conventional bar codes which may be used to vary other information. This information is furthermore readable preferably on a card reader which employs mechanical fingers which scan the underside of the card along predetermined paths as the card is inserted into a reader. The fingers are mechanically connected to the movable contact set of a multiple contact switch.

As the card is inserted toward a final position, the switch is moved successively through a plurality of switch positions. The position of the switches when the card reaches its full extent within the slot are determined by the positions of the first notches along the paths. Different contacts of different switches are connected in series in such a way that one of the switches is used to actuate groups of contacts on other switches and to verify that the setting of the other switches are the result of a valid code.

This information which is read is then compared with the time of the ticket's surrender, as indicated by a clock, and the elapsed time is used as a basis to compute an amount due which is displayed to the customer. A cash receiver device accepts a cash payment from the customer and determines when the amount of the payment has reached the amount due. When it does, the system executes an operation which authorizes the departure of the customer from the premises. Alternatively, the system may issue a receipt which may be deposited at the exit gate to automatically open the gate.

In addition to the use of the present invention in connection with unattended parking lots and garages, it may also be used where there is a cashier. In such an installation the prerecorded ticket is handed to the cashier by the customer when he is leaving. The casher then inserts the ticket in a reader and collects the charge which is automatically computed for him. The system also has utility in other similar applications in which it is desirable to automatically charge a customer on the basis of elapsed time through the issuing of a coded ticket to him at the beginning of the period, which he surrenders at the end of the period for which he is to be charged.

Furthermore, while the present description is directed primarily to applications in which it is desirable to receive payment in the form of cash from the customer, it is contemplates that, in some applications, payment may be made in the form of a charge to the customer's account, perhaps upon tendering of proper identification such as inserting a coded credit card into a card reader.

These and other objects and advantages of the present invention will be more readily apparent from the following detailed description of the drawings illustrating one preferred form of a fee computing system according to principles of the present invention, in which:

FIG. 1 is a block diagram of an automatic parking garage fee computing system according to an embodiment of the present invention;

FIGS. 2A and 2B are alternative arrangements of systems of FIG. 1;

FIG. 3 is a perspective illustrating a ticket dispenser and a pay station according to one possible arrangement of the system of FIG. 1;

FIG. 3A is an elevational view of the panel of the pay station of FIG. 3;

FIG. 4 is a horizontal view, partially broken away, of a ticket dispenser of FIG. 3;

FIG. 5 is an elevational cross sectional view through the dipesning mechanism of FIG. 4 illustrating the mechanism in a de-actuated condition;

FIG. 6 is a view similar to FIG. 5 illustrating the dispensing mechanism in an actuated condition;

FIG. 7 is a schematic diagram of the control circuitry of the ticket dispenser of FIG. 4;

FIG. 8 is a symbolic logic diagram representing the operation of the ticket dispenser of FIG. 4;

FIG. 9 is a block diagram of a pay station of FIG. 3;

FIG. 10 is a diagram of a sample ticket in the form of an embossed card encoded according to one of the principles of the present invention;

FIG. 11 is a table illustrating one form of code as illustrated on the ticket of FIG. 10;

FIG. 12 is a horizontal cross-sectional view, partially broken away through the pay station of FIG. 3 illustrating particularly the ticket reader;

FIG. 13 is a cross-sectional view through the ticket reader of FIG. 12 illustrating a card in position, ready for insertion in the reader;

FIG. 14 is a view similar to FIG. 13 illustrating the card partially inserted into the reader;

FIG. 15 is a view similar to FIGS. 13 and 14 illustrating a card inserted further into the reader;

FIG. 16 is a cross-sectional view through the ticket reader of FIG. 12 illustrating in detail the ticket reader decoding mechanism;

FIG. 17 is a cross-sectional view taken just beneath the cover plate along line 17—17 of FIG. 12;

FIG. 18 is a view similar to FIGS. 13–15 illustrating a card being ejected from the reader;

FIG. 19 is a schematic diagram illustrating the wiring of the reader switch of FIG. 16;

FIG. 20 is a schematic diagram of the elapsed time computing circuit of the logic circuit of FIG. 9;

FIG. 21 is a schematic diagram of the fee computing circuit of the logic circuit shown in FIG. 9;

FIGS. 22 through 26 are schematic diagrams of the logic computer and control circuit from the block diagram of FIG. 9; and

FIG. 27 is a symbolic logic diagram illustrating the function and operation of the pay station control circuitry of FIGS. 22–26.

GENERAL DESCRIPTION OF SYSTEM

The preferred embodiment of a system according to the present invention is generally illustrated in the block diagram of FIG. 1 in connection with an automated parking lot or parking garage having a parking area 10. Entry to the area 10 is obtained via an entrance ramp 11 from which access to the area 10 is controlled by a power operated entry gate 12. Automobile departure from the area 10 is achieved by way of an exit ramp 13, access to which is controlled by a power actuated exit gate 14. At the entrance ramp 11 adjacent the entry gate 12 is a ticket dispensing area 15 at which an entering motorist 16 must stop prior to gaining entry to the parking area 10. At the area 15, the motorist 16 must obtain a ticket in order to open the entry gate 12 which blocks his entry to the parking area 10. The ticket bears a record of the time it was dispensed to the entering motorist 16. The ticket is automatically dispensed by a ticket dispenser 100. The ticket dispenser 100 operates to dispense a ticket to the motorist in response to a signal which is generated by electrical circuitry at the entrance area 15 in response to the presence of the motorist's vehicle at the area 15. When the motorist withdraws the ticket from the dispenser 100, the dispenser 100 automatically actuates the entry gate 12 to raise the gate and admit the motorist to the parking area 10.

When an exiting motorist 21 wishes to leave the parking area 10, he drives his car to a pay area 22 near the

exit gate 14 which blocks his passage from the parking area 10 to the exit ramp 13. At the exit area 22, the exiting motorist 21 inserts the ticket, which he had obtained upon entry to the lot, into a ticket reader slot in a pay station 200. The pay station 200 automatically compares the time of entry recorded upon the ticket with the real time of day, computes the amount that the motorist owes, and dipslays this amount to the motorist. The motorist then inserts the amount that he owes in cahs into a cash acceptor at the pay station 200. The pay station 200 will acknowledge receipt of the full amount when paid by authorizing te motorist's departure from the area 10, such as by automatically opening the exit gate 14, giving the exiting motorist access to the exit ramp 13.

The ticket dispenser 100 is provided with an indexable magazine 101 which is provided with a plurality of ticket compartments 102. Each of the compartments 102 contains a supply of tickets corresponding to a different period of time, and each of the tickets within a given compartment has recorded thereon information indicative of the period of time to which that compartment corresponds. The dispenser 100 will automatically dispense a ticket to an entering motorist from a selected one of the compartments 102. Selection of the compartment is achieved in accordance with the time of day by indexing the magazine 101 in response to control signals through a clock input 103.

The pay station 200, according to one embodiment of the present invention, includes a clock 201 which synchronizes the indexing of the dipsenser 100 and computation performed by the pay station 200 in accordance with real time. The clock 201 has its outputs connected to the input 103 of the dispenser 100 and to the fee computing portion of the pay station 200. To provide a customer grace period and thereby relieve high charges for customers who enter near the end of one time period and exit just after the beginning of the next, the output to the pay station may lag the output to the dispenser by, for example, one-half hour. The fee computing portion includes a ticket reader 202 which accepts the ticket from the exiting motorist 21 and reads the motorist's entry time as recorded on the ticket issued him when he entered. The information read from the ticket by the ticket reader 202 is communicated to a computation module 203 which compares the entry time from the ticket with the real time as determined by the clock 201 at the time the ticket is read. The computing module 203 converts the time difference into a monetary figure representative of the charge for that amount of time and displays the amount due to the motorist on a display device 204. The pay station 200 is also provided with a cash receiver 205 into which the exiting motorist 21 may deposit the amount displayed to him to obtain access to the exit ramp 13. The cash receiver mechanism 205, in conjunction with the computing module 203, determines when the amount displayed on a display device has been paid. When it has, a vending control 206 is actuated to authorize the motorist's exit from the parking area 10.

Two of the general embodiments of the system as set forth thus far in FIG. 1 are illustrated in FIGS. 2A and 2B. Referring to FIG. 2A, the parking area 10 having the entrance ramp 11 and an exit ramp 13 is illustrated with a ticket dispenser 100 positioned adjacent the ticket dispensing or entry area 15 to dispense the ticket to the entering motorist at the area 15 and to thereafter actuate and raise the entry gate 12. The pay station 200 is located adjacent the pay area 22 and operates to receive the motorist's ticket and the payment due for the time during which he was parked, and, in response to receipt of the payment, actuates the exit gate 14 to allow the motorist to depart by way of the exit ramp 13.

FIG. 2B illustrates an alternative arrangement to which the system of FIG. 1 may be applied. In this embodiment, the parking area 10 having an entrance ramp 11 and an exit ramp 13 is provided with a ticket dispenser 100 arrnaged, as in FIG. 2A, adjacent the ticket dispensing area 15 in a manner which allows it to control the operation of the entry gate 12. However, in this embodiment, the pay station 200 is located in a pedestrian lobby which may be in the lobby of the parking garage, or in the lobby of one of the buildings served by the parking area 10. The pay station 200 operates in the same manner as the pay station of FIG. 2A; however, instead of opening the exit gate 14 upon receipt of payment, the unit 200 issues a receipt. This receipt may be in the same form as the ticket dispensed by the ticket dispenser 100 and has recorded on it the time that it was dispensed. The receipt is valid only for a short period of time which is sufficient to allow the motorist to remove his car from the parking area 10 and proceed to the exit gate 22. At the exit area 22, a receipt ticket reader 202' is provided to accept the receipt, read the time encoded upon it, compare the time read with the real time from the clock 201, and, if the receipt is still valid, to actuate the exit gate 14. By this arrangement, a motorist may park at the area 10 and, upon returning to remove his car, may pay his fee at the pay station 200 in the lobby. The arrangement of FIG. 2B allows the use of a single pay station for multiple exit gates and allows the motorist to proceed more quickly through the exit gate by relieving him of the necessity to deposit his cash from his automobile.

Referring to FIG. 3, the dispenser 100 and the pay station 200 according to the arrangement shown in FIG. 2A is illustrated for use with a parking garage in which the entrance ramp 11 and the exit ramp 13 are adjacent. As shown in FIG. 3, the dispenser 100 is positioned adjacent the dispensing area 15 which is provided with means which may include electric eye detectors or magnetic loop pick-ups 17 for detecting the presence of an entering automobile at the area 15. The dispenser 100 is provided with a rotatable magazine 101 having a plurality of compartments 102 from which a ticket 31 is automatically dispensed through a slot 104 upon detection of the presence of an automobile at the area 15. When the ticket 31 is withdrawn from the slot 104 by the motorist, the dispenser 100 actuates a mechanism to raise the gate 12 to allow the motorist to enter the parking garage. At the exit area 22, as best shown in FIG. 3A, the pay station 200 receives the ticket 31 through the ticket reader 202 to compute and display the amount due on the display device 204. The motorist may deposit cash in the form of coins through the coin slot 211 or currency through the bill receiving slot 212 which, by decrementing the display counter 204 until the amount due is reduced to zero, executes a signal authorizing the motorist to leave the parking area, which signal operates to raise the exit gate 15. Change is also given to the motorist if required. For this purpose, the specific embodiment illustrated herein is provided means for returning change of

from one to four nickles for overpayment made in coin. While no means are sown for comparting and returning change for currency deposited, it is understood that this provision could be added.

The pay station **200** is provided with other controls an indicators on the face of the control panel **210.** These include a lost card push-button **228** which is used in lieu of the insertion of a card to assess the exiting motorist a fee, usually the maximum fee, if he has lost his ticket. Also provided is a cash return push button **229,** a coin return slot **230,** "fee paid", "use correct change only", and "card in wrong" indicator lights **225, 226,** and **236** respectively, and a bent coin release (not shown). The details of operation of one preferred embodiment of the system, along with the operation of the preferred embodiment, is set forth in detail below.

DESCRIPTION OF TICKET DISPENSER

The ticket dispenser **100** is illustrated in FIG. **4** with a circular magazine **101** having a plurality of circumferentially spaced and radially aligned ticket compartments **102.** The dispenser **100** is provided with an output dispensing slot **104** in the front panel **105** thereof forming part of the cabinet **106.** The slot **104** and the panel **105** face toward the ticket dispenser area **15.** The dispenser **100** is adapted to dispense a ticket **31** through the slot **104** toward a vehicle positioned at the dispensing area **15.**

The circular magazine **101,** in the embodiment illustrated, is provided with 12 of the bins or compartments **102.** Each of these compartments is adapted to carry a stack of similar or identical rectangular shaped tickets **107.** Each of the compartments **102** is in the form of a vertically oriented stacking tray **108** made up of a pair of channel shaped side sections, the traps being rectangular in cross-section and mounted upon the circular base plate **110.** The plate **110** has 12 radial slots **111** therein. The trays **108** are rigidly mounted on the plate **110,** one spaced symmetrically about each of the slots **111.** The circular base plate **110** is pivotally mounted to the top of a cabinet base plate **113** which forms a rigid part of the cabinet **106.** The base plate **110** is, for this purpose, supported on a bearing shaft **114** which also supports, intermediate of the plate **113** and the plate **110,** a circular ratchet disk **116.** The disk **116** has, uniformly spaced about the circumference thereof, 12 unsymmetrical V-shaped notches **117.** A locking lever **118,** pivotally mounted at point **119** to the base **113,** is provided with a detent roller **120** at the other end which is adapted to drop into the notches **117** to lock the plate **116** in any one of 12 positions corresponding to the 12 positions of the different compartments **102** adjacent the dispensing slot **104.** The lever **108** is spring biased by a tension spring **122** attached between the mid-point of the lever **118** and a point **123** on the base **113** so that the detent roller **120** rides against the rim of the disk **116.**

A ratchet pawl mechanism is provided for indexing the magazine **101** by sequentially advancing the compartments **102** past the slot **104** in the direction shown by the arrow **125.** This pawl mechanism includes a ratchet pawl **127** which is pivotally mounted at point **128** to a pawl arm **129** which is pivotally mounted to the shaft **114.** The pawl end **130** is biased under the influence of a spring (not shown) into engagement with the notches **117** in the circumference of the disk **116.** The arm **128** is oscillatably driven by a linkage **131** pivotally connected at its opposite ends between the lever **129** and an eccetrically positioned pinion and gear wheel **133.** The gear wheel **133** is driven by another gear **134** on the shaft of an electric motor **135.** When motor **135** is energized, the resulting rotation of the gear wheel **133** rockes the linkage **131** and oscillates the arm **129** to advance the magazine in **101** when the arm **131** is moving in the direction of the arrow **136,** with the pawl end **130** engaged in a notch **117** of the disk **116.** When the linkage **131** is moving opposite the direction of the arrow **136,** the pawl end **130** will slip to the next notch **117** as the detent **120** prevents backward rotation of the magazine **101.** A cam **138** is concentrically mounted on the shaft of the gear wheel **133** and is shown in the position that it will be in when the motor **135** is de-energized. In this position, it opens the normally closed contacts of a limit switch **141.** When the motor **135** is energized, the gear wheel **133** rotates in the direction of the arrow **143.** At a small angle upstream of the limit switch **141,** in the path of the cam **138,** is a normally closed limit switch **144.** The operation of these limit switches in the control of the machine will be best illustrated in connection with the logic and wiring diagrams of FIGS. **7** and **8** below.

Another motor, **150,** is provided to drive the ticket dispensing mechanism through its output gear **151** which drives a gear wheel **152** to which is concentrically mounted a cam **153** shown in its normal position in FIG. **4,** when the motor **150** is de-energized. In this position, the cam **153** opens the normally closed contacts of a limit switch **155.** Pivotally attached at one end to an eccentric point on the gear wheel **152** is a linkge arm **158** which is pivotally attached at its opposite end to the midpoint of a lever arm **159** which is in turn pivotally attached at point **160** to a bracket **157** fixed to the base **113.** A free end **161** of lever **159** is adapted to move in the slot **111** beneath the compartment **102** which is located adjacent slot **104** when arm **158** is rocked by energization of the motor **150.** The lever **159** underlies the disk **110** and is biased upwardly against the disk by a spring **162** for which purpose it is mounted above the base **113** by bracket **157** and secured loosely on its axis **160.**

The operation of the lever **159** in dispensing tickets is better illustrated in FIGS. **5** and **6.** Referring to FIG. **5,** the lever **159** is illustrated in its rest position of FIG. **4.** To the free end **161** of the lever **159** is mounted a feed finger **163** provided with a notch **164** in the upper surface thereof and an upper cam surface **165.** The tray **108** is provided with a slot **166** at the base of its outer edge adjacent the slot **104** in the front panel **105.** The width of the slot **166** is greater than the thickness of one of the cards in the stack **107** but less than the thickness of two of the cards so that it may serve to separate the cards individually from the bottom of the stack to feed them through the slot **104.** The plate **110,** upon which the trays **108** are mounted, is illustrated with one of its slots **111** positioned in alignment with the feed finger **163.** With the lever arm **159** in its retracted position (as shown), the feed finger **163** is biased downwardly by a plastic ring **167** mounted to the underside of the circular base plate **110.** When the lever **159** is advanced in the direction of the arrow **169,** the feed finger **163** moves to the left in FIG. **5** and upwardly to the position illustrated at **170,** where the notch **164** may engage the inward edge of the lowermost ticket of the stack **107.** As the arm **159** advances to its fully ex-

tended position (171 in FIG. 4 and that position illustrated in FIG. 6) the lowermost card of the stack 107 is extended through the slot 166 in the tray 108 and is projected outwardly through the slot 104 in the panel 105 as the issued ticket 31. When the issued ticket 31 is present in the slots 166 and 104, a switch actuator 173 is driven downwardly against the force of a spring 174 as the card 31 contacts the roller 175 mounted at the uppermost end of the actuator 173. When the actuator 173 is driven downwardly, the contacts of a normally closed limit switch 178 are opened to indicate that the card 31 is present in the slot. A latch 178 is provided to prevent a card from being pushed back into the slot 104. This latch 178 is biased upwardly into the path of the card, is cammed so as not to interfere with the advancing card, but catches the trailing edge of the card once it is advanced.

The control circuit for the dispenser 100 is illustrated in FIG. 7. The control circuit includes a pair of 110 volt AC power leads 181 and 182. The limit switch 178 has one of its terminals connected to the lead 181 and the connected to one terminal of a switch 183 which is a remotely controlled switch which is closed in response to a signal generated by the entry of a card into the dispensing area 15. The other terminal of the switch 183 is connected through the winding of a relay 184 to the power line 182. Connected across the switch 183 is a set of normally opened contacts 184-1 of the relay 184 which enables the relay 184 to latch itself in an energized state once the switch 183 is momentarily closed. Other relays, 185, 186, and 187 are provided in the control circuit. The relay 185 is connected in series with the limit switch 141 and normally closed contacts 186-1 of the relay 186 and the switch 178 across the power lines 181 and 182. Normally open contacts 187-2 of the relay 187 are connected across the limit switch 141. Connected across the winding of the relay 185 is the winding of the motor 135. The relay 186 is connected in series with the limit switch 155 and normally closed contacts 185-1 of the relay 185 across the power lines 181 and 182. The normally opened contacts 184-2 of the relay 184 are connected across the limit switch 155, and the winding of the motor 150 is connected across the winding of the relay 186. The winding of the relay 187 is connected in series with contacts 187-1 of the relay 187 and the limit switch 144 between the power lines 181 and 182. Connected across the contacts 187-1 is a remote controlled switch 190 which closes in response to output signals from the clock.

OPERATION OF TICKET DISPENSER

The function and operation of the circuit of FIG. 7 is explained in connection with the logic diagram of FIG. 8. First, a car entering the dispensing area 15 will energize a switch represented at 183 to generate an electrical signal which will pass through a logical OR-gate 191 to an input of an AND-gate 192. As long as there is no card 31 present at this time in the slot 104. the limit switch 178 will be closed and a signal will be present at the other input of the AND-gate 192. Thus the signal from the car entering the switch 183 will pass from the OR-gate 191 through the AND-gate 192 and will energize relay 184 which will latch in the energized condition by feeding back a signal through the OR-gate 191 representing the relay contacts 184-1. The energizing of the relay 184 also causes a signal, represented by closing of the contacts 184-2, to pass through an OR-gate 193 and to enter an AND-gate 194. This signal will normally pass through the AND-gate 194 to energize the relay 186 and the motor 150. If, however, the dispenser magazine is indexing at the time this signal is proceeding, this condition will be represented by the absence of a signal at the negative input of the AND-gate 194 representing a condition in which the contacts 185-1 of the relay 185 are broken. If this is the case, this signal will be stored, as relay 184 will remain energized, until the contacts 185-1 again close indicating that indexing has been completed. When the signal passes through the AND-gate 194 to energize the motor 150, the contacts of the limit switch 155 will close causing a feedback signal to be generated to the OR-gate 193, which keeps the motor running until it has completed a card dispensing cycle. As the motor 150 advances a card 31, the card trips the limit switch 178, removing a signal from the input of the AND-gate 192 to disable the feeding of any more tickets until the ticket 31 within the slot has been removed. The limit switch 178 also supplies an enabling signal to the input of an AND-gate 195 which, when removed by the presence of a card 31 in the slot 104, also disables the indexing operation by disabling the operation of the motor 135. When the relay 186 is energized, indexing of the magazine 101 is also inhibited by a breaking of the normally closed contacts 186-1 of the relay 186 as represented by the feedback loop to the negative input of the AND-gate 195.

Indexing of the magazine 101 is initiated by clock ouput signals represented at 190 which are emitted from the clock 201 (FIG. 1). These clock signals pass through an OR-gate 196 to the input of an AND-gate 197. If the index motor 135 is in its rest position, the contacts of the limit switch 144 will be closed and the clock signal will pass through the AND-gate 197 to energize the relay 187. When the relay 187 is energized, a feedback signal will cause the relay to latch in its energized condition through the contacts 187-1. The relay 187 supplies a signal through its contacts 187-2 which passes through the OR-gate 198 and to the AND-gate 195, where, as long as a ticket 31 is not present in the slot 104, and as long as relay 186 is not energized indicating that a ticket is currently being dispensed, then the signal will pass through the AND-gate 195 to energize the relay 185 and to energize the the indexing motor 135. The energizing of the relay 185, as pointed out above, will disable, through the contacts 185-1, a dispensing of cards while the indexing operation is in progress. When the motor 135 begins to actuate, limit switch 141 closes, causing a feedback signal to be fed back through the OR-gate 198 to maintain the motor 135 in energized condition until the indexing cycle is completed. Also, the actuation of the motor 135 opens the contacts of the limit switch 144, removing the signal from the input of the AND-gate 197, allowing the relay 187 to drop out.

While not shown in the diagrams of FIGS. 7 and 8, appropriate conventional circuitry is provided to cause the entry gate 12, if it is desired, to open upon removal of the ticket 31 from the slot 104. This signal may be derived from the limit switch 178.

DESCRIPTION OF PAY STATION

The pay station which was discussed generally in connection with FIGS. 1 through 3A above is illustrated in

block diagram form in relation to its operating components in FIG. **9.** The pay station **200** includes the clock programmer **201.** Briefly, this clock includes a time of day output **210** to the logic and computing module **203** and a pulse output **209** which is connected to the clock input **103** of the dispenser **100.** The pulse is generated on the output **209** each time the output on line **210** changes from one level to another so that the dispenser magazine **101** will be indexed in intervals corresponding to the time of day. The clock **201** includes means to program the outputs and to thus divide the day up into preselected time periods. For the example illustrated in the last column of FIG. **11,** these indexing pulses will be generated at 6 A.M. and on each hour from 9 A.M. to 7 P.M. Many available commercial clock programmers of this type are suitable for this purpose.

The pay station **200** includes the ticket reader module **202** which is described in detail in connection with FIGS. **11** through **19** below. Generally, the ticket reader **202** reads the ticket **31** which is inserted by an exiting motorist into the pay station, and conveys this information in the form of an electrical signal along a line **214** to the logic and computation module **203.** The module **203** returns a signal to the reader **202** along line **215** to actuate a ticket ejector mechanism which drops the inserted ticket into a bin when the fee has been paid to clear the reader for the next exiting customer. The logic and computation module **203** has an electrical output **216** which communicates an electrical signal representative of the amount due to the display module **204.** The module **203** also will supply a signal to the cash acceptor **205** along a line **218** when the final fee has been paid in its exact amount and the inserted money may be irrevocably accepted by bypassing the return mechanism which will be included in the cash acceptor **205** and depositing the money in a permanent cash receptacle. The cash acceptor **205** includes a coin accumulator **221** which is of any commercial form. An acceptable coin accumulator mechanism for this purpose is Model 10-01 manufactured by National Rejectors, Inc., 5100 San Francisco Avenue, St. Louis, Missouri 63115. The cash acceptor mechanism **205** may also include a dollar bill validator **222** which may be of any commercial type. A suitable one for this is the model Simplex 200, also manufactured by National Rejectors, Inc. It will be clear that either the coin accumulator **221** or the dollar bill validator **222** may be used either alone or together depending on whether their particular application requires or is intended to accept cash in the form of coins or currency or both. The coin and bill mechanisms **221** and **222** will generate appropriate output signals identifying the amounts which they have received along lines **223** and **224** respectively to the logic module **203.** The pay station **200,** as pointed out in connection with the FIG. 3B above, includes a panel **227** which is accessible to the customer. The panel **227** includes a manual amount entry button **228** for a lost ticket which will enable the customer to assess himself the maximum fee due in the event he has lost or misplaced his ticket and thus permit his exiting from the parking area. The panel also includes a coin or cash return mechanism actuator button **229** which enables the customer to return his money prior to the final actuation and acceptance of his payment in the event that he has inserted an improper amount of money. It also includes a coin or change return slot **230** from which change is returned to him in the event he does not have the exact change. The panel also includes all indicating lights to tell him that the change capacity of the machine is exhaust and that exact change is required, or that he has inserted his card in the wrong direction or some other improper operation.

TICKET CODING

The ticket in the preferred form for use in the present system is illustrated in FIG. **10.** The ticket is made of a plastic material such as high impact polystyrene and is in the form of a conventional credit card. According to one aspect of the present invention, information is embossed upon the card and may be in the form of the conventional Addressograph-Multigraph bar code, **301,** as illustrated in the figure. However, this information is not read in the conventional manner, but instead is used to generate a unique code for identification of the twelve time periods corresponding to each of the compartments **102** of the dispenser magazine **101** of FIG. **1.** This code is illustrated in the table of FIG. **11.** The information is read from the card by a pair of sliding switches which are axially displaced in the direction of arrow **302** as the card is inserted into the reader **202** in the direction of the arrow **303.** The switches include feeler fingers which are adapted to scan the cards along two lines **304** and **305.** The feeler fingers of the switches are adapted to engage in the depressions in the underside of the card of the first notch or bar of the code which they contact as they scan along the lines **304** and **305.** These notches which will be engaged are illustrated as notches **307** and **308** in the example of FIG. **10,** and will result in a displacement of the switches by the distances **309** and **310.** The switch mechanism for translating these distances into digital information is explained in connection with the following FIGS. **12** through **17.**

From FIGS. **10** and **11,** it can be seen that the only restriction on the coding **301** is that no notch be present to obstruct the paths **304** and **305** between the position of the desired code notches **307** and **308** and the leading edge **311** of the card **31.** However, beyond these positions, any information may be encoded upon the card without interfering with the reading of the code for the purposes of the present system. Thus, this other information may be used for other purposes. In FIG. **11,** the 10 decimal digits are divided into seven groups (a) through (g). As long as the coding on the card is consistent with digits selected from the groups indicated for the various digit positions, any digits may be used in these positions, and any number of additional digits may be used to the left of the seven digit positions shown. Furthermore, while only two paths **304** and **305** are shown, it is to be understood that more than two paths may be used in some applications, and, with the present coding system, up to five paths are available for use. Of course other codes may be used other than the five position bar code shown.

The selected code is illustrated in FIG. **11** and is employed to uniquely identify any one of 12 numbers. These numbers have been divided into two groups, the first group including numbers **1** through **6** and the second group including numbers **7** through **12.** The groups are identified by the appearance of a bar in the first position of a selected one of the rows **304** and **305,** which in the example of FIG. **10** is the bar **307** in row **304,** which identifies the number as being from, for exam-

ple, the first group of numbers, which includes numbers 1 through 6. The bar 308 identifies the one of the numbers 1 through 6 which is to be selected. As an example, if the card code is to indicate number 12, the code on the card will be as shown in line 12 of the table. The first digit may be any digit having a bit in row 304 (group (a), e.g. number 1). The second through the sixth digits may be any five digits not having bits in 305 (group (e), e.g. 40967) and the seventh digit may be any digit having a bit in line 304 but having no bit in line 305 (group (d), i.e. number 4). The switching circuit which generates the code in the form of an electrical signal is illustrated in FIG. 19, described below.

DESCRIPTION OF TICKET READER

The design and operation of the ticket reader 202 will be best understood by reference to FIG. 12, which shows the ticket reader 202 mounted on the panel 227 of the pay station 200. The reader 202 is mounted to the panel 227 in an inclined orientation and includes a housing 231 having an opening 232 therein for receiving tickets 31 to be inserted upwardly and inwardly through the opening 232 into the reader 202. The opening 232 is closed by a plate 233 which is attached to the housing 231 by a leaf spring 234. In FIG. 12, the plate 233 is shown in its closed position biased upwardly against the under surface of the housing 231. The phantom line 235 shows the plate 233 deflected downwardly to the position which it will attain when a card is depressed against it while it is being inserted by the exiting motorist.

Insertion of the card can better be understood by reference to FIGS. 13 through 15. Referring to FIG. 13, the card 31 is shown with the coded bars 307 and 308 embossed therein. The card reader 202 includes an internal slot 238 which communicates with the opening 232 and which is formed between the parallel guide plates 239 and 240. An ejector finger 241 extends across the slot 238. The finger 241 is spring-biased such that it will be moved against the force of a spring 270 as the card 31 is inserted into the slot 238 as can be seen by reference to FIG. 16. A card retaining latch 243 is provided mounted on the free end of a lever 244 which is pivotally attached at point 245 which is fixed in relation to the plate 240. The latch 243 serves to catch the trailing edge 312 of the card 31 when it is completely inserted into the slot 238 to retain the card in the slot against the force of the spring-biased ejector finger 241. As will be seen in connection with FIG. 16 below, the latch 243 is spring-biased upwardly and is movable downwardly by a solenoid driven link or lever 246 for ejection of the card into a bin when the payment has been made, or may be manually depressed downwardly by the customer pressing upon the plate 233 if the customer wishes to remove his card prior to completion of his payment. A reader plate switch 237 is provided which is tripped by a lever 242 extending from the plate 233 to monitor the position of the plate 233. A front card limit switch 220 detects the initial pressure of the card in the slot 238.

As the card 31 is inserted into the slot 238, the pair of switch actuator fingers 247 and 248, as shown in their rest position in FIG. 13, are held in this retracted position by a card detector finger 249 which is pivotally mounted at point 250 which is stationary with respect to the plate 240 through an abutment surface 251 which acts upon an extension 252 of the bars 253 which carry the fingers 247 and 248. The bars 253 are biased upwardly by springs 275, 276 (FIG. 16), but the abutment 251 is biased downwardly under the force of a spring 255 which is stronger than spring 276 which biases upwardly the levers 253. As the card 31 is inserted through slot 238 to the position shown in FIG. 14, finger 249 is pivoted about point 250 to raise the abutment surface 251 against the spring 255 to allow the fingers 247 and 248 of the levers 253 to be elevated to ride against the lower surface of the card 31. As the card 31 is further inserted into the slot as shown in FIG. 15, the fingers engage in the respective depressions formed by the bar codes 307 and 308. The section of the card 31 in FIGS. 13 through 15 are taken along the line 305 of the card of FIG. 10. The finger 248 is positioned along the line 305, and the finger 247 is positioned along the line 304 (FIG. 10). Thus, as FIG. 15 shows, the finger 247 will drop into the notch 307 and be deflected to the right in the figure as the card is inserted into the slot 238, and, it will be seen that, if the card were inserted further into the slot, finger 248 would drop into the notch of bar code 308 of the card 31 (FIG. 16). Both the fingers 247 and 248 would be deflected to the right to specific positions when the card 31 is fully inserted to the point where its trailing edge 312 would be retained by the finger 243.

Referring briefly to FIG. 17, the relative arrangements of the components discussed thus far will be seen. The lower guide plate 240 has an opening 258 therein through which the feed fingers 247 and 248 may contact the card. Also, the card detecting fingers 249 project through this opening 258. The plate 240 is rigidly mounted by a pair of brackets 259 to the panel 227 of the unit 200. The upper guideways 239 are Z-shaped in cross section and are secured to the plate 240 to guide and retain the card and thus the scan lines 304, 305 in their proper positions in the slot 238. A limit switch 261 is provided which has an actuator 262 projecting into the slot 258 to detect the position of the card when it is fully inserted within the slot 238. Another limit switch 262 is provided beneath the plate 233 to verify that the card 31 has been ejected when the final amount has been paid to thereby insure that the customer has not withdrawn and saved his card for future use upon payment of the amount due. This feature, which will be better understood in connection with the discussion of the electrical and control circuit below, is provided to prevent customers from saving tickets for use on future days where the result would be a reduced fee by using it in place of the proper ticket which may have been issued earlier on the future day.

The mechanical details of the reader and the switch mechanism are illustrated in FIG. 16. The ejector finger 241 is formed of the free end of the lever 266 which is pivotally mounted at one end to a slide bar 267. The lever 266 is spring-biased downwardly by a spring 268 connected in tension between the mid-point of the lever 266 and the slide bar 267. The slide bar 267 is slideably mounted on a pair of guideways 269 which are rigidly attached to upstanding brackets 264, 265 fixed to the plate 240. The slide bar 267 is spring-biased toward the bracket 264 by a spring 270 connected in tension between the bracket and an extension of the slide bar 267.

Fixed side panels 272 of the plate 240 are provided for the pivot point 245 which secures the latch 243 and lever 244. The card eject link 246 is actuated down-

wardly to eject the card by a solenoid 274 attached to a panel 273 of the plate 240. The finger 243 is biased upwardly by the spring of the solenoid 274. The ejecting of the ticket 31 upon the lowering of the finger 243 is illustrated in FIG. 18.

The read finger levers 253 which carry the read fingers 247 and 248 are spring biased upwardly by the springs 275 and 276, respectively, which are attached in tension between the members 253 and a lever guide plate bracket 277. The bracket 277 is fixedly secured to and connected between the side panels 272. Fixed to this bracket is a pair of lever guide plates 278 which retain the levers 253 in contact with a circuit board 280. Connected to the plates 278 is the spring 255 which biases the card detecting finger 249.

Secured to the bracket 277 and guide plate 278 by screws 279 is the double-clad printed circuit board 280 which carries the contacts of the switching circuit. A pivot pin 281 is mounted through the board 280 and has a pair of retaining washers 282 at each end. The finger levers 253 have a slot 283 therein through which the pin 281 extends to mount the levers 253, both pivotally and slideably, to the printed circuit board 280. U-shaped spring clips 284, 285 are fixed to the levers 253 and each has a pair of contacts 286 and 287 adapted to ride on the surface of the printed circuit board and to complete a circuit between an etched strip 288 and a different one of a set of separate etched contacts 289-1 through 289-8 on the PC board 280. When a valid code is presented on a card inserted in the reader 202, the circuit is completed through both of the sets of contacts as will be seen in connection with FIG. 19 below. If no valid code is presented, that is if neither of the switches is actuated to the last position, position 289-1, then no circuit is completed.

Referring to the switch circuit diagram of FIG. 19, the power input terminal 295 is connected to each of the first contacts 289-1, 291-1 of the series 289 and 291 respectively. If either of the contacts 284 or 285 is in contact with this first position, then a valid numerical character is recognized by the energizing of the strips 288 and 290. In the example shown in the figures, the finger 247 in engagement with the bar code 307 causes the contacts 285 to connect the strip 290 to the contact 289-1 and to simultaneously apply the voltage from the contact 295 to both of the strips 290 and 288 which are connected together by the conductor 296. Similarly, the finger 248 which has engaged the bar code 308 causes the contact 284 to connect the contact 291-7 to the strip 288 and thereby to apply this energizing potential to the output line 297-12 of a set of output lines 297-1 through 297-12. The energizing of line 297-12 represents a number 12 and represents a card which has been dispensed from a compartment 102-12 of the magazine 101 of the dispenser 100.

DESCRIPTION OF PAY STATION CONTROLS

As pointed out in connection with the discussion of FIG. 1, the pay station includes a time and amount due computer 203, a display device 204, a cash receiving and crediting device 205, and an output control device 206. Generally, the electrical components associated with the computation module 203 are illustrated in FIGS. 20 and 21. FIG. 20 illustrates the elapsed time computing circuitry, while FIG. 21 illustrates the fee computation circuitry and the associated circuitry for the display module 204. The output control circuitry 206 is illustrated generally in FIGS. 22 and 23, while the cash receiving and control circuitry is illustrated partially in FIGS. 22, 24, and 25. The power supply and wiring associated with the programmer 201 is illustrated in FIG. 26. The interrelation of these circuits will be better understood in connection with the logic and operational discussion outlined in subsequent figures.

Referring to FIG. 20, an elapsed time computing circuit 401 is illustrated. This circuit computes the time period upon which the fee is to be based, and also provides additional means for selecting alternative bases for computing the fee, such as the maximum fee limit, a flat night rate, a lost card maximum fee, etc. The circuit 401 includes a plurality of inputs 402, 12 in number, which connect to the outputs 297-1 through 297-12 of the card reader switching circuit 202 (FIG. 19). The circuit 401 also includes a terminal 403 which is connected to the input of the card reader switch 295, and is provided with a reset output 404 which resets the display and storage circuits 204 to zero. A plurality of fee basis setting outputs are provided. These include a set of twelve time interval outputs 405 and a maximum fee output 406, all connectable to the fee computation circuit (FIG. 21). The circuit 401 is also provided with a fee set control output 407 which controls the actual setting of the fee in the storage counters 204 in accordance with the signals at the outputs 405 and 406.

The circuit 401 is provided with a 36 volt 60 hz input 411 which is connected through a contact 711-2 of a lost card maximum fee control relay 711 (FIG. 22), through its normally closed contact to the common terminal of the card-in limit switch 261 (FIG. 17) of the card reader 202. The normally closed contact of this limit switch is connected through a relay winding energizing circuit 414 to ground. The circuit includes the winding of a relay 415 which, in the normal stand-by position illustrated, is normally in the energized condition. The relay energizing circuit 414 is designed to provide this relay with an approximately 300 millisecond delayed drop-out. The normally opened contact of the card in limit switch 261 is connected through the normally closed contacts 415-2 of the relay 415 (which are illustrated as open) because the relay 415 is normally energized, and to the output 403 which, as stated above, connects through the card reader 202 which in turn closes the circuit between the output 403 and a selected one of the inputs 402, provided a valid card has been read by the reader 202.

These inputs 402 are connected to different sets of contacts on a 12 deck, 24 position stepping switch 420. The first 11 of the contacts 402 are connected each to one of the contacts on each of the decks of the switch 420 in progressively increasing positions on each of the decks. These connections are illustrated by the diagonal conductors 421 in FIG. 20. The 12th input, 402-12, is connected directly to the output 405-5 and is representative of the last time period of the day for which a flat night rate is to apply. The wipers 423 of each of the decks of the stepping switch 420 are each connected to one of the outputs 405. Because only one of the inputs 402 can be energized by the switch 202 at any one time, then not more than one of the outputs 405 can be energized at one time, that one being determined by the position of the stepper switch contacts 423. With the contacts in the position shown, none of the outputs 405 is energized, since no wiper contacts a conductor 421. This condition is representative of a " top-out"

condition, in which every motorist entering prior to the night rate period will be assessed the maximum fee. This condition will occur whenever the one energized conductor **421** is contacted by no wiper **423.**

The wipers **423** are advanced from left to right in FIG. **20** by a stepper relay **424** in response to pulses from the block **201** along the clock output line **210.** The stepper relay automatically recycles from the 24th to the first position upon completeion of the sweep from left to right.

Each of the wiper contacts **423** is connected through the input of an OR-gate **430** which consists of the set of diodes **431** commonly joined at their anodes to a bus line **432.** The bus line **432** is connected through a diode **433** to the set output **407.** When one of the circuits through the stepping switch **420** is completed, a 60 cycle half sine wave output will appear at the output **407.** Similarly, the bus line **432** is connected through a diode to a relay energizing circuit **435** which includes the winding of a relay **436.** The relay **436** provides a "top-out" fee control, a condition represented when the relay **436** is not energized. The relay **436** will be energized by the appearance of a signal on any of the output lines **423** if a contact has been made with any of the lines **421** of the stepping switch **420.** A set of relay contacts, set **436-1,** which is connected to the output of an OR-gate **437** having diode inputs connected from all but the night rate input of the inputs **402.** If the relay **436** is not energized, the maximum output **406** will be energized to indicate that the maximum "top-out" fee is applicable. Also connected directly to the maximum fee output **406** is the normally opened contact of the lost card relay contact **412-2,** connected through the normally opened contact **415-3** of the normally energized relay **415.**

The maximum fee output **406** is connected through a diode **441** to the set output **407** so that pulses will be simultaneously generated on both output lines when the maximum fee applies. A set output is in turn connected through a diode **442** to a relay energizing circuit **443** which includes the winding of a relay **444.** The relay **444** is the fee setting control relay which has connected across it the card in backwards indicator light driving circuit **445** which operates the card in backwards indicator light **236.** This card in backwards indicator light **236** will be lit whenever a card is inserted which does not result in an output of the set output **407.** This condition is monitored through a relay contact **415-4** of the normally energized relay **415.**

The fee computation circuit **501** of the computing module **203** is illustrated in FIG. **21.** This circuit includes twelve inputs **502-1** through **502-12** which connect directly to the outputs **405** of the time computing circuit **401.** An input **503** is provided which connects directly to the maximum fee output **406** of circuit **401.** The inputs **502** and **503** are connected through a diode matrix **505** which converts the input signal from a single one of the lines **502** or **503** to a three-digit digital output on the lines **506, 507** and **508.** The matrix **505,** as illustrated, is set up for computing fees based on a rate scale of 25 cents per hour with a maximum fee of 3 dollars for a day. It will be seen that, in the embodiment illustrated in FIG. **21,** the fee scale may be set up on any basis which utilizes fees which are an even multiple of 5 cents.

The digital outputs from the lines **506–508** are stored for display and future computation on three two deck, 10 position rotary switches **511–513,** respectively. The display **204** is driven by outputs (not shown) from these switches **511–513.** The circuits of the switches **511–513** connect the switches in a decrementing counter type circuit in which the switches are set to an initial digital number representative of the fee due as generated by the diode matrix **505.** The decrementing counter circuits also operate to recompute the balance due as cash is inserted into the pay station **200** by subtracting the amount deposited from the amount displayed on the switches.

The hunt circuit function which sets the counters **511–513** to their initial values is provided by the circuits **515–517** respectively. When the set relay **444** (FIG. **20**) is energized, the contacts **444-1** through **444-3** will energize. Simultaneously, the pulses from the set output **407** of the circuit **401,** which output is connected to the set input **520** of the circuit **501,** proceed through the diodes **521** through **523** of the circuits **515–517** respectively and through the coils **524–526** of the switches **511–513** respectively, and through the transistors **528–530** respectively to ground. This causes the counters **511** through **513** to be pulsed and stepped in a clockwise direction through the application of the 60 cycle half wave rectified signal on the set input **520.** The energizing of the relay contacts **444-1** through **444-3** connects the wipers of the first decks **511-1** through **513-1** of the switches **511** through **513** to the base circuits of the transistors **528** through **530** respectively. These base circuits include transistors **531** through **533** which have their bases connected to the normally opened contact of the relay contact sets **444-1** through **444-3,** and their collector emitter paths connected across the base emitter paths of the transistors **528** through **530.** When any one of the switches **511–513** is in a position in which its wiper contact is connected to an energized one of the inputs **506–508,** then the respective transistor **531–533** is energized to render the associated transistor **528** through **530** nonconductive. This condition breaks the circuit from the set input **520** through the respective counter coil **524–526** and causes the stepping of the switches **511–513** to stop when the switch has achieved the position which displays the amount due as presented on the outputs **506– 508** of the diode matrix **505.** By inspection of FIG. **20,** it will be seen that the set signal input at input **520** to the circuit **501** is of limited duration and is controlled by the delayed drop-out of 300 milliseconds of the relay **415.** During this time delay, sufficient pulses have been transmitted through the set input **520** to insure that all of the switches **511–513** have been stepped enough times to advance them to their proper positions to display or store the amount due.

It will be seen that the switch **513** has logically only two positions, a zero position and a five position.

When the counters **511–513** have stored the amount due, the counters may be decremented to subtract any amount paid from the amount or balance due stored in the counters **511–513.** The signals which cause this subtracting function are applied through a subtract input **541** which is connected through a diode **542** in series with the coil **526** of the counter **513.** Each of the pulses at the input **541** represents a payment in the amount of 5 cents toward the balance due. As will be explained below, all coins deposited into the cash receiver **205** will be converted into a number of pulses representative of their nickle equivalent. (As a practi-

cal manner, currency deposited will operate directly in the reduction of the amounts stored in the dollar digit column on the counter **511.**) Each 5 cent pulse entering the input **541** causes the counter **513** to rotate one position. Each time a zero position is engaged, a transfer digit signal is transmitted along the line **544** which connects between the wiper of the second deck **513-2** of the switch **513** and an input diode **545** which is the equivalent in the circuit **516** of the diode **542** in the circuit **517.** This causes the five cent pulse from the input **541** to be transmitted through the switch deck **513-1** and the line **544** to energize the winding **525** associated with the switch **512** to decrement the switch **512** by one digit. Similarly, when the counter **512** is in a zero position, this condition is monitored through the switch deck **512-2** which has its zero contact connected through a line **547** and through an input diode **548** which is circuit **515**'s equivalent of the diodes **545** and **542.** This causes the five cent pulse which has been transmitted through the diode **545** of circuit **516** to further pass through the wiper contact of the deck **512-2** and the line **547** and the diode **548** to energize the relay **524** and decrement the counter **511** by one digit. When the total amount has been paid, the zero conditions of the switches **511-513** are detected by the circuit which will be described in connection with FIG. **23** below.

Circuitry is also provided to reset the counters **511–513** to their zero positions without depositing money. This reset circuit includes a reset line **550** which connects through a diode **561** to a reset input **562** which is connected from the reset output **404** of the circuit **401.** The reset line **550** is connected to the non-zero switch positions of the second decks **511-2** and **512-2** of the switches **511–412,** and **512,** the gating circuit of an SCR **351** connected between the "five" contacts of the first deck **513-1** of switch **513** in series with the coil **526** of the counter **513.** In this manner, the half wave rectified pulses which are output from the output **404** of the circuit **401** operate to advance the switches **511–513** to zero in exactly the same manner that the switches **511–513** were set to a non-zero position. The pulses on the reset input **562** are present whenever a card is absent from the card reader as indicated by the switch **261** of FIG. **20.**

Other conditions which operate to reset the counters **511–513** to a zero indication are applied through the circuit **571.** This circuit includes a pair of parallel connected relay contacts including contacts **571-1** of a relay **572** (FIG. **23**) and contacts **573-1** of a relay **573** (FIG. **22**). These relays operate to clear the counter at the occurence of each "vend" condition, that is whenever a transaction has been completed which results in a customer being permitted to leave the parking area, as represented by the new relay **572,** and by a "cancel sale" condition which results when a customer has changed his mind during the course of a transaction by depressing the cancel sale push button on the panel of the pay station.

Referring now to FIG. **22,** the coin counting circuit **601** is illustrated. This circuit generates the 5 cent equivalent pulses by closing contacts of a relay **602** (FIG. **24**). These pulses are converted to electrical signals through a circuit which includes the contacts **602-1** of the relay **602** to apply the pulse signals to the output terminal **603** which is connected to the input **541** of the circuit **501** (FIG. **21**). The circuit **601** includes three limit switches **605-1, 605-2,** and **605-3,** which are physically contained within the coin accumulator mechanism **221.** These switches are physically positioned so that they will be tripped in different combinations depending on whether quarters, nickles, or dimes are deposited into the coin accumulator slot **211** (FIG. 3A). As is symbolically shown by the OR-gates **606-1** through **606-3,** the depositing of a quarter results in a momentary closure of the switches **605-1** and **605-2.** Similarly, the depositing of a dime results in a closure of the switches **605-2** and **605-3,** while the depositing of a nickle results only in the closure of switch **605-3.** These switches are connected each between a **35** volt DC source **607** and an input circuit **609** of a parallel to sequential pulse converter circuit **610.** The circuit **610** converts simultaneous pulses appearing at its input terminals **611-1** through **611-5** into a pulse train having a number of sequential pulses equal to the number of parallel pulses at the different inputs **611.** Specifically, the depositing of a quarter results in a pulse being applied to each of the five inputs **611,** the input **611-2** being energized by the switch **605-2** and the inputs **611-1** and **611-3** through **611-5** being energized by closure of the switch **605-1.** Similarly, the depositing of a dime closes the switches **605-2** and **605-3** to energize the inputs **611-2** and **611-1** respectively. The depositing of a nickle energizes only the terminals **611-1** through the closing of the switch **605-3.** The operation and details of the circuit **610** are illustrated in FIG. **24.**

Referring briefly to FIG. **24,** the circuit **610** includes a power supply **631,** a free-running oscillator circuit **632,** and five identical memory channel circuits **633-1** through **633-5.** Each of the memory channel circuits **633** includes one of the input terminals **611,** an output terminal **634,** a pulse storage circuit **635** which stores a pulse input at the input terminal **611** until the circuit is triggered in such a manner as to cause it to transmit this pulse to its output **634,** and a gating circuit **636.** The gating circuits **636** of each of the circuits **633** are connected through the lines **638-1** through **638-5** in a circular shift register form. One of the circuits **636,** and only one, is energized at any instant of time. When power is first applied, the first of these circuits, **636-1,** is energized through a start circuit **641** by a signal from the oscillator **632.** Shift pulses generated at an output **642** of the oscillator **632** are simultaneously sent to trigger inputs **643** of each of these circuits **636.** The shift pulses cause the energized one of the circuits **636** to de-energize, and the next consecutive circuits **636** to energize by the transfer of a signal along the line **638.**

The oscillator circuit **632** is a conventional unijunction relaxation oscillator circuit which operates in a free running mode to generate a series of pulses at its output **642** from the base-one terminal **645** of its unijunction transistor **646.** The frequency of these pulses is determined by the RC circuit **647.** The values of the resistor and capacitor components of the circuit are selected to provide pulse frequency outputs which can be selected at two levels, one at six pulses per second and a second at 35 pulses per second. The selection is achieved by the position of the relay contacts **650-4** of a relay **650** (FIG. **23**). When the contacts **650-4** are closed, the frequency is at six pulses per second, which frequency is used to operate a change return mechanism as will be pointed out below. In this position, a resistor **651** is shunted across a second resistor **652** to provide the lower frequency operation of the oscillator

632. When the contacts 650-4 are opened, the resistor 651 is out of the circuit, and the oscillator 632 will free run at the higher frequency of 35 pulses per second which establishes the rate at which the series of pulses will be emitted from the circuit 610 at its output relay 602.

The output consists of a reed relay 602 which has one terminal of its winding connected to all of the outputs 634 of the circuit 633 and the other terminal connected to a +24 volt DC supply.

The storage circuits 635 each includes a pulse storage relay 661 which is energized by the application of a pulse to the input 611. When the relay 661 energizes, it latches itself through its contact 661-1 to store the pulse, and the normally closed contacts 661-2 open. When the associated shift register circuit portion 636 of the circuit 633 is energized, an SCR 662 becomes conductive, causing a momentary ground to be applied on line 663, which causes the relay 661 to drop out. This causes the normally closed contact 661-2 which opened when the relay 661 energized, to remake, generating a positive pulse, which causes a transistor 664 to momentarily conduct, grounding the output 634 and momentarily energizing the output relay 602. In a similar manner, as the shift register circuit 636 operates to scan the circuit 635, all of the pulses will be sequentially generated at the relay 602.

Referring to FIG. 23, the circuit illustrated operates in conjunction with the circuit 701 of FIG. 22 to perform an AND-gate function which permits a vending operation to occur only when the counters 511–513 simultaneously approach a zero reading as the result of cash being deposited into the cash receiver. This function is performed in the coincidence circuit 801 of FIG. 23 which samples the zero positions of the counters 511–513 at its inputs 804, 802, and 803 respectively to energize the relay 650. The energizing of the relay 650 is logically AND-ed with the counter decrementing pulses at another gate input 805. The input 805 is connected to the output 603 of the circuit 601 of FIG. 22. The inputs 802–804 are connected to the zero position contacts of the first decks 311-1 through 313-1 of the counter switches 311–313.

The circuit 801 includes a series circuit consisting of an SCR 811, a transistor 812, transistor 813, and the winding of the relay 650. The gate of SCR 811 is connected through a circuit to the input 802 of the circuit 801, and the bases of transistors 812 and 813 are similarly connected through circuits to the inputs 803 and 804 respectively. The inputs 802–804 will be energized when the switches 511–513 read zero, and in this condition the devices 811–813 will be conductive in a manner which will energize the relay 650. The energizing of the relay 650 causes its set of contacts 650-1 to assume a position indicated in the figure. Upon the energizing of the relay 650, a pulse is generated to the capacitor 821 and applied to the base of a transistor 822. This transistor is connected in series with the winding of the relay 572 and a transistor 823 between a +35 volt DC line and ground. The input 805 which carries the counting pulse signals is connected through a storage circuit 825 to the base of the transistor 823. After each pulse at the input 805, the transistor 823 will be rendered conductive for a short period of time thereafter. If, during this time, the relay 650 energizes, the pulse transmitted through capacitor 821 to the base of transistor 822 will cause a current to flow which will energize the relay 572 which constitutes the vend control signal discussed in connection with FIG. 22. The output of the second AND function is the energizing of the relay 572. This output is again logically AND-ed in the circuit 701 of FIG. 22.

Referring again to FIG. 22, the output circuits which perform the function of block 206 of FIG. 12 are illustrated. The ultimate output function of the pay station (at least in connection with the FIG. 3A embodiment herein described) lies in the raising of the gate 14 to allow the motorist access to the exit ramp 13 once he has paid the amount due for the time he has parked. This function is ultimately obtained through the closing of the relay contacts 473-1 which energize the gate raising circuit. The output circuits, however, provide additional functions primarily in the form of safeguards which prevent motorists from cheating the system by causing the gate to be raised without the depositing of the total amount due while simultaneously returning a portion of the customer's money to him. Further circuitry is provided which insures that the gate will be raised once the parking fee has been paid.

Toward these ends, the relay 473 is connected in series with the normally opened relay contacts 572-4 of the relay 572 (FIG. 23), and a parallel circuit consisting of the normally opened contacts 711-3 of the lost card relay 711 and the normally opened contacts 263A of the card drop switch 263. The drop card solenoid 274 is connected in parallel across the winding of a coin drop relay 713. This parallel winding circuit is connected in series with the normally opened contacts 572-2 of the vend control relay 572 (FIG. 23) across 120 volt AC power leads 771 and 772. Thus, the raising of the gate by the actuation of relay 473 can only occur when both the coin drop solenoid 713 and the card drop solenoid 274 are energized, and the card has actually been retained by the pay station as verified by the card drop switch 263 (FIG. 17). Alternatively, in lieu of the actual detection of the dropping of a card by switch 263, vending may occur provided the lost card relay 711-3 has been energized.

A change refunding circuit 721 is provided which includes a relay 722 which is included in the coin accumulator mechanism 221 and operates in response to a series of pulses which count out the number of nickles to be returned to the customer in change. The winding of the solenoid 722 is connected in series with a pair of transistors 723 and 724 across the DC power leads 725 and 726. The base of the transistor 723 is connected to the vending circuit 701 so that change can only be returned when a vend control signal is executed, thereby preventing customers from exhausting the change of the pay station without actually paying for parking privileges. The transistor 724 has a base connected through a time delay circuit 728 to a normally opened conact 650-2 of the relay 650 (FIG. 23). The normally closed contact 650-2 of the relay 650 is connected to the output 603 of the circuit 601. The common terminal of the contact set 650-2 is connected through the normally opened contact 602-1 of the 5 cent pulse generator relay 602 (FIG. 24), which is connected through the normally closed of the contacts of the set of contacts 573-4 of the relay 573 and through the normally closed position of the contacts 473-2 of the vend relay 473 to the positive DC line 725. By this circuit, prior to vend, a signal in the form of a series of pulses is generated by the closing of the relay contact 602-1 and the series of

pulses is communicated to the normally closed contact of the set **650-2** to the output **603** of circuit **601** to apply counting pulses to the input **541** of the circuit **601** of FIG. **21.** By reference to FIG. **24,** it will be noted that the frequency of these pulses is at **35** pulses per second during this time period. At the instant the counters **511-513** (FIG. **21**) read zero, the relay contact **650-2** will switch as will be explained in connection with the discussion of FIG. **23** below. At the same time, the contacts **650-4** (FIG. **24**) switch to change the pulse rate frequency from 35 pulses per second to 6 pulses per second, and these pulses are applied to the base of the transistor **724** to energize the relay **722** at a low frequency required for the change dispensing mechanism.

The lost card relay **711** is connected in series with a front card switch **220** and the lost card push button switch **228** between DC lines **725** and **726.** The relay **711** is provided with latching contacts **711-1** which cause the relay to latch in its ON condition once the push button **228** is depressed. The breaking of the latching state of the relay **711** is achieved by the insertion of a card into the card reader which opens the switch **261** to de-energize the relay **711.** The latching contacts **711-1** of the relay **711** are connected in series with the resistor between the junction of the push button **228** and the switch **261** and the junction of the relay contact sets **602-1** and **573-4.** A coin return coil **752** is connected in parallel with the winding of the relay **573** to the normally opened contact of the coin return push button switch **229.** This normally opened contact is also connected to the normally opened contact of the set of contacts **573-2** which forms a holding contact of the relay **573.** The common terminal of the set of contacts **573-2** is connected in series through the normally opened one of the set of contacts **650-3** of the relay **650** to insure that all counters will reset to zero when the coin return button is depressed. The bent coin return solenoid **751** is connected between lines **771** and **772** through the normally closed contacts of the front plate switch **237** and the normally closed contacts **572-2** of the vend relay **572.** This circuit prevents the accepting of coins when the customer has his finger in the card slot, and also will return coins in the event of a power failure.

The use correct change indicator light **225** is connected across the parallel lines **771** and **772** through the normally opened contacts of the coin change slot empty switch **775.** The normally closed contact of the switch **775** is connected through the normally opened position of the contacts **722-1** of the change refund conrol relay **722.**

Rferring to the present **25,** the circuitry employed when the bill validator is used with the present system is illustrated. The bill validatory **222** energizes a relay **980** upon recept of a valid dollar bill. Also provided is an SCR gating circuit **981** having an input **982** which connects to the zero contact of the hundreds switch **511,** point **984** (FIG. **21**). This circuit **981** gates an SCR **988** connected in series with the contacts **980-1** of relay **980** between plus 35 volt DC and the coil **524** (point **986** of FIG. **21**). The gating circuit **982** derives its power from point **987** of the AND-gate of FIG. **23.** Also, a contact set **980-2** of the relay **980** is provided at input **805** of FIG. **23** to connect a plus **35** volt pulse to the AND-gate of that circuit to replace the pulse from the coil counter.

Referring to FIG. **26,** a power supply is illustrated which is a conventional power supply suitable for generating the power required to operate the circuits described above. In addition to this power supply **901,** the stepper relay circuit for the stepper relay **424** (FIG. **20**) is illustrated as connected in series with a rectifier **902** and a programmer switch **903** across a 36 volt AC output of the power supply. The programmer switch **903** is momentarily closed by the clock programmer **201** to generate the pulses to the stepper relay **424.** The switch **903** is ganged to a switch **904** which constitutes the clock output to the ticket dispeners **100** which causes the indexing of the dispenser magazine **101.** The programmer drive includes a synchronous drive mechanism which operates through the widning **905** connected across the 60 cycle 120 volt AC in both leads.

PAY STATION OPERATION

The function and operation of the pay station, including particularly the function of the circuit as set forth in FIGS. **20–26,** are symbolically set forth in the logic diagram of FIG. **27.**

Referring to FIG. **27,** the clock-programmer **201** is illustrated with its pulsed output **211** provided for connection to the dispenser **100** input **103,** and its output **210** connected to the input of the stepper relay **424** which maintains the stepper switch **401** in constant synchronization with the time of day. An AND-gate **1001** represents the coincidence of three conditions, (1) that the lost card relay **711** is de-energized, (2) that the back card switch **261** is de-actuated, indicating that no card is present in the card reader, and (3) that an AC signal is present on the line **411.** The output **1002** of the AND-gate **1001** is therefore normally in the ON state and the relay **415** is normally energized. When either a card is inserted in the reader or the lost card switch is depressed, the relay **415** will drop out after a 300 millisecond delay. If a card is inserted, and prior to the dropping out of the relay **415,** a signal will pass through the AND-gate **1003** and thus through the OR-gate **1004** to energize the maximum fee line **406.** If the back card switch **261** is energized, a signal will pass through the AND-gate **1005** as long as the relay **415** is still energized, to the line **403** in the input **295** of the reader switch circuit **202.** The card will be read and a signal will be output to the stepper switch inputs lines **402.** If information has been read from the card, the signal will be output on one of the stepper switch output lines **405** and will pass through the OR-gate **907** to energize the "top-out" relay **436** which indicates that the maximum fee does not apply. If the relay **436** does not energize, the signal will pass through the AND-gate **910** if the relay **415** is still energized, and through the OR-gate **1004** to signify a maximum fee on the line **406.** The maximum fee line **406** and the output of the OR-gate **907** are both connected through an OR-gate **912** to generate a set output signal to the set line **407,** and to energize the set in relay **444.** If there is no signal on line **407** and the relay **415** is energized, the card in backwards light **236** will be lit.

The signals on the lines **405** from the stepper switch **401** are fed through the diode matrix **505** to generate the coded amount due signals on the lines **506–508,** which are input to the counter switches **511–513** respectively. The set pulses on line **407** will pass through the OR-gates **915** of the hunt circuits **515–517** and through the AND-gates **916** and the OR-gates **917** to

step the counters 511–513 to the set value. When the switches 511–513 have attained their set value, a coincident signal is fed back along the line 921 which represents the first deckds of the switches and into the output of an AND-gate 922 as the set relay 444 is energized, the signal will pass through the AND-gate 922 and disable the AND-gate 916, blocking the pulses from the AND-gate 915 to stop the counters 511–513 to their predetermined positions in accordance with the outputs of the diode matrix 505. Similarly, signals on the reset line 550 will pass through the AND-gates 917 to set the counter to zero and the counters are stopped in their zero positions by signal from the zero switch position of the switches 511–513, which disables the AND-gates 924 to block the reset pulses. The pulses out of the OR-gates 917 represent the energizing of the counter coils 524–526.

Amounts paid are subtracted from the counters 511–513 by the 5 cent pulses which pass through the line 541 into the OR-gate 915. Since this occurs after the relay 415 has dropped out, there is no signal present on line 407 and the relay 444 is de-energized so that there is no signal present out of the output of the AND-gate 922 to disable the AND-gate 916. Thus, the signal pulses from the line 541 pass through the OR-gate 915, the AND-gate 916, the OR-gate 917 to energize the coil 526 and decrement the switch 513. This pulse 541 passes only directly into the circuit 517. The pulse is allowed to pass through the other circuits 515 and 516 only as a transfer bit is generated along the transfer lines 544 and 547 respectively to engable the AND-gates 931 and 932 respectively.

The 5 cent pulses on the line 541 are generated by the circuit 610 as explained in detail above. The frequency of the pulses output from the circuit 610 are controlled by the counter zero relay 650 which is energized by the AND-gate 801 which generates an output signal when the counters 511–513 are all in their zero position. The output of the circuit 610 is the pulser relay 602.

The ultimate operations of the control circuit include, most importantly, the opening of the gate represented by the operation of the gate solenoid 473, which also causes the light of the fee paid light 225 on the panel, the coin drop operation represented by the actuation of the coin drop solenoid 713 which drops the money deposited by the customer irretrievably into a cash box within the unit, the coin return operation in which this cash is alternatively returned to the customer in the event his sale is cancelled as represented by the actuation of the coin return solenoid 752, and an additional coin return solenoid 751 which, when deactuated, allows the coins to pass directly through the unit without being counted and returned to the customer. This solenoid is de-actuated if the power of the system were to fail or the system were otherwise inoperative, and finally the change refund solenoid 776 which returns nickles one at a time to the customer as change. Tracing the operation through the system, when all of the counters have reached zero a zero signal passes through the AND-gate representing circuit 801 to actuate the zero signal solenoid 650, which signal is differentiated by the capacitor circuit 821 and then AND-ed again with the cash pulses from line 541 in the AND-gate circuit 701 to energize the vend relay 572. This signal is AND-ed again in AND-gate 944 with either the card drop signal 263 or the lost card relay output 711 to close the gate relay 473 and actuate the fee paid light 225. The pulse signals 541 occur only when the gate relay 473 is de-energized, the cancel sale relay 573 is also de-energized, and the counter zero relay 650 is de-energized. When the relay 650 is energized, these pulse signals are used to actuate the change return relay through line 945 and the AND-gate circuit 721 where they will energize the change relay 722 only when they occur simultaneously with the vend signal from the vend relay 572. The change signal from the relay 722 passes through an AND-gate 948 to energize the change refund solenoid 776 as long as the change empty switch 775 is de-actuated. The actuation of the switch 775 will also illuminate the change empty light 226 on the panel.

The maximum fee relay 711 becomes energized whenever the lost card push button 228 is pushed, which passes a signal through the OR-gate 951 and the AND-gate 952. This relay latches through an AND-gate 953 as long as the cancel sale relay 573 has not been energized or the gate solenoid 473 has not been energized, both of which relays serve to break the holding circuit and erase the maximum fee 711 from the memory. The front card plate switch 237 also serves to break the holding circuit through the AND-gate 952 to cancel the maximum fee from the memory. The coin return relay 751 is normally energized and holds itself through the AND-gate 961 unless the cancel sale push button 229 is depressed or the front card plate switch 237 is depressed or the vend relay 572 is actuated. When any one of these conditions happens, or if power is to fail, coins which are deposited will be returned to the customer. Depression of the cancel sale push button 229 also generates a signal through an AND-gate 963 as long as the vend relay 572 is de-energized, which causes the total amount paid to be returned to the customer through actuation of the coin return solenoid 573 which will latch and hold itself through the AND-gate 966 unless the counter setting of zero is represented by the energizing of relay 650. This comparison with the zero setting prevents the customer from diverting his money into the cash return slot during the vend operation.

In the foregoing detailed description, an automatic variable fee charging system is described which accomplishes the general objectives of the present invention and realizes general advantages over system of the prior art, particularly in reliability, cost, and simplicity of design. From the embodiment illustrated, certain other advantages are realized. Particularly, a system is provided utilizing reusable precoded cards which provide advantages over prior systems when used in fully automated parking applications, and in addition also provides great utility in attended parking systems where an attendant collects the money and makes change for the customers. In such an application, this system can be used to provide security to the garage management in accounting for the cash which the attendant handles. For example, the system may be used to store the accumulated total of the computed amounts due.

Part of the simplicity and reliability of the system is derived from certain features in the control system. One feature is in the employment of a step-down counter which operates in a manner which provides the many counting and storage functions while avoiding a requirement for additional storage registers. Another

feature resides in utilizing an electronic pulser to supply counting signals to step-down the register at one frequency while using another frequency output from the same pulser to count out change.

Another feature lies in subtracting the paid amount from the plurality of digit counters counting down serially but setting the counters in parallel from line frequency pulses.

Another advantage derives from the ability to apportion variable fees on a non-uniform basis over, say, a day. For example, it may be desired to charge more for the first few time periods a customer parks than later time periods. Also, it may be desired to charge at a different rate at peak periods, say, at mid-day. This flexibility is provided by the combination of a diode board which can be easily charged, and the programmer which steps the stepping switch of the computer and indexes the dispensing magazine. By varying the three parameters, the diode board, the dispenser programming, or the reader computer programming, virtually any charging scheme may be attained.

What is claimed is:

1. An automatic fee computing system for a parking facility comprising:

a. a clock;

b. a ticket dispenser including

1. an indexable storage magazine having a plurality of ticket storage compartments,

2. each of said compartments corresponding to a different period of time,

3. each of said compartments containing a supply of tickets encoded with identifying information unique to the supply of tickets within that compartment,

4. means for selecting the one of said compartments corresponding to the reading of said clock, and

5. means for dispensing a ticket from said selected one of said compartments;

c. ticket reading means including

1. a ticket reader for deriving the encoded identifying information from a received ticket, and

2. means for comparing the derived information with the output of said clock and for generating a signal from the result of the comparison in accordance with the time elapsed between the dispensing of the ticket and the real time of said clock; and

d. means responsive to said comparison signal for transforming the elapsed time information into a monetary fee.

2. An automatic fee computing system according to claim **1** further comprising:

cash receiving means; and

means for signalling the receipt of said monetary fee by said cash receiving means.

3. An automatic fee computing system according to claim **2** further comprising:

said ticket dispensing means being adapted to dispense a single ticket to each customer entering a parking area; and

means responsive to the acknowledgement of said fee for authorizing the customer's deparature from the parking area.

4. An automatic fee computing system according to claim **3** wherein said ticket receiving means includes means for receiving cash as payment of the monetary fee and in response thereto authorizing the departure of the motorist from said area.

5. A system according to claim **3** wherein;

said acknowledging means is in the form of a ticket issuing means which issues a receipt ticket to the customer; and

said system further comprises a receipt receiving means for releasing the customer from said parking area.

6. A system according to claim **1** wherein said ticket reader comprises:

means for edgewise receiving an embossed card;

a plurality of switches, each including two sets of contacts, one set including a plurality of contacts and the contacts of one set being movable with respect to the other;

a plurality of feeler means, one connected to each of the movable sets of contacts, and each positioned with respect to the card receiving means to scan the surface of the inserted card along different paths, and each adapted to engage a depression in the surface of said card encountered along said paths so that the fingers, once engaged in the depressions, will be displaced by the insertion of said card so as to move the movable set of contacts connected to the feeler to position the switch to compelte a path between a unique pair of contacts of the different sets;

some of the contacts of each of said sets corresponding to unique items of information, and others of the contacts corresponding to different ones of the switches, the unique information contacts of each of the switches being connected in series with the contacts of other switches corresponding to that given switch.

7. A system according to claim **6** wherein the information encoded upon the cards is conventional bar coded decimal information.

8. An automatic parking system comprising:

a clock;

a supply of reusable pre-coded tickets including plural groups of tickets, each group corresponding to a different period of time;

each of the tickets of any given group being encoded with identifying information unique to the tickets within that group;

a ticket dispenser,

said ticket dispenser including means for storing separately each of said groups of tickets, and means controlled by said clock (means) for selectively dispensing a ticket from the one of said groups which corresponds to the period of time indicated upon said clock;

a ticket reader for reading the information encoded upon said ticket;

means for comparing the information with the time indicated upon said clock to compute the time elapsed between the dispensing of the ticket and the time indicated by the clock;

means for computing a monetary feed based upon said elapsed time computation;

cash receiving means; and

means for indicating the receipt of said monetary fee by said cash receiving means.

9. A system according to claim **8** wherein said reading means includes a code reader comprising:

means for edgewise receiving an embossed card;

a plurality of switches, each including two sets of contacts, one set including a plurality of contacts and the contacts of one set being movable with respect to the other;

a plurality of feeler means, one connected to each of the movable sets of contacts, and each positioned with respect to the card receiving means to scan the surface of the inserted card along different paths, and each adapted to engage a depression in the surface of said card encountered along said paths so that the fingers, once engaged in the depressions, will be displaced by the insertion of said card so as to move the movable set of contacts connected to the feeler to position the switch to complete a path between a unique pair of contacts of the different sets;

some of the contacts of each of said sets corresponding to unique items of information, and others of the contacts corresponding to different ones of the switches, the unique information contacts of each of the switches being connected in series with the contacts of other switches corresponding to that given switch.

10. A system according to claim **9** wherein the information encoded upon the cards is conventional bar coded decimal information.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,775,593 Dated November 27, 1973

Inventor(s) Carl K. Gieringer, Vernon T. Kleimeyer
Thomas J. Schinner, and Paul A. Singer

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 27, line 32 before "tickets" insert

-- reusable --

Signed and sealed this 23rd day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents