# United States Patent [19]

**Robbins**

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[45] **Nov. 5, 1974**


[54] **BILL ACCEPTING MOTOR FUEL DISPENSING APPARATUS**


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[73] Assignee: **Tokheim Corporation,** Fort Wayne, Ind.



[22] Filed: **Feb. 15, 1972**

[21] Appl. No.: **226,406**

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 84,320, Oct. 27, 1970, abandoned.

[52] **U.S. Cl.** ..... **194/13,** 222/2

[51] **Int. Cl.** ..... **G07f 13/02**

[58] **Field of Search** ..... 194/5, 13; 222/2



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,285,381 | 11/1966 | Robbins | 194/5 |
| 3,357,531 | 12/1967 | Romanowski | 194/13 |
| 3,360,094 | 12/1967 | Romanowski | 194/13 |
| 3,469,741 | 9/1969 | Bickford | 222/2 |
| 3,550,743 | 12/1970 | Rothchild | 194/13 |
| 3,570,644 | 3/1971 | Booth | 194/5 |
| 3,587,808 | 6/1971 | Romanowski | 194/13 |



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[57] **ABSTRACT**

A fuel dispensing apparatus which is operable through a series of manual and automatic events, to deliver exactly one dollar's worth of fuel in response to the deposit of a valid $1 bill. The deposit initiates the testing of the validity of the bill, the posting of the credit and prevents a further deposit. Manual actuation of a locked approval means and of a control lever to "on" position resets the computing register, activates means to supply fuel to the nozzle and prevents further operation of the resetting means. Manual operation of the nozzle will start the flow of fuel. Delivery control means is driven in time with the cost register, reduces the flow rate when the credit approaches zero, and stops flow when it reaches zero. The control means then resets automatically to its initial position and the bill acceptor is conditioned to process another bill. If another bill is deposited, the acceptor is again disabled and another delivery can be made, without approval and control lever actuation, by merely opening the nozzle. Additional $1 deliveries can be made in the last described manner until the control lever has been returned to its initial position but thereafter, the approval and "turn on" acts must be repeated to secure delivery.

A modified form enables a limited number of dollar bills to be deposited at the outset of a dispensing operation, instead of a single bill, and permits the predetermined amount of fuel to be dispensed without interruption.


**52 Claims, 20 Drawing Figures**

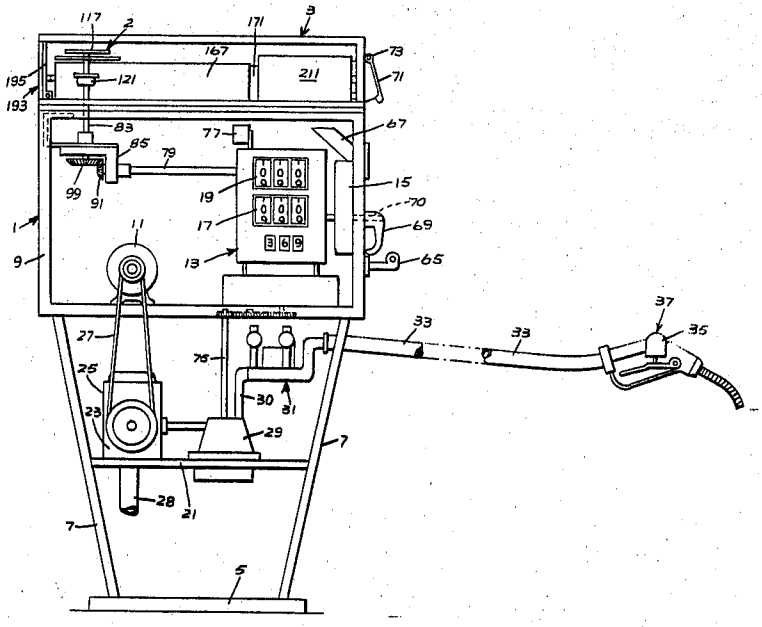


FIG.1

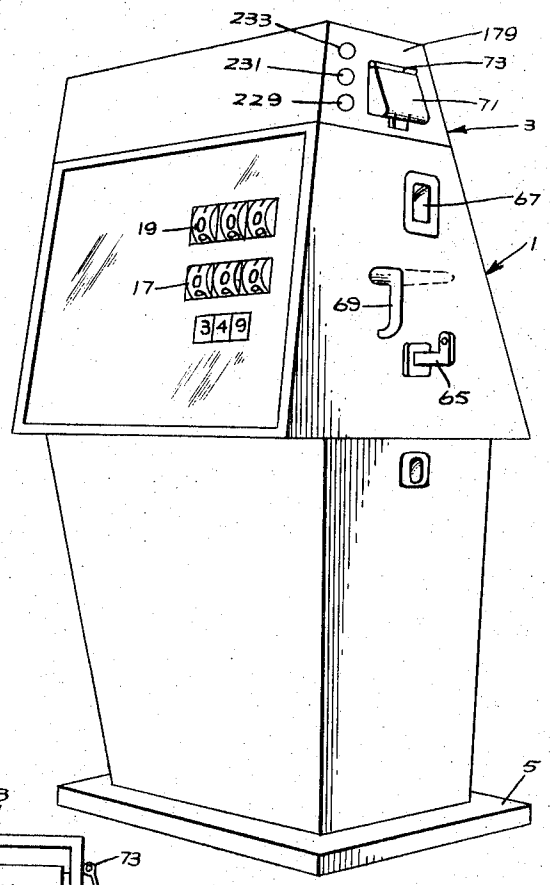
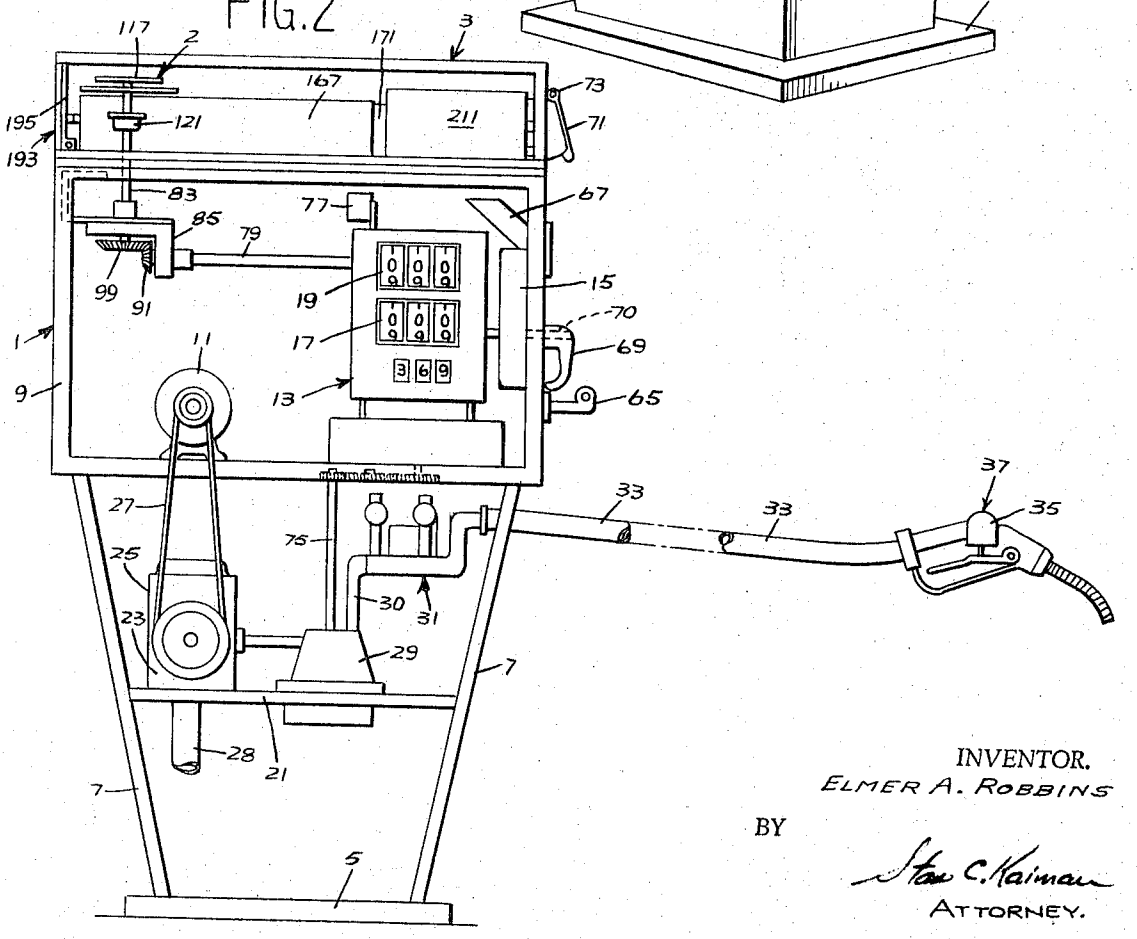



FIG.2

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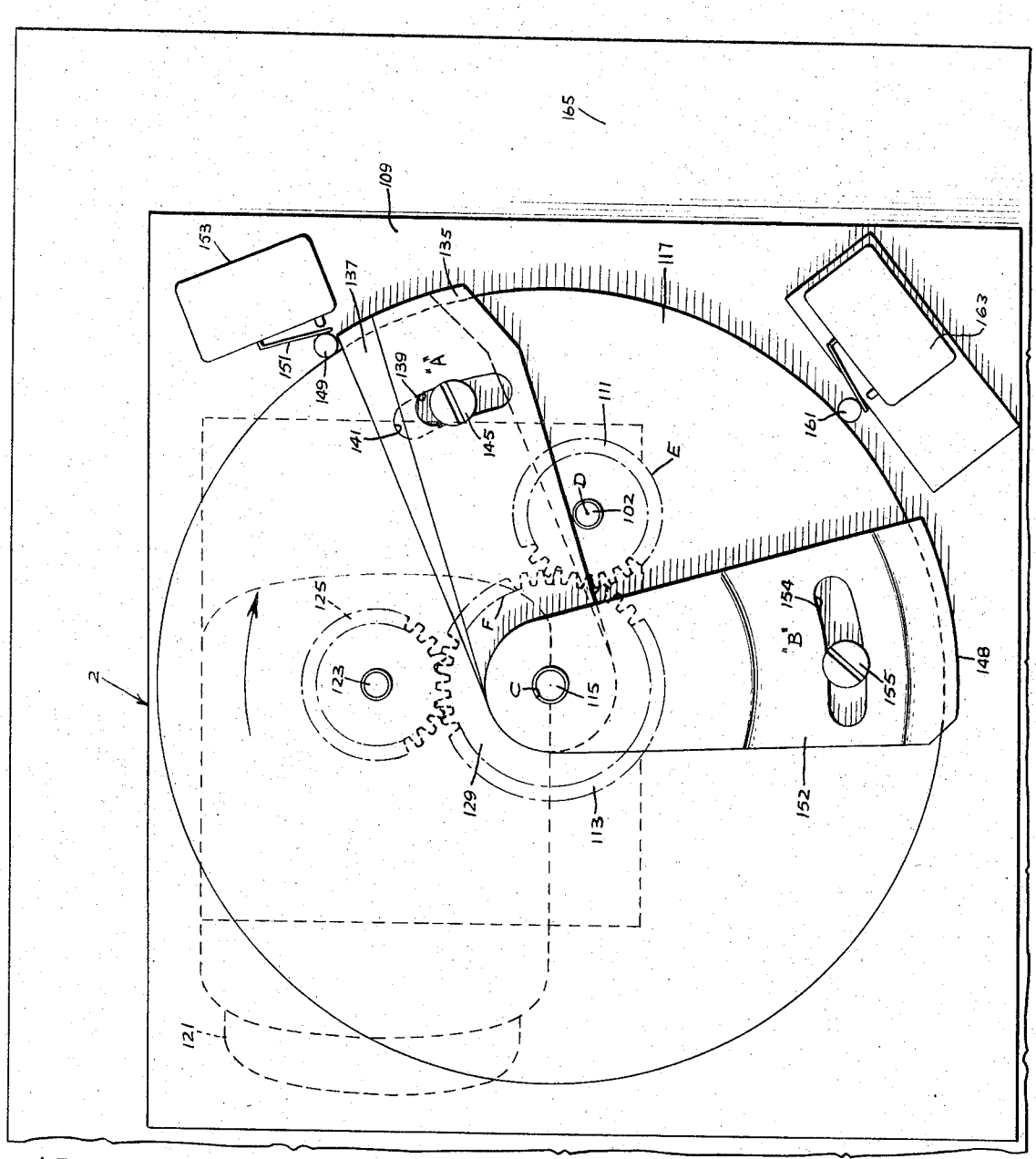


FIG5

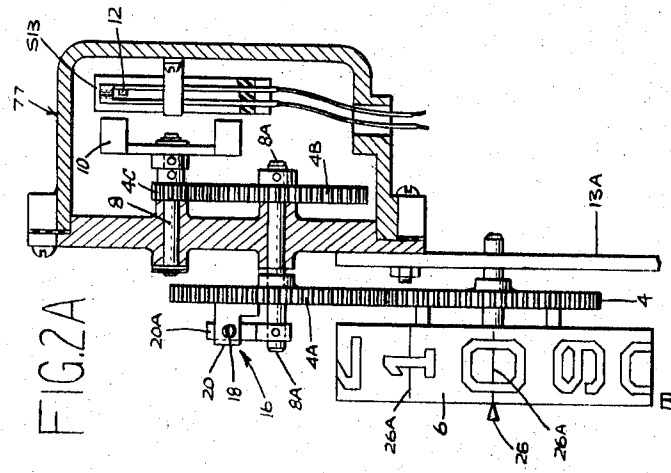


FIG.2A

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FIG.3.

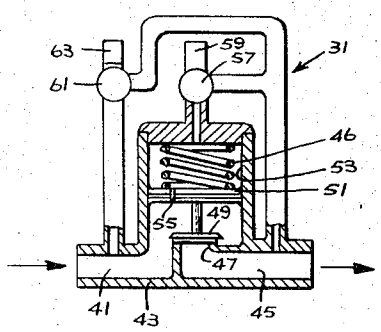



FIG.4A

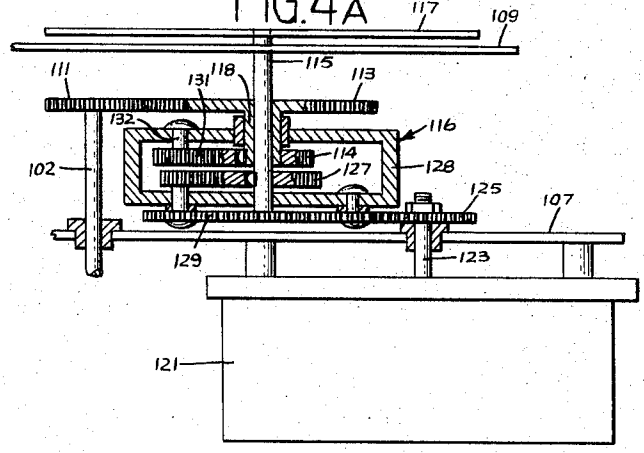



FIG.6

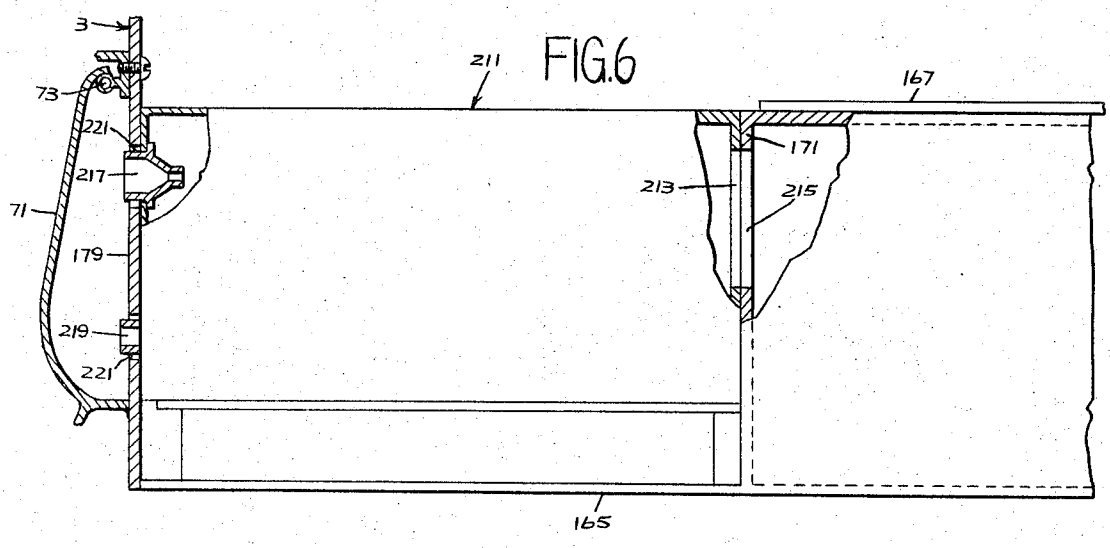



FIG.10

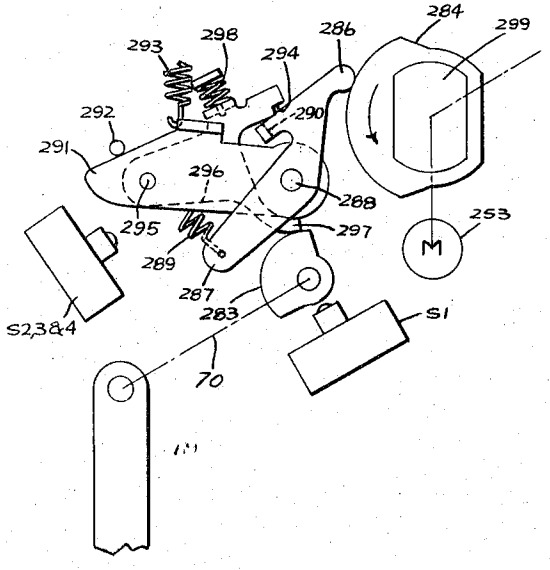
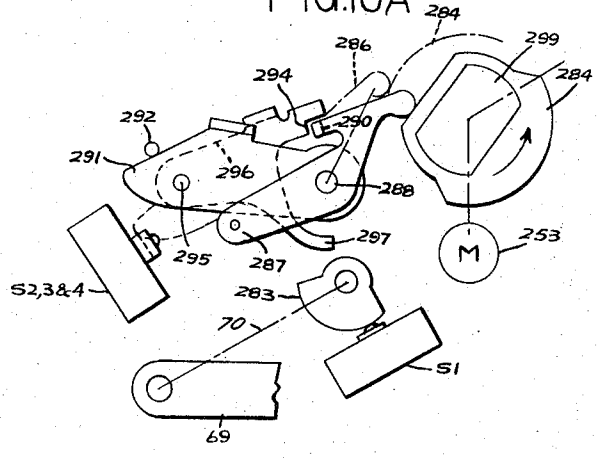



FIG.10A

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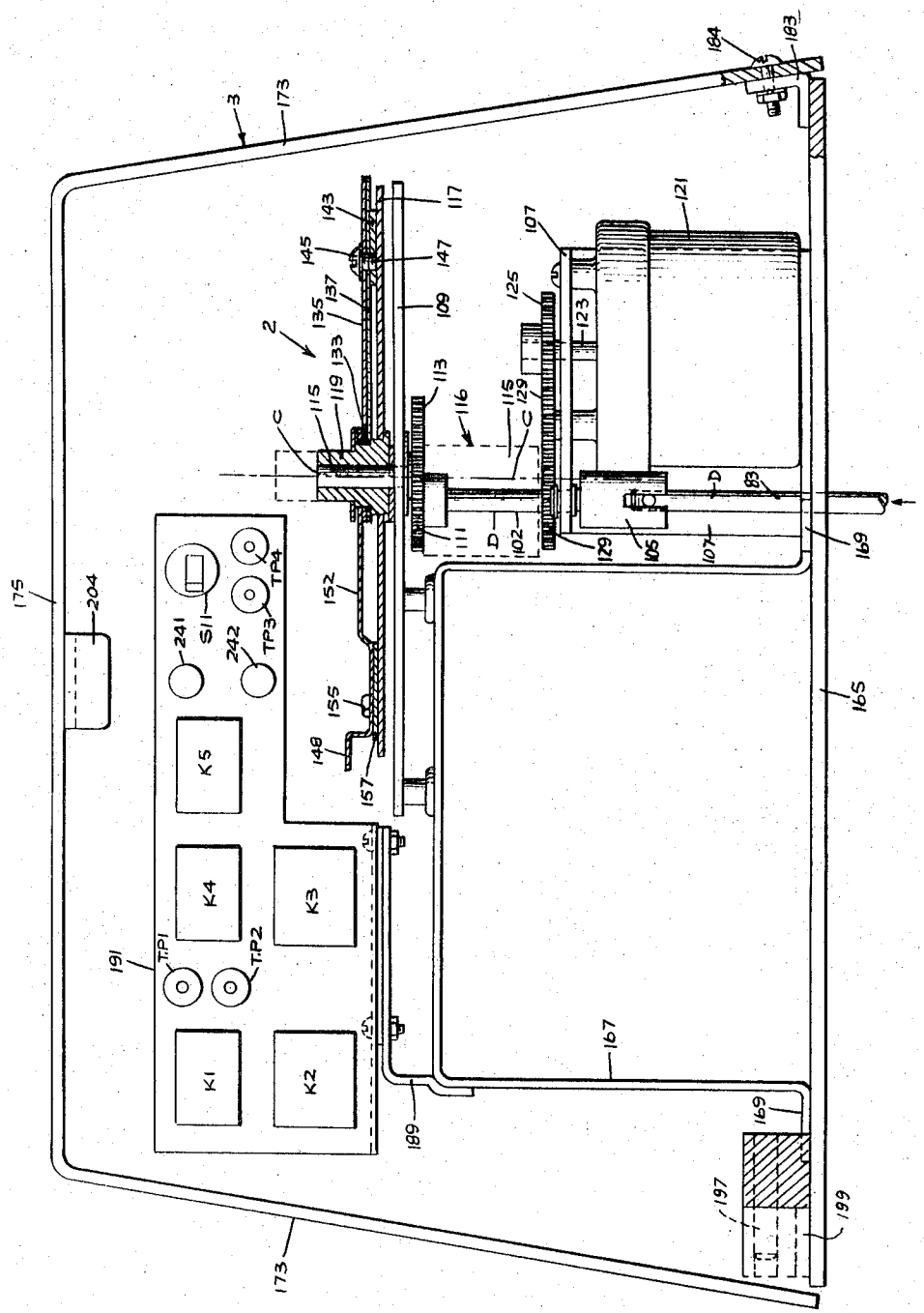


FIG.4

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FIG. 7

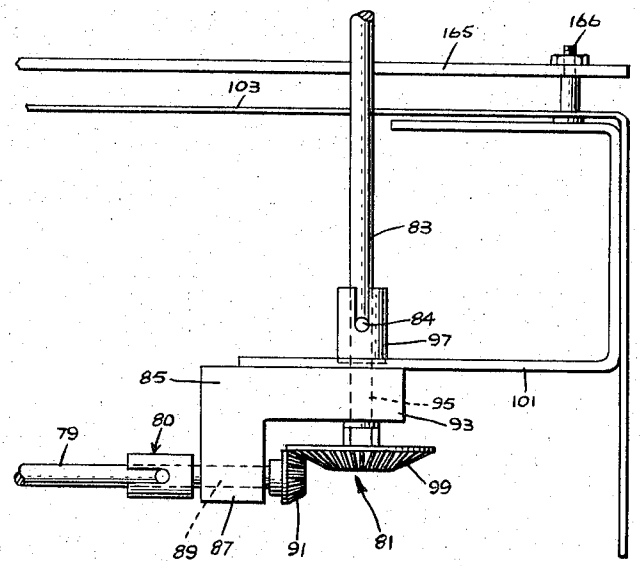


FIG. 8

FIG. 8A

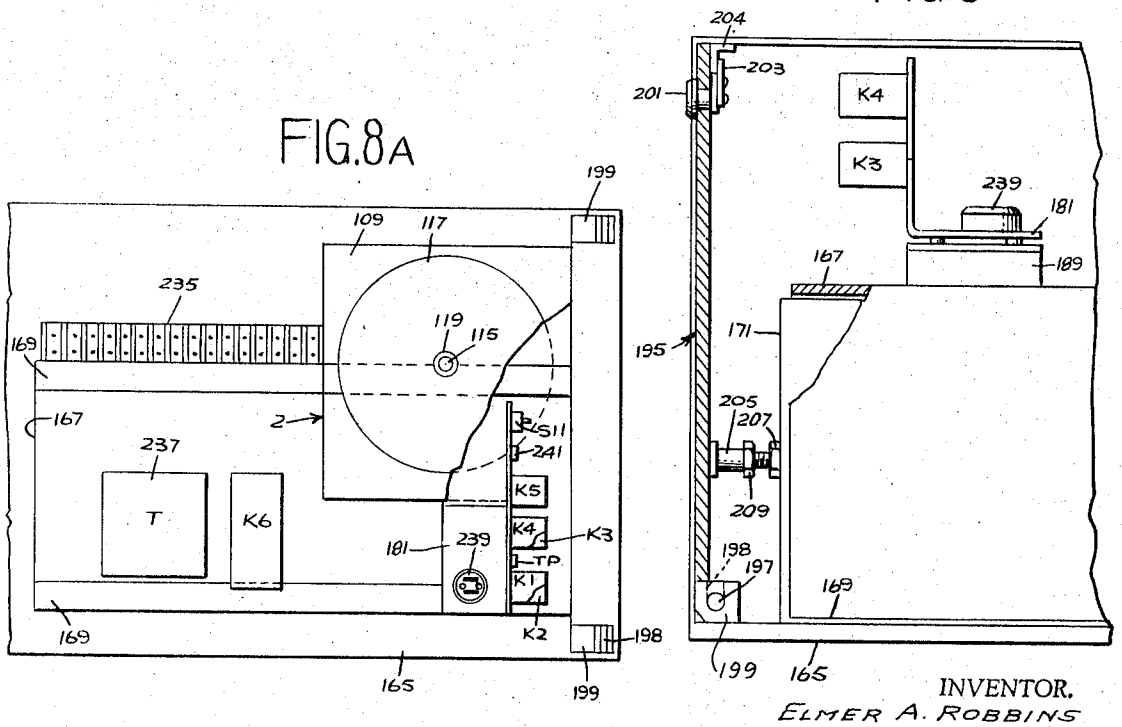


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FIG. 9A

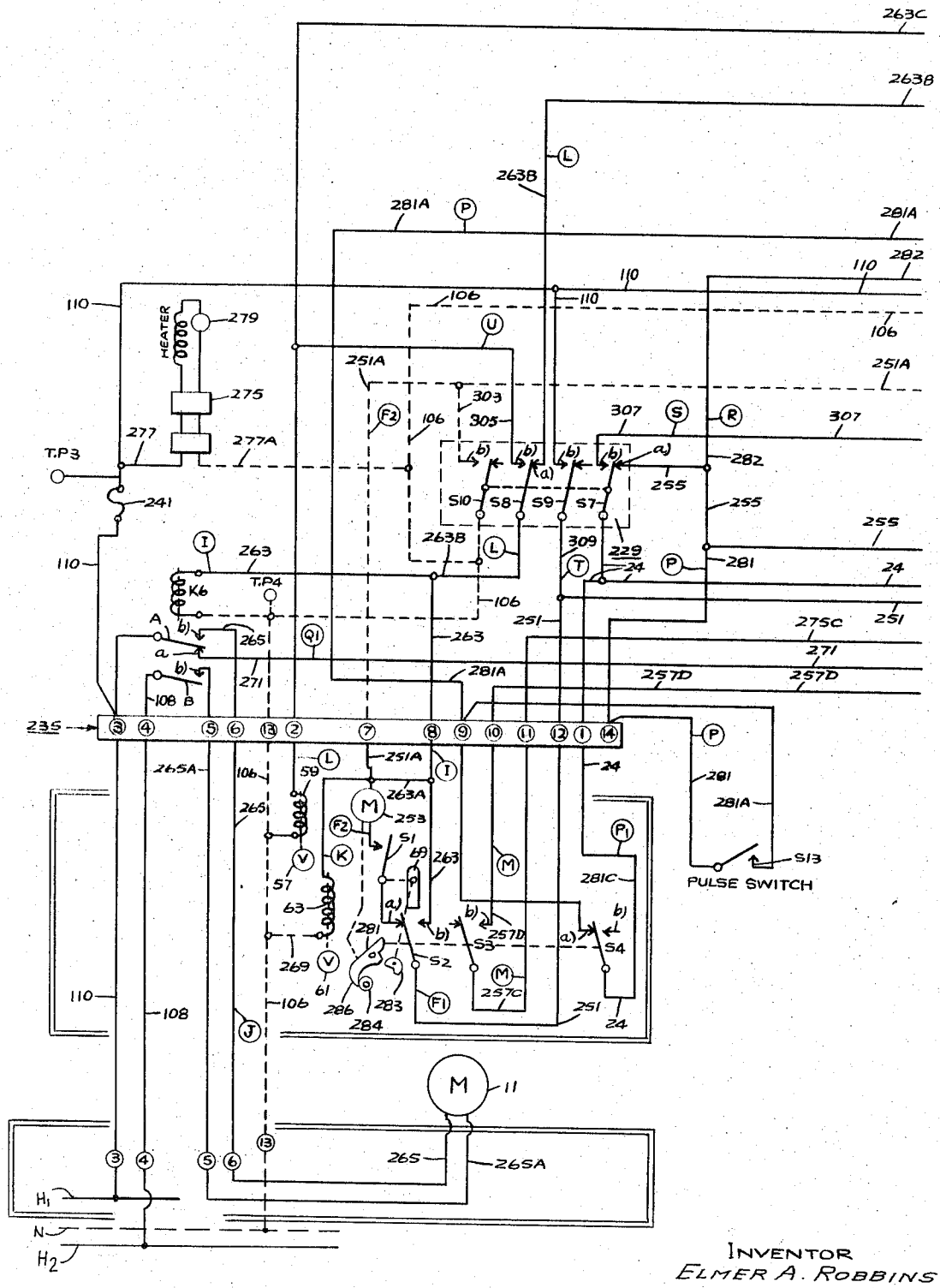


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FIG. 9B

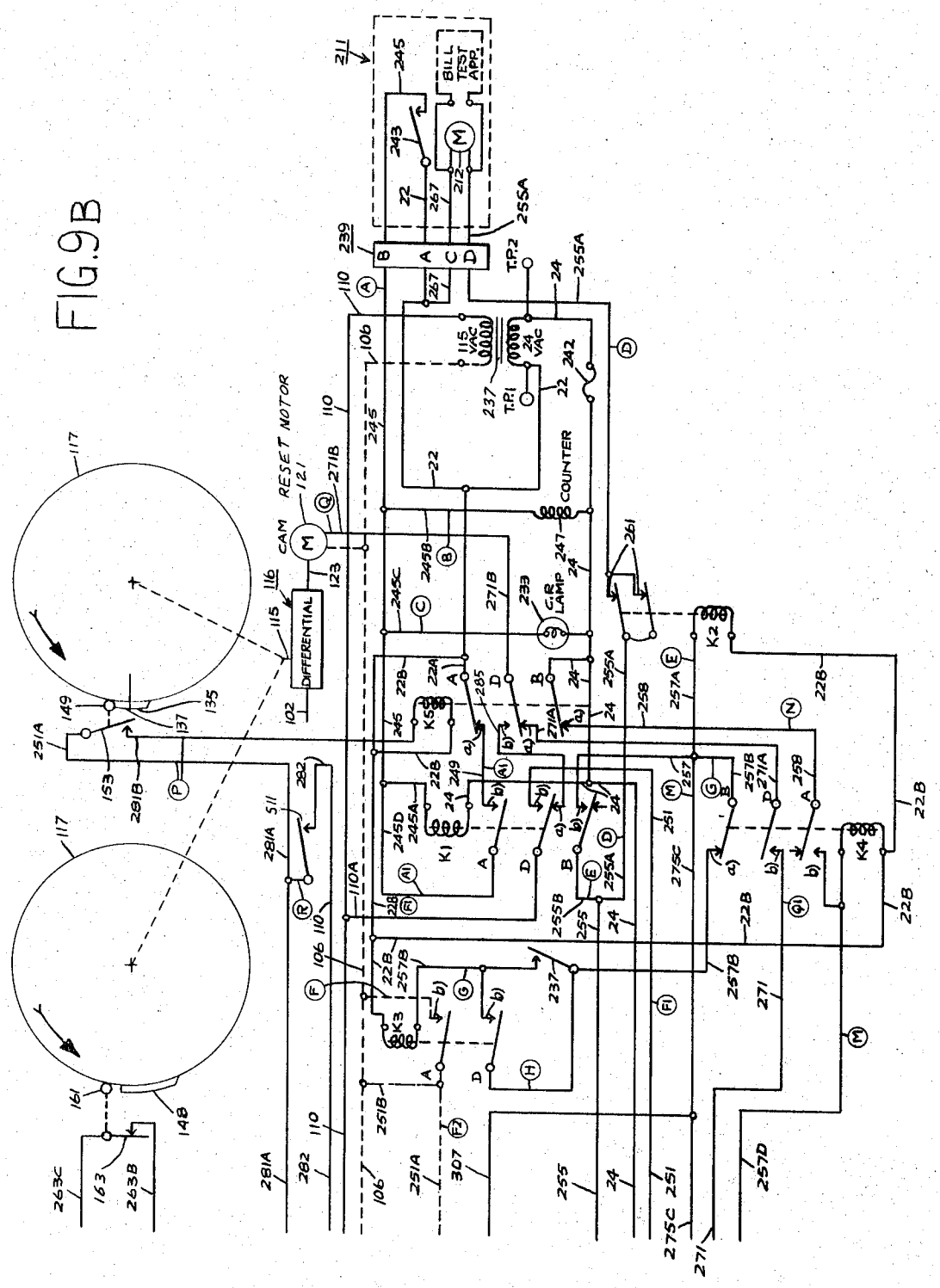


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Fig. 11

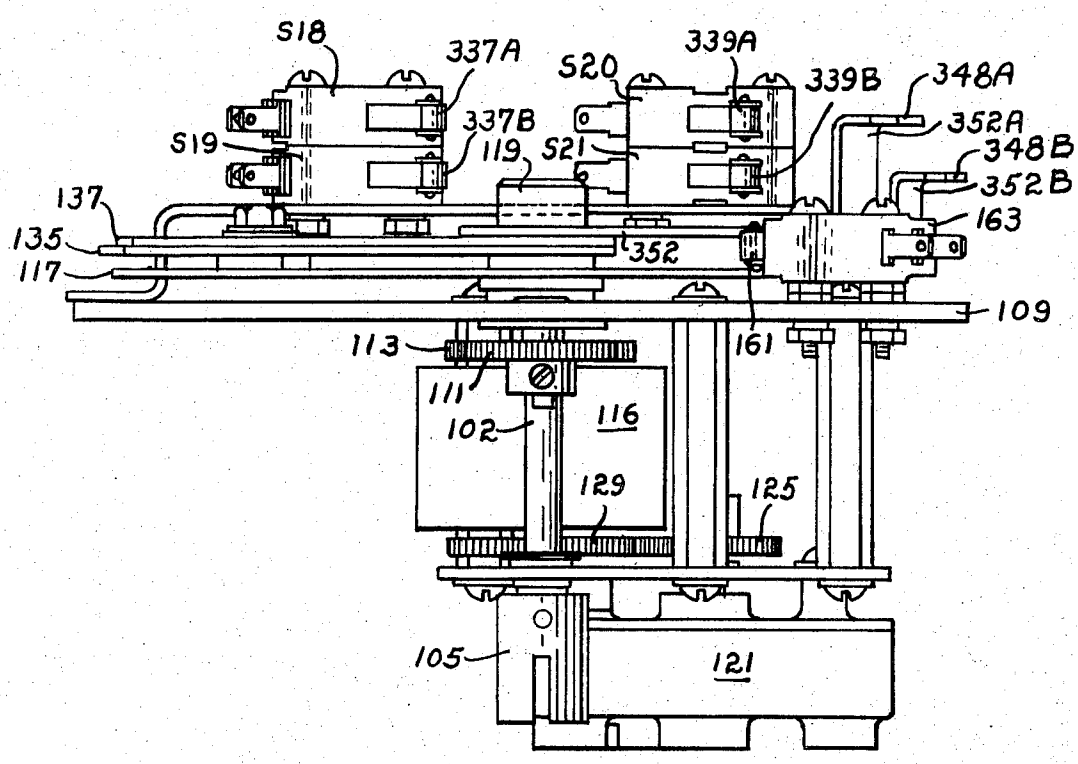


Fig. 13

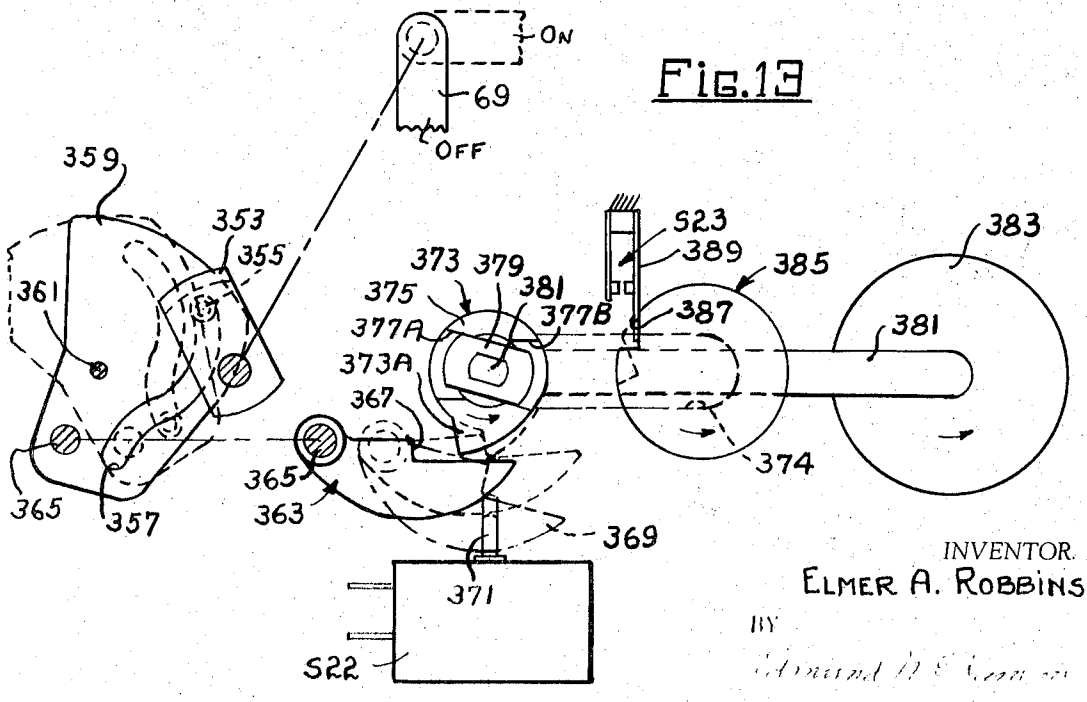


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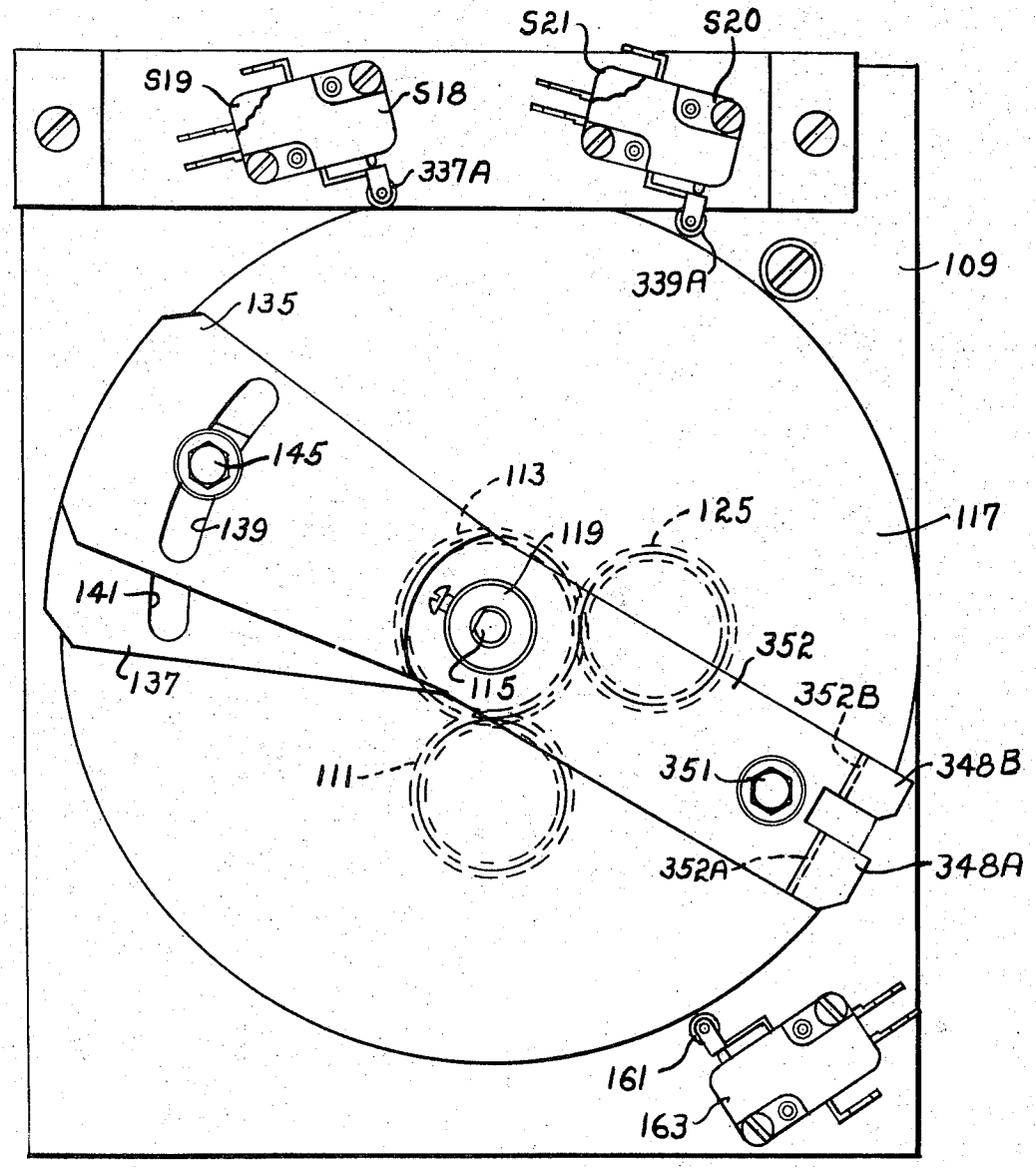
Fig.12

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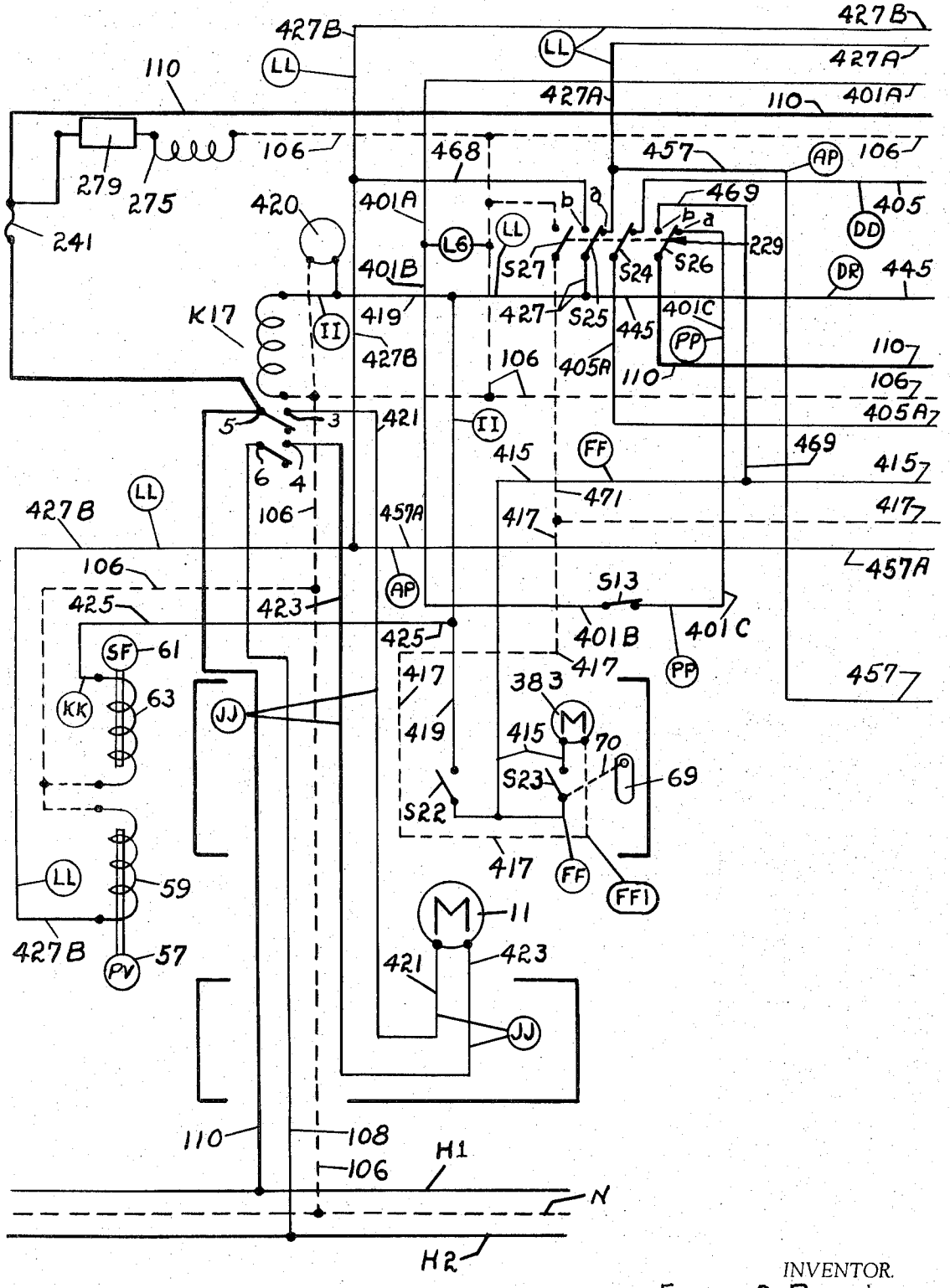


Fig. 14

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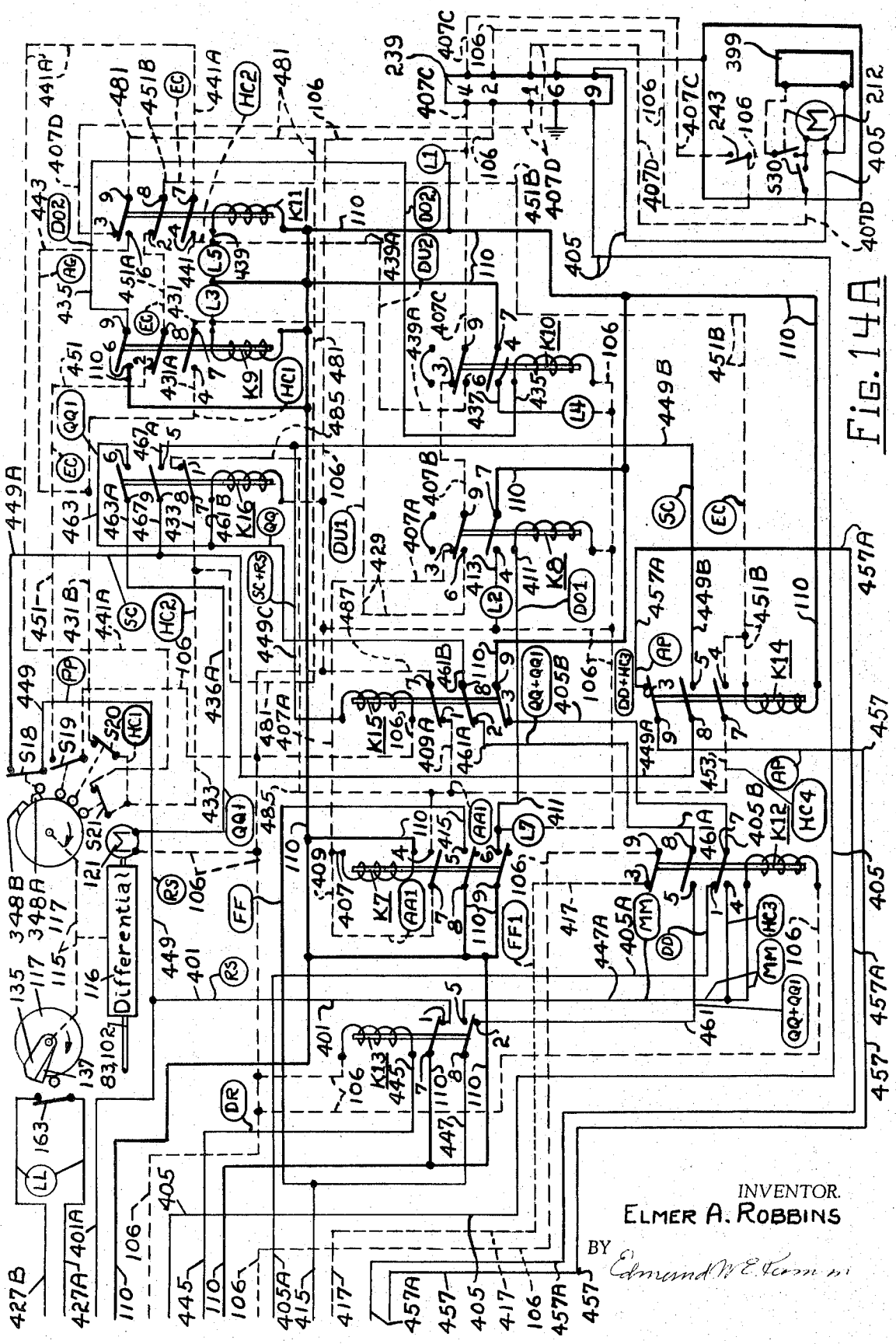


FIG. 14A

# BILL ACCEPTING MOTOR FUEL DISPENSING APPARATUS

This application is a continuation-in-part of Applicant's Ser. No. 84,320 now abandoned, filed Oct. 27, 1970, for Bill Accepting Motor Fuel Dispensing Apparatus.

## BACKGROUND OF INVENTION

Various forms of money operated dispensing devices appear in the prior art, most of which are coin operated. In recent years, the increase in fuel price, shortage of coins and other factors have virtually obsoleted such devices and have spurred the development of bill accepting and validating machines. Such devices are basically electric and electro-mechanical in nature and are subject to the rather stringent, explosion proof construction requirements of Underwriters Laboratories, Inc., when they are used in hazardous areas. At this time, it is impractical, if not impossible, to build a bill acceptor which is "explosion proof". The obvious alternative is to build the dispenser, in which the bill acceptor is to be used, so that the latter can be located in an "ordinary" (non-hazardous) space, as such space is defined by U. L. regulations. One such space exists above the island of the usual filling station. It extends upwardly from a level which is 48 inches above the service floor, which is usually the driveway of the station. The dispenser lighting equipment such as the fluorescent lamp tubes, ballast, starters, wiring, etc., have been installed, for years, in this particular ordinary space to avoid the necessity for and the cost of rendering them explosion proof, and the validator and its associated equipment, including the stop control apparatus, are located in this space, in the dispenser described herein, for the same reasons.

Another problem related to money operated dispensers is that of securing accurate termination of a prepaid delivery. Whereas, in the near past, delivery terminating within the final nickles worth was acceptable, this tolerance has been reduced to the last half cents worth. The problem has been magnified by the fact that since the price per gallon of fuel has increased materially, the normal speed of operation of the cents decade has increased materially, which in turn makes it more difficult to secure an accurate stop of a delivery. A novel solution for this problem is disclosed herein.

Another problem is posed by the requirement by some fire prevention authorities that no delivery may be made from a dispenser without the supervision of a qualified attendant. The requirement has usually been met by providing a key locked "approval switch" which has to be manually closed, momentarily, by the attendant before the dispenser can be turned on and used by a customer and the dispenser is again locked up as soon as the nozzle is returned to its support. Such a system is not particularly objectionable in a dispenser which provides a credit mechanism capable of establishing credit to an amount which approximates the value of the fuel wanted by the customer. The mechanisms needed to store varying and relatively large amounts of credit are relatively complex and expensive, as are bill acceptors for validating multiple denominations of bill. Marketing studies have indicated that the usual purchase is one dollars worth, hence it is not logical to provide a variable credit bank or a multidenominational validator. However, it is necessary to provide some means to enable a customer who wishes to fill up his tank, to do so with a minimum of delay. Accordingly, provision is made to accept a series of one dollar bill deposits once the first transaction has been approved.



In view of the above information, it will be seen that one object of the invention is to provide a dollar bill operated dispenser which has a high degree of flexibility of operation.

Another object of the invention is to provide such a dispenser at a reasonable cost.

A further object is to provide a dispenser of the kind described which will deliver exactly a dollars worth of fuel upon the deposit of a valid dollar bill.

Yet another object is to provide an apparatus which prevents an initial delivery, upon establishment of a first credit, until a manual act of approval has been performed and until the registers have been reset to zero by another manual act.

Yet another object is to provide an apparatus which will permit additional deliveries to be made in response to additional bill deposits, without performing the acts of approval and resetting, so long as the dispenser has not been restored to its initial condition.

A further object is to provide a dispenser in which the resetting of the registers and the initial delivery of fuel is prevented until the manual act of approval is performed, even though a credit has been established.

It is also an object to provide a dispenser which will prevent the deposit of an additional bill as soon as previously inserted bill is accepted, and which will permit another deposit only after an existing credit has been exhausted or cancelled.

Another object of the invention is to provide an apparatus which resets the stop control mechanism upon the exhaustion of credit or upon the restoration of the dispenser to its initial condition.

Still another object is to provide a stop control mechanism which includes a pulser, to terminate dispensing exactly as the prepaid delivery is completed.

A further object is to provide means for resetting the pulser to its initial position each time the money register is reset to zero.

Yet another object is to provide a dispenser which is settable so as to operate upon the deposit of a bill or to operate in the normal manner, and in which means are provided to reset the stop control means to its initial condition each time the dispenser is turned off, when it is being used in the normal manner.

Another object is to provide a receptacle to receive all accepted bills, together with a register which is advanced by one unit each time a credit is established on the dispenser.

A further object of the invention is to provide a modified form of dispenser which comprises means for accepting a small number of $1 bills at the start of the dispensing cycle and means for dispensing such prepaid amount without automatic interruption of the delivery except when the total amount has been delivered.

Another object of the modified form is to provide means for resetting the stop control mechanism only when the manually operable start-stop means is moved to its stop position while any part of the prepaid amount remains undelivered.

Still another object is to prevent the depositing of more than a predetermined number of bills at the start of the dispensing cycle.

Yet another object of the invention is to prevent the deposit of additional bills after the delivery of a prepaid amount of fuel has been started and until such delivery has been completed.

These and other objects will become apparent from a study of this specification and the drawings which are attached thereto, are made a part thereof and in which:

FIG. 1 is a perspective view of the dispenser showing the nozzle support, manual control lever, approval and selector switches, credit lamp and access door for the bill acceptor.

FIG. 2 is an elevation showing the interior of the dispenser and the arrangement of its components.

FIG. 2A is a view showing the pulser drive and zero adjusting means.

FIG. 3 is a diagram of the control valves and connecting fluid passages.

FIG. 4 is an elevation of the top portion of the dispenser viewed from the left of FIG. 2, with the door removed to show the stop control mechanism.

FIG. 4A is a section of the stop mechanism differential and drives.

FIG. 5 is a plan view of the stop control mechanism.

FIG. 6 is an elevation, partly in section, of the acceptor, the cash box and the passages there between for guiding an accepted bill.

FIG. 7 is a detail of the computer output drive to the differential.

FIG. 8 is an enlarged view of the top left corner of FIG. 2.

FIG. 8A is a plan view showing the tunnel, the stop mechanism and the locations of various electric components.

FIGS. 9A and 9B constitute a schematic diagram of the system, circuits and components.

FIG. 10 is a diagrammatic view of the switch actuating mechanism of the power resetting mechanism in its normal condition.

FIG. 10A is a view similar to FIG. 10 showing, in full lines, the actuating mechanism conditioned for subsequently actuating the switches and, in dashed lines, in switch actuated position.

FIG. 11 is an elevation showing the modified form of the stop control mechanism.

FIG. 12 is a plan view of the mechanism of FIG. 11.

FIG. 13 is a diagrammatic view showing the modified power resetting mechanism for the registers and showing the parts thereof in a number of key positions which they occupy during the resetting cycle.

FIGS. 14 and 14A constitute the wiring diagram for the modified apparatus.

## DESCRIPTION OF PREFERRED FORM

Referring to FIGS. 1 and 2, numeral 1 indicates a motor fuel dispenser which comprises a top housing 3 within which are disposed a bill acceptor 211, a cash drawer 171, a stop control mechanism 2 and various electrical parts and circuits which are described in detail below. Since all of the electrical equipment in this space is more than 48 inches above the bottom of the dispenser base 5, it occupies an ordinary or non-hazardous space and is not subject to Underwriters Laboratories requirements for explosion proof construction. Other components such as the pulser 77, the solenoid valves 57,61, motor 11, etc., which are disposed at a lower level, must be of explosion proof construction.

As seen in FIG. 2, base 5 has members 7 fixed to it, which support a box-like frame 9. The electric motor 11, a computing register 13, and a power reset mechanism 15 are mounted in this frame. The computer is of the type disclosed in Pat. no. 2,814,444 issued to Bliss on Nov. 26, 1957, which comprises quantity and value registers 17 and 19 respectively, which are resettable to zero by the uni-directional rotation of a resetting shaft 299, through substantially one revolution.

The power resetting mechanism 15 is provided to produce such rotation of the resetting shaft and to perform other switch setting and control functions, and is preferably of the type disclosed in Pat. No. 3,187,945 issued to Wright et al. on June 8, 1965. The structures of this mechanism which are essential to the understanding of the invention, are shown in FIGS. 10 and 10A hereof. Referring to said Figures, 69 is a manual start-stop lever which is in its vertical, FIG. 10 position when the dispenser is inoperative, and in a substantially horizontal position (FIG. 10A) during delivery.

Shaft 70 connects lever 69 to rotate cam 283 which, upon rotation to its FIG. 10A position, closes normally open switch S1, which is in circuit with normally closed switch S2,a and the resetting motor 253. This motor drives resetting shaft 299 and a cycle control cam 284 which is fixed to 299. This cam actuates a follower lever 286 which rotates freely on shaft 288. The arm 287 of the follower is biased by spring 289 to hold the follower in contact with its cam.

A switch actuating lever 291, also freely rotatable on shaft 288, is held against a stop 292 by spring 293, and the free end of the lever has a cam profile which is adapted to depress the actuator button of switches S2, 3 & 4 when the lever is rotated counterclockwise to its actuated position.

An interponent 296 is pivotally mounted at one end on a pin 295 fixed in lever 291 while its other end is bifurcated. The upper branch or arm has its lower end corner notched at 294 to receive an ear 290 formed on the follower, and spring 298 biases the interponent clockwise to urge the notch into engagement with the ear. The lower arm 297 projects into the path of cam 283.

These parts occupy their FIG. 10 position when the dispenser is in normal inoperative condition and it should be noted that ear 290 is free of the notch.

When lever 69 is rotated to its "on" position, cam 283 closes switch S1 and also clears arm 297 of the interponent so that spring 298 will hold the lower edge of the upper arm thereof in contact with the upper edge of ear 290.

Subject to conditions described below, the closure of S1, with S2 in its initial position, energizes motor 253 which drives the resetting shaft 299 through one revolution. During the first portion of such revolution, it actuates the clutch mechanism of the computer to disconnect the register wheels from the count input and transfer mechanisms and connects them to the resetting gear train of the computer. Simultaneously, the follower 286 descends the cam 284 to the full line position in FIG. 10A, in which the ear 290 clears the lower edge of the upper interponent arm and the latter drops to engage notch 294 and ear 290.

During the next phase of rotation of 299, it is connected to drive the gear train of the computer so that any of the register wheels which are not in their zero indicating positions will be driven to such positions in upcounting direction. Further rotation of the shaft disconnects the shaft from the gear train and shifts the clutching mechanism to its initial position to reclutch the wheels to the count input means and disconnect them from the resetting train. Thereafter, or simultaneously therewith, the follower 286 is rotated counterclockwise by cam 284 until it reaches the dashed line position of FIG. 10A. This rotation of the follower is transmitted by the interponent, to the switch cam lever 291 which, during the final portion of its motion, shifts the switches S2, 3, & 4 from their *a* contacts (FIG. 9) to their *b* contacts. The opening of the switch S2,*a* interrupts the circuit of motor 253 to stop shaft 299 in substantially its initial position, to complete the single revolution.

While the functions of the switches S2, 3, & 4 will be described in detail below, it should be noted that the closing of S2,*b* causes the operation of flow supplying means such as the pump motor 11 and certain valves so that liquid can be dispensed.

When dispensing is completed, lever 69 is returned to its initial position. This restores cam 283 to its FIG. 10 position to reopen S1 and raises the arm 297, which in turn rotates the interponent counterclockwise about its pivot 295, which disengages the notch 294 from ear 290. Cam lever 291, being thus freed from the follower, will be rotated by spring 293 to its initial position and permits switches S2, 3, & 4 to return to their *a* contacts, to complete the cycle. It should be noted that the switches S2, 3, & 4 cannot be returned to their *b* contacts without repeating the above described cycle which results in resetting the registers to zero.

A shelf 21 is fixed to members 7, above and parallel to the base, and supports a pump and air separator unit 23, 25, which is driven by motor 11 through belt 27. The pump inlet is connected by suction line 28 to a tank (not shown) and pressurized fuel passes from the pump, through the separator to meter 29. The measured fuel then flows to the control valves, indicated generally by 31, through hose 33 to the manually operated valve 35 in the nozzle 37.

As shown in FIG. 3 the meter discharge pipe 30 communicates with a chamber 41 of the main valve body 43. The discharge chamber 45 of the body communicates with chamber 41 through a port 47 which is controlled by a poppet valve 49 attached to a piston 51 which works in a cylinder 53. A small, fixed orifice 55 bypasses the piston. Chamber 45 discharges into the hose. A light spring 46 in the cylinder acts on the piston to urge it and valve 49 in the valve closing direction.

A normally closed pilot valve 57 is connected to a solenoid 59 which opens it upon energization. The inlet of 57 communicates with cylinder 53 above the piston and its outlet is connected with chamber 45. Thus when the pilot valve is closed, the opposing fluid pressures acting on the piston are balanced through the orifice, so that the main valve will be closed by the spring. When the pilot valve is open, and the nozzle valve is also open, liquid will be bled from the cylinder more rapidly than it can be replaced through the orifice. A differential pressure will thus be applied to the piston in the valve opening direction, which will overcome the spring and cause the piston to open the main valve. Since the magnitude of the pressure differential will increase and decrease with the magnitude of the flow through the nozzle valve, the main valve will "follow" or modulate the flow to the nozzle in accordance with the setting of the nozzle valve.

A normally closed slow flow valve 61 is connected to be opened by another solenoid 63, when the latter is energized. This valve is connected directly between the chambers 41 and 45 so as to bypass the main valve. When open, it permits flow to the hose at a rate of about 4 to 5 GPM. This valve is closed to terminate the prepaid deliveries, as will be described below, and contributes much to the accuracy of the delivery.

A nozzle support 65 and boot 67 are mounted on the frame adjacent the manually operable control lever 69. The lever is mounted on a shaft 70 of the power reset which can be rotated about 90°. The lever occupies a vertical, depending position (full lines FIG. 1) when the dispenser is in its initial or "off" condition and is rotated counterclockwise to its dashed line position to cause the dispenser cycle to start, when it is set for normal operation, and to condition it for starting when it is operated under the control of the bill acceptor. When the lever is in its rotated or horizontal position, it overlies the nozzle support so as to prevent the nozzle from being mounted thereon and it must be rotated clockwise far enough to stop dispensing and to insure the institution of another resetting cycle, before it is sufficiently clear of the nozzle support to permit the nozzle to be hung thereon.

A door 71 is hinged by 73, along its top edge, on the end wall 179 of housing 3 (FIG. 6), so as to close the openings 221 therein, through which a bill may be inserted in and returned from the bill acceptor 211.

As shown in FIG. 2, a shaft 75 connects the meter to drive the computer 13 and thereby, its gallons and cost registers 17, 19, in accordance with the amount of fuel delivered. The gallons delivered are continuously multiplied by the price per gallon, so that the cost register shows the exact value of the fuel delivered at any stage of the delivery.

As shown in FIGS. 2 and 2A, a pulse initiating mechanism 77, usually referred to as a "pulser", is suitably mounted on a side frame 13A of the computer 13. The penny wheel 6 of register 19 carries a gear 4 fixed to it, which meshes with a gear 4A, of the same size, and which rotates freely on the shaft 8A of the pulser. A lug 20 extends axially from the outer face of gear 4A, parallel to shaft 8A but eccentric to it, so as to cross the path of a lever 20A which has its hub pinned to the shaft. The lever is preferably disposed tangentially with respect to the shaft. A screw 18 is adjustably mounted in the lug so as to extend substantially normal to the lever for abutting engagement therewith. Thus as the wheel 6 rotates in a count increasing direction, gear 4 will rotate clockwise (viewed from the left of FIG. 2A), gear 4A will rotate oppositely, so that lug 20 and screw 18 will drive lever 20A and shaft 8A in a counterclockwise direction.

Shaft 8A carries gear 4B which meshes with gear 4C and drives it in the ratio of 5 to 1. Gear 4C is fixed to shaft 8, which also carries a two pole magnet 10 fixed to it. A reed switch S13 is mounted on the pulser casing so that the magnet poles will alternately pass the armature 12 of the switch, and since the switch is normally open, it will be closed and opened once in response to the passage of each pole. Due to the ratio of gears 4B

and 4C, movement of the penny wheel through 36°, which is an advance of 1 cent of the count, produces a 180° rotation of the magnet and therefore one complete cycle of the switch.

When the pulser is initially installed on the dispenser, the gears **4** and **4A** are brought into mesh with a pole in position to hold the switch just closed and with the zero indicators **26, 26A** in alignment. Thereafter, during dispensing, the one pole will pass the armature so that the switch will open, as the count moves toward the first of 1 cent, and the second pole will close the switch when the indicators **26, 26A** for numeral 1 coincide. If the desired closing of the switch is not obtained, the time of closing can be advanced or retarded by moving the screw **18** into or out of the lug **20,** as will be described below. Thus it is seen that the switch will be closed once for every cent's worth of liquid dispensed, exactly when the dispensing thereof is completed.

In the computing register disclosed, the indicating wheels or dials are reset in the same direction as that in which they are driven during counting. Thus if the penny wheel is at zero when the registers are reset, it will not be moved during a reset cycle. However, if it is not at zero, it will be moved far enough to move it to zero. The magnet **10** will also be moved in the latter case, so that it occupies its initial position, and every full dispensing cycle will be started with the magnet occupying its proper position.

A shaft **79** (FIG. **2** & **7**) extends from the computer and forms a part of the drive train for the stop control mechanism. It is driven in time with the cents wheel and pulser during delivery, but is not reset therewith because it is driven by the money output of the computer rather than by the cents wheel.

Shaft **79** is coupled at **80** to the input shaft **89** of a bevel gear set **81** which comprises a bearing bracket **85,** mounted on the dispenser frame by bracket **101.** Shaft **89** has bearing in the depending arm **87** of bracket **85** and drives gear **91** which meshes with gear **99** fixed to output shaft **95,** which bears in arm **93** of bracket **85.** Differential drive shaft **83** is driven by shaft **95** through coupling **97.**

Referring to FIGS. **4** & **4A,** shaft **83** extends upwardly into housing **3** and is coupled at **105** to an extension shaft **102** which rotates in suitable bearings in brackets **107** and **109** which are fixedly mounted on the dispenser top plate **165** and the top of the cash drawer tunnel **167** respectively. A gear **111,** fixed to **102** near its upper end, but below bracket **109,** meshes with the input gear **113** of a differential unit **116** (FIG. **5**). Gear **113** is connected by a hollow shaft **118,** which rotates in a bearing in the differential case **128,** to the sun gear **114.** The other sun gear **127** is fixed to shaft **115** which extends upwardly through gears **114, 113** and their shaft **118,** and through a bearing in bracket **109,** to terminate in a stepped hub **119** which is fixed to it. A control disc **117** is fixed to the lowest step of the hub.

An electric motor **121** is mounted on and below bracket **107** and its output shaft extends upwardly therethrough and has gear **125** fixed to it, to mesh with gear **129,** which is fixed to the differential casing **128,** concentric with, but free of shaft **115.**

One of more planetary pinions **131** are rotatably mounted on shafts **132,** which are fixed in the differential case **128,** parallel to and eccentrically of shaft **115.** These pinions mesh with both sun gears. Thus when shaft **102** is driven and the motor is stationary, gears **111, 113** and shaft **118** will drive sun **114,** which in turn rotates pinions **131** to drive sun **127,** shaft **115** and disc **117** clockwise as viewed in FIG. **5.** When shaft **102** is stopped and motor **121** runs, gears **125, 129** rotate the case **128.** The pinion shafts orbit about stopped sun **114** and drive sun **127,** along with shaft **115** and disc **117,** in the same clockwise direction.

A pair of radially extending, delivery stop cams **135, 137** are rotatably mounted on the second step **133** of hub **119** (FIG. **4** & **5**). Cam **135** lies above, but in contact with **137** and each is provided with an arcuate slot, **139, 141** respectively, near their outer ends and centered on the axis of the hub. A spacer **143** is disposed between cam **137** and the disc, and a screw **145** is passed through both slots and the spacer and enters a tapped hole **147** in the disc. The outer ends of the cams project beyond the periphery of the disc and are adapted to actuate a roller **149** which is mounted on the actuating lever **151** of a normally open stop switch **153.** The parts are shown in their initial positions in FIGS. **5** & **9B,** although in FIG. **9B** the cams and disc are viewed from the bottom of FIG. **4** rather than from the top as in FIG. **5.** It should be noted that the cams will have to be rotated the better part of a revolution before the cam **135** will engage the switch actuator roller **149.**

The screw **145,** when loosened, permits the cam **135** to be adjusted so as to advance or retard the time of switch closure while cam **137** may be similarly adjusted to change the time of reopening the switch. The screw, when tightened, will preserve the adjustment.

A flow control cam **148** is carried by an arm **152** rotatably mounted on step **133,** above and in contact with cam **135.** The cam **148** projects beyond the periphery of the disc from the upwardly bent end of **152** which position is at a higher level than that of cam **135** so that it cannot actuate switch **153.** The roller **161** of a normally closed switch **163** is mounted in the path of cam **148** and out of the path of cam **135.** The arm **152** is also slotted at **154** to receive screw **155** which also passes through a spacer **157** and into a tapped hole in the disc.

It should be noted that the leading edge of cam **148** is advanced further, with respect to its switch roller **161** than cam **135** is with respect to its roller **149,** so that switch **163** will be actuated before **153,** as the disc **117** rotates (FIG. **5**). Briefly stated, the opening of switch **163** deenergizes pilot valve solenoid **59** to close valves **57** and **49,** leaving valve **61** open to deliver liquid at a slow rate. Thereafter switch **153** closes preparatory to transmitting the pulse from pulser **77** when it occurs, to means which will cause the closure of valve **61** to terminate the flow and perform other functions described below. Both of the switches are mounted on the bracket **109.**

As seen in FIG. **7,** the dispenser top plate **165** , which serves as a baseplate for mounting the mechanisms which are located under the cover **3,** is fastened to the domeplate **103** of the dispenser at various points by spacer fasteners **166.** Also, as seen in FIGS. **4, 8A,** and **8** the tunnel **167** is of sheet metal and has flanges **169** bent outwardly to lie flat on the baseplate **165** to which they are spotwelded, to complete the tunnel to receive the cash drawer **171.**

The cover **3** comprises a top wall **175** (FIG. **4**) having downwardly diverging side walls **173** and one end wall

179 (FIGS. 1 & 6) which defines the bill guide 217 receiving openings 221. The opposite end 193 of the cover (FIGS. 2 & 4) is open. A number of angle pieces 183 removably connect the cover to the plate 165 by means of bolts or other suitable fastenings 184.

A bracket 189 is mounted on the tunnel member and supports a panel 181, above and extending transversely of the tunnel member. The panel supports relays K1 through K5, a calibration switch S11, a 24 volt circuit breaker 242, 24 volt test points TP1 and TP2 which are connected to the opposite ends of the 24 volt secondary coil of transformer 237, a 115 volt circuit breaker 241 and 115 volt test points TP3 and TP4, which lead to the neutral line 106 adjacent the coil of relay K6 (FIG. 9) and to the hot main 110 adjacent the breaker 241. These components will be described further in connection with the circuitry.

The end 193 of the housing 3, (FIGS. 4, 8, & 8A) is provided with a removable door 195 which is recessed in the end of the housing. The panel 181, the end of the tunnel and that of the cash box are exposed upon opening and removal of the door. Axially aligned, horizontal hinge pins 197 are fixed to the inner side of the door so as to be offset inwardly from the inward side of the door and spaced upwardly somewhat from the lower edge thereof. The pins extend outwardly and are received in upwardly open grooves 198, formed in socket members 199 fixed to the upper side of plate 165. A key lock 201 is mounted on the door and has a bolt 203 which is moved into and out of engagement with a stop 204 fixed to the housing, to lock the door in place. The door has an inwardly extending tapped boss 205 cast on its inner face, which projects horizontally toward the end of the cash box 171. A screw 207, provided with a nut 209, is screwed into the boss and is adjusted so that the head of the screw presses on the end of the box, when the door is closed, so as to hold the box in proper engagement with the bill acceptor 211 which is disposed at the opposite end of the box (FIG. 6).

As shown in FIG. 6, the acceptor has a bill discharge opening 213 disposed to align with a bill receiving opening 215 in the adjacent end of the cash box, to insure that all accepted bills are deposited in the box.

The acceptor-validator mechanism may be any one of a number which are available on the open market. It is preferred to use the device made by National Rejectors, Inc., Model 34-03-001.

This machine has a slotted bill insert guide 217 and a slotted bill return guide 219 disposed at the end opposite to that facing the cash box, so that the guides lie within the aperatures 221 formed in the end 179 of the housing 3. When the acceptor mechanism is operating, a bill inserted in 217 will be drawn into the machine and will be passed through the testing mechanism. If the bill is not found to be acceptable, it will be returned to the depositor through guide 219. If the bill is found to be acceptable, it passes through the opening 213 into the cash box, and a signal is generated which conditions the dispenser for operation as described below.

Referring to FIG. 1, a key operated mode selector switch 229 is mounted on the end 179 of housing 3, adjacent the door 71. This switch may be set to either one of two positions by means of a key which may be withdrawn after such setting. In one position, the switch establishes circuitry which enables the dispenser to be operated in the normal manner, by removing the nozzle from support 65 and turning the manual control lever to its on position. In the other position of the switch, no delivery can be made until a bill has been inserted, tested and found to be acceptable.

A second key operated switch 231, referred to as the "Approval Switch", is mounted above and in like manner to switch 229. This switch is adapted to be operated by turning the key in the lock to close the switch, which returns to its open condition when the key is returned to its initial position and is withdrawn from the lock. This switch must be used to pre-condition the dispenser for operation in response to the deposit of a bill. It performs no function when the dispenser is being operated in the normal mode.

The station attendant retains possession of both of the keys.

The approval switch is used primarily to compel the attendant to be present at the dispenser before the starting of the dispenser so as to ascertain whether the potential customer who has shown his intention of using the dispenser is actually capable of serving his vehicle in a safe manner. In some jurisdictions, the authorities do not require such approval and in such cases the switch and its corresponding circuitry may be omitted, as will be discussed below.

A signal lamp 233 is also mounted on the end 179 of the housing 3, above the approval switch, which lights when a bill has been inserted and accepted to show that a credit exists on the machine. It is extinguished when such credit is exhausted by delivery of the prepaid amount of fuel or upon resetting of the stop mechanism, with a credit still posted, in response to the return of the manual control lever 69 to its initial position, which cancels any remaining credit.

Various other components are mounted within the housing 3, either on the base plate 165 or on various brackets. As shown in FIG. 8A, a terminal strip 235 is mounted on the plate; a 115 VAC transformer 237 is mounted on the tunnel along with the previously mentioned relays, and on the leg 181 of bracket 189, a socket 239 is mounted to receive the plug which carries current to the bill acceptor 211. The pump motor relay K6 is also mounted on the tunnel beside the transformer. With this description of the basic components of the system, reference is made to FIGS. 9A and 9B which disclose the circuitry provided to connect the components so as to accomplish the necessary functions.

WIRING DIAGRAM (FIGS. 9A and 9B)

The electrical system is shown in its initial condition in FIGS. 9A and 9B. Selector switch 229 is set for operation of the system in the prepaid delivery mode, the system is energized and the bill acceptor 211 is running so that a bill can be deposited, but no credit has been established.

The dispenser is in its initial, inoperative condition with the control lever 69 in its vertical off position and the nozzle is on its support. Valves 49, 57, and 61 are closed and pump motor 11 is deenergized. The registers 17 and 19 show the gallonage and cost of the previous sale. Disc 117 of the stop mechanism has been reset to its starting position so that the cams 135, 137, and 148 are in the positions shown in FIGS. 5 and 9B.

Power is supplied to the system from a 115 VAC main although, if desired, 230 VAC may be used for some circuits, such as that for the pump motor, if 230 VAC components are provided in such circuits. A second voltage 24 VAC is also provided for use in some

circuits. The "hot" 115 VAC line is designated by numerals **110** and **110A** throughout the diagram while the corresponding neutral has two braches **106** and **108.** In the 24 VAC system, the hot line is designated by numeral **24** while the ground lines are indicated generally by numeral **22,** with suffices such as A, B, C, etc., identifying branches thereof. In a 230 volt pump motor circuit, line **108** will be connected to another hot main instead of to neutral.

The 24 volt supply is provided by the transformer **237** which has its primary coil connected at one end to line **110** which contains a circuit breaker **241,** and at its other end directly with neutral branch **106.** Its secondary is connected to lines **24** and **22** as already indicated.

BILL DEPOSIT & ACCEPTANCE

When a $1 bill has been deposited in the acceptor and has been tested and found to be valid, the machine closes its switch **243** momentarily and reopens it, to close:

*CIRCUIT A* from **24V** ground **22** through pins A of validator socket **239,** switch **243,** pins B, vend line **245,** branch **245A,** coil of relay K1 to **24V** main **24.**

*CIRCUIT B* in parallel with Circuit A, from line **245** through **245B,** the coil of pulse actuated credit register **247** to main **24.**

*CIRCUIT C* (Also parallel) from **245** through **245C,** credit lamp **233** to **24.** Since the above circuits would be reopened by the reopening of the bill validating switch **243,** the normally open contacts A,*b* of relay K1 which were closed upon its energization, are used to establish a substitute ground.

*CIRCUIT A1* from line **245** at **245A,** through **245D,** K1 contacts A,*b*), line **249,** normally closed contacts A,*a* of relay K5, branch ground **22A** to **22.** Thus Circuits A, B, & C will be held energized.

The motor **212** which drives the bill acceptor is normally held energized by

*CIRCUIT D* from ground **22,** through **267,** pins C, motor **212,** pins D, line **255A** which includes the normally closed parallel contacts **261** of relay K2, line **255,** contacts *a,* S7 of the selector switch **229** to line **24.** This circuit is broken, to stop motor **212** so as to prevent the deposit of another bill, upon the energization of relay K1, the normally open contacts B,*b* of which are now closed to establish

*CIRCUIT E* from main **24** through selector switch contacts S7, a), lines **255, 255B,** K1 contacts B,*b,* line, **257, 257A,** coil of relay K2 to ground at **22B.** This relay opens switch **261** to de-energize Circuit D and motor **212.**

The energization of relay K1 also energizes one leg of a circuit which will be extended by additional means to cause the operation of the register resetting motor **253.** This leg is defined as

*CIRCUIT F1* from line **110** through line **110A** at K1, its contacts D,*b,* line **251,** connectors **12** of terminal strip **235,** normally closed contacts S2,*a* of the power reset mechanism, to the normally open switch S1, thereof which will be closed when the manual control lever **69** of the dispenser is rotated from its vertical off position to its horizontal on position (FIG. **1**). It will thus be seen that operation of this lever to its on position without the establishment of a credit, will produce no results because Circuit F1 is not energized. Assuming that F1 has been energized, the closure of S1 by operating lever **69** will not start the resetting motor **253** but merely applies power to the second leg,

*CIRCUIT F2* from now closed switch S1 through motor **253,** line **251A** to the normally open contacts A,*b,* of relay K3, which is the approval relay and which must be energized by closure of the approval switch **231,** the contacts of which are normally open. This closure is momentarily effected by the authorized attendant by means of his key. Such closure energizes

*CIRCUIT G* from **24V** ground **22B** through the coil of K3, line **257B** which includes the approval switch contacts normally closed contacts *a,*B, of relay K4, to line **257** which is supplied from main **24** through S7,a, lines **255, 255B** and contacts B,*b* of K1. The energization of K3 closes its contacts D,*b* to close a parallel

*CIRCUIT H* around the approval switch to hold relay K3 energized after switch **231** is opened. K3 when energized also closes its contacts A,*b* to complete

*CIRCUIT F* which includes circuits F1 and F2 and the final leg through K3 contacts A,*b* to the 115 VAC neutral **106.**

It should be noted that the manual operations of the approval switch, the manual lever **69** and the insertion of a bill may be performed in any order, but that no action of the power resetting mechanism will occur until the entire Circuit F is completed. Further, until the resetting mechanism has been operated through its cycle, there can be no delivery of fuel since with S2 in its *a* position the valves remain closed and motor **11** remains unenergized.

Assuming that the delivery has been approved and a credit has been established and that the lever is now moved to its on position, such action will start the resetting motor **253** which will reset the registers **17** and **19** to zero and will also reset the pulsing switch to its initial position, if such action is necessary. As the resetting is completed, the motor reconnects the registers to be driven by the meter and opens switches S2,*a* and S4,*a* as it closes S2,*b,* S3,*b.* Opening S2,*a* opens Circuit F to stop motor **253** while the opening of S4,*a* opens a circuit leg P1 which supplies power for a calibrating function which is described below.

The closing of switch S2,*b* switches the power which is being supplied through the Circuit leg F1 into

*CIRCUIT I* which extends from the switch through line **263** to the coil of the pump motor relay K6, which is connected to neutral line **106.** The energization of K6 moves its A and B contacts to engage their respective *b* contacts so as to energize

*CIRCUIT J* from Main **110** through contacts A,*b,* line **256,** pump motor **11,** line **256A,** contacts B,*b* to neutral **108.** The pump motor is thus started. Switch S2,*b* also energizes a branch **263A** from line **263,** which is a part of

*CIRCUIT K* from said switch through **263, 263A,** the solenoid **63** of the slow flow valve **61,** and line **269** to **106.** The valve is thereby opened. Switch S2,*b* also energizes another branch **263B** from line **263** which is

*CIRCUIT L* which extends from the switch and line **263** through line **263B,** which includes selector switch S8,*a,* and the normally closed switch **163** of the control mechanism **2,** and continues on through line **263C** to the solenoid **59** of the pilot valve **57** and terminates in neutral **106.** The pilot valve is thus opened and the main valve **49** will open as soon as the nozzle valve is opened by the customer to supply his vehicle tank.

The above described closing of switch S3,*b* by the resetting motor 253 establishes a

*CIRCUIT M* from main 24 through selector switch contacts S7,*a*, lines 255, 255B, B*b* contacts of K1, lines 257, 257C, resetting mechanism contacts S3,*b*, line 257D, the coil of relay K4 to ground 22B. The energization of K4 closes its contacts A,*b* and D,*b* and opens B,*a*. The closing of contacts A,*b* establishes a holding

*CIRCUIT N* from ground 22B through the coil of K4, K4-*b*,A line 258, the normallly closed contacts B,*a* of relay K5 to main 24.

The opening of the K4, B,*a* contacts breaks the holding Circuit G for the approval relay K3 which drops out to break its holding Circuit H as well as the last leg of Circuit F, so that the reset motor 253 cannot be restarted by manipulating control lever 69 to close switch S1. Once the lever is returned to its initial position, the entire starting cycle of events must be carried out to secure another delivery, so long as the selector switch remains in the prepaid delivery mode position.

The closure of K4 contacts D,*b* extends a circuit leg for the reset motor 121 for subsequent operation as described below.

DELIVERY OF FUEL & CREDIT COUNTDOWN

With the system conditioned as described above, motor 11 is operating, valves 57, 61 are open, registers 17 and 19 are zeroized and the pulser and the control mechanism cams 135, 137, and 148 are in their starting positions, so that opening of the nozzle valve will start delivery and valve 49 will open to a degree corresponding to the nozzle valve setting.

At the end of the delivery of every penny's worth of fuel, the pulsing switch S13 will close to initiate a pulse, but such pulse will not be effective because the pulsing circuit is held open by the normally open stop switch 153, which is actuated by cams 135, 137. The amount of fuel delivered and the cost thereof is accumulated on the registers 17, 19.

The control cam 148 is set so that is will open switch 163 when about 93 cents worth of fuel has been dispensed. The timing of this event is not critical and can be varied by loosening screw 155 and adjusting the cam 148. This event must occur far enough in advance of the closing of switch 153 to insure that only the slow flow valve is open when switch 153 closes.

The opening of switch 163 breaks Circuit L of the pilot valve solenoid 59 so that the pilot valve 57 closes and in turn causes the main valve 49 to close, regardless of the nozzle setting. Flow continues slowly through valve 61.

During, but before the end of the delivery of the last penny's worth of fuel, the stop cam 135 closes switch 153, which closes the ground leg of the pulsing

*CIRCUIT P* which extends from main 24 at the selector contacts S7,*a* through lines 255, 281, terminal 14 of strip 235, to one side of the as yet open pulsing switch S13, and from its other side through line 281A, to switch 153, then through line 281B and the coil of relay K5 to ground 22B.

When the pulsing switch S13 is closed by the pulsing mechanism 77, it energizes Circuit P so that relay K5 is operated to open its *a* contacts and close the D,*b* contacts.

The opening of its A,*a* contacts breaks the substitute ground Circuit A1 to deenergize relay K1. The opening of the K1-D,*b* contacts breaks Circuit leg F1 thereby cutting off the supply of power to Circuit K of the slow flow valve which closes and terminates the flow of fuel. The same interruption deenergizes Circuit I to the relay K6 which opens Circuit J of the motor 11 so that the pump stops. Circuit L to the pilot valve is similarly interrupted although it has already been interrupted by switch 163.

The opening of K1 contacts B,*b* breaks Circuit E through the coil of K2 to allow its switch 261 to reclose Circuit D and restart the bill acceptor motor 212.

The energization of K5 opened its contacts B,*a* in the holding Circuit N for relay K4, so that it has also dropped out. K5 also closed its contacts D,*b* to line 285 and since K1 has closed its contacts D,*a* as it dropped out, a

*CIRCUIT Q* is established from main 110A, through K1-D,*a*, 285, K5-D,*b*, line 271B and motor 121 to neutral 106.

This motor starts and drives the differential mechanism 116 so as to rotate the disc 117 and its cam in the same direction as they were driven during countdown. The disc will rotate only as far as is required to allow the roller 149 of switch 153 to ride off of cam 137 and permit the switch to open, thereby breaking Circuit P to deenergize K5 and stop the motor 121. The roller 161 of switch 163 has also dropped from cam 148 so that the switch is reclosed, thus reconditioning Circuit L of the pilot valve to be reenergized upon restoration of the power supply to the reset mechanism switch S2,*b* which is still closed.

Since all of the relays are in their initial conditions and the bill acceptor is operating, the customer now has the choice of inserting another bill or of terminating the transaction by returning the control lever to its off position and hanging up the nozzle.

Assuming that another $1 bill is deposited and accepted, the vend switch 243 will be momentarily closed to energize Circuit A and relay K1, which shifts its movable contacts A, D & B to their respective *b* contacts. Closing of the A,*b* contacts reestablishes the substitute ground Circuit A1 to hold K1 energized. The counter Circuit B and credit lamp Circuit C are energized and held simultaneously with Circuits A and A1. Circuit B advances the counter 247 by one digit, which represents the accepted $1 bill.

The closing of the K1-B,*b* contacts again energizes Circuit E to pull in K2 which opens switch 261 and stops the bill acceptor motor 212, so that no further deposits can be made. The same K1 contacts extend power to the approval switch contacts via Circuit G but the operation of this switch is not needed because the control lever 69 was not returned to its off position, so that the power reset switches S2, S3, & S4 remain closed on their *b* contacts. Thus the closure of K1-D,*b* contacts will reenergize Circuit F1 to supply power directly to switch S2,*b* and through it to Circuits I, K & L. The motor relay K6 is energized by Circuit I and closes its contacts to energize the Circuit J and thereby starts the pump motor 11. Circuit K reopens the slow flow valve by energizing its solenoid 63 and since cam switch 163 is closed, Circuit L energizes solenoid 59 to open the pilot valve 57. Thus the dispensing of the second dollar's worth of fuel may proceed upon opening of the nozzle valve.

It should also be noted that the closure of K1-B,*b* has also closed Circuit M to energize relay K4, which, in turn, by shifting its A & D contacts to their respective

*b* positions, has closed Circuit N to hold K4, has reopened the approval switch Circuit G and has conditioned a second power supply line for the cam reset motor, Circuit Q1, which will be described below.

Accordingly, upon opening of the nozzle valve, the main valve 49 will open and the delivery will continue as described above, with the counters 17 and 19 continuing to accumulate the fuel dispensed, the only difference being that, since they have not been reset, they will show the instantaneous totals of both the previous and the current delivery.

Assuming that the delivery continues to completion, the flow will be terminated in the same manner as in the previously described delivery and the system will be in the same condition as it was at the start of the delivery which has just been described, and the customer is provided with the same options as before.

If it is assumed that he elects to deposit another $1 bill but that the vehicle tank cannot accept the amount of fuel to be delivered, the system is again activated by the pulse from the bill acceptor and the relays and circuits will be established in the same way as described in connection with the second deposit, so that dispensing will occur in response to the opening of the nozzle valve. The registers 17 and 19 will operate to show the instantaneous total of the three deliveries, since they have not been zeroized.

Since the nozzle 37 is provided with an automatic shutoff mechanism of the usual kind, the valve 35 will close as soon as the fuel level in the tank rises sufficiently to immerse the nozzle tip. By withdrawing the nozzle somewhat from the tank and operating the nozzle valve, the tank can be filled full, but since the full amount of fuel cannot be delivered, the customer merely turns the control lever off and hangs up the nozzle. Since the delivery was not terminated by the stop cams 135, 137 and 148 and their switches 153 and 163, relay K4 was not energized and all of the relays as well as valve solenoids 59, 63 and motor 11 remain energized so long as lever 69 remains in its on position. However, upon the return of the lever to its off position, the switches S1 through S4 of the resetting mechanism are returned to their initial positions with the *a* contacts closed and cannot thereafter move out of such positions until the resetting motor 253 is again energized to reset the registers.

Switches S1 and S2,*b* are opened and with the latter open, Circuits I, K & L are opened to drop relay K6 which opens pump motor Circuit J; to deenergize solenoid 63 which allows the slow flow valve to close and to deenergize the solenoid 59 to allow the pilot valve to close, if it was open.

Since K5 is not energized, the cam resetting motor 121 cannot be energized in the previously described manner by Circuit Q because contacts K1-D,*a* and K5-D,*b* are open. However, the dropping of relay K6 closes a

*CIRCUIT Q1* from main 110 through K6 contacts A,*a*, line 271, K4 contacts *b*,D (which are held closed because K4 is energized), line 271A, K5-*a*, D contacts, line 271B and cam reset motor 121 to neutral 106. The disc 117 is thus rotated in the same direction as before but since the pulse switch S13 may be open, the previous source of power for Circuit P, which is needed to stop 121, is not reliable and a new one must be provided. The original source was from selector S7,*a* and lines 255, 281, through pulse switch S13, 281A to terminal 9 of 235, and the rest of Circuit P, to energize K5. The new source

*CIRCUIT P1* extends from the 24 volt main 24, through reset mechanism contacts S4,*a*, which were closed by lever 69 upon return to off position, and line 281C and said terminal 9, to lines 281A switch 153, 281B and the rest of Circuit P.

So long as cam switch 153 remains open, the motor 121 remains energized through Circuit Q1. However, when cam 135 closes 153, K5 is immediately energized through Circuits P1 and P, and causes the relays K1, K2 and K4 to be dropped, K3 and K6, having been previously dropped, do not change.

The energization of K5 closes contacts D,*b* while dropping of K1 closes its contact D,*a*, thereby breaking Circuit Q1 and establishing Circuit Q through line 285, so that the motor 121 continues to run. When the roller 149 drops from cam 137, switch 153 reopens, to break Circuit P and drop K5. Contacts D,*b* open to break Circuit Q thus stopping motor 121 and even though the K5 contacts D,*a* of Circuit Q1 are remade, this circuit is no longer effective because the dropping of K4 has opened the contacts D,*b* which are in said circuit.

With the dropping of K2, the bill acceptor motor is reenergized so that another bill may be deposited. While the pulsing switch S13 may not be in its initial position at this time, its zeroizing is insured by the fact that the full cycle of credit posting, approving and register resetting must be carried out before the next delivery can be made and the resetting of this switch occurs during the register resetting event of the new cycle.

Only one other potential way of operating the system in the prepaid mode remains to be explored. Upon termination of a delivery by exhaustion of the established credit, all of the relays K1 through K6 have been dropped. The customer turns the control lever 69 to its initial position and hangs up the nozzle. This action opens the switch S1, closes S2,*a* and S4,*a* and opens S2,*b* and S3,*b*. The bill acceptor is operating, the cams have been reset to their initial positions, the credit lamp has been extinguished and no other functions remain to be performed to complete the cycle.

As previously noted, the mere operation of lever 69 to its on position, once it has been turned off, produces no notable effect. It would close switch S1, but since all of the relays are out and Circuit F is open, there will be no resetting of the registers or any other action of the various mechanisms.

The customer could fail to return the lever 69 to its off position and leave the motor running after and incomplete delivery, but in this case he could not return the nozzle to the hook 65 and boot 67. He would have to drape it on the pump housing, throw it on the ground or otherwise dispose it in an unnatural manner which would be obvious to any attendant. The same problem exists with respect to all existing dispensers of any kind.

MODIFIED FORM—WITHOUT APPROVAL MEANS

It was previously mentioned that in some jurisdictions, approval of the delivery by an authorized attendant is not required by the fire authorities. In such cases, the wire 251A of Circuit F2 may be disconnected from the A contact of relay K3 and connected directly to neutral 106 as by wire 251B. If desired, the components which constitute Circuit G may be omitted.

Dispensing from such a system would be started by deposit and acceptance of a bill, which would energize circuits A, B, and C. K1 would then energize Circuits A1, F1 to S2,B of the power reset mechanism, and E to K2 which stops the bill acceptor.

Upon operation of the lever 69 to its on position, the registers are immediately zeroized by Circuits F1, F2, and switches S2, S3 and S4 close on their *b* contacts. S3,*b* closes Circuit M to energize K4 which establishes its holding Circuit N. S2,*b* closes Circuits I, K and L, to start the pump and open the solenoid valves. The dispenser will then deliver fuel upon opening the nozzle valve.

Repeated deposits may be made, so long as lever 69 is not turned off, without resetting the registers, and the control cams are reset upon the completion of each prepaid delivery. The pulsing switch is reset only during zeroizing of the registers. The mechanism is cleared, after an unfinished prepaid delivery, in the same manner as described above, upon return of the lever 69 to its initial position. It will thus be apparent that the system functions in the same way as before except that the approval function is not required to be preformed.

SLOW FLOW AND SHUT OFF ADJUSTMENTS

Cam 137 establishes the initial positions of the cams 135 and 148 which are the reference positions for setting the cams. It is the amount of displacement of each cam from its initial position, during delivery, to its actuating engagement with the roller of its switch, which determines when the event controlled by it will occur. Adjusting the cams 135 and 148 relative to the disc and cam 137 in a direction opposite to that of the rotation of the disc (counterclockwise FIG. 5, clockwise FIG. 9B) brings the initial positions of the cams closer to that of cam 137 and increases the amount of rotation of the disc needed to produce the event and therefore requires a greater delivery to produce the event. Adjusting the cams in the direction of rotation of the disc produces the opposite effect.

Cam 137 is initially positioned so that the desired settings of cams 135 and 148 will fall near the center portion of their range of adjustment, so as to provide adequate adjustment capacity in both directions. Once cam 137 is positioned properly it should not be moved. If it is moved, the other cams will have to be readjusted because their initial positions relative to that of 137 have been changed. Cam 137 must not stop disc 171 before 163 is reclosed.

Cam 148 is adjusted before cam 135 and it is usually set to open switch 163 when the register shows a delivery of 93 cents, but is subject to reasonable variance. In any case the setting must be such that the main valve 49 is closed before the delivery is stopped. The fact that for the valve to close, a certain amount of fuel must pass into cylinder 53 through orifice 55, produces a dash-pot effect which delays complete closure of 49, even though the pilot valve closure is substantially instantaneous. Further, the setting of cam 148 must not be so retarded as to cause switch 163 to be held open when the disc has been reset.

The point of operation of switch 163 can be determined by depositing a bill and making a delivery, while watching the cost register 19, with the nozzle valve full open. If the slow flow occurs too soon, say at 90 cents, the cam 148 should be adjusted (after the disc has reset) by loosening screw 155 and moving the cam a slight amount in the direction opposite to the rotation of the disc. After tightening the screw, another delivery is made and further adjustments and trial deliveries are made until the event occurs at the proper time. If the slow flow occurs too late, say at 98 cents, the cam is adjusted in the same direction as the disc rotation in the same manner as above.

The adjustment of cam 135 usually follows that of 148 although either may be adjusted as needed without adjusting the other. Cam 135 is usually set so as to close switch 153 when register 19 reads 99¾ cents. This switch must not close until the delivery has advanced into the last penny's worth of the prepaid amount, and it must remain closed until the last cent's worth of fuel has been delivered and the disc and cams have been reset to their initial positions.

Since the delivery normally would not be stopped by the pulse switch S13 until the prepaid quantity has been delivered, means is provided for stopping delivery during the setting of cam 135 by means of the cam 135 alone, without the stop pulse from the switch S13. This means comprises

*CIRCUIT R* which extends from main 24 at selector contacts S7,a), through lines 255 and 282 to normally open, manual test switch S11 and to line 281A of Circuit P. The pulsing switch is thus shunted by switch S11 so that it will supply power to Circuit P whenever switch 153 closes and thereby energizes K5 to stop delivery and reset the cams.

To determine whether cam 153 needs adjustment, switch S11 is closed, a bill is deposited and a delivery is made which will terminate when switch 153 is closed by cam 135. If the register reads less than 99¾ cents, screw 145 is loosened and cam 135 is adjusted counter to the direction of rotation of the disc. If the reading is more than 99¾ cents, the cam is adjusted in the same direction as the motion of the disc. After refastening the screw, another delivery is made to determine where the register stops. This process will be repeated until the proper setting is reached, within practical limits. Then switch S11 is reopened and another delivery is made using the pulse switch to terminate the delivery. If the register 19 does not read exactly $1 the screw 18 of the pulser 77 is adjusted, and additional deliveries are made until the register does read exactly. One of the main reasons for choosing the 99¾ cents reading adjustment of the cam is to bring the final $1 adjustment within the range of the pulse switch adjusting mechanism 16.

OPERATION AS A NORMAL DISPENSER

In order to enable the system to be operated in the normal, postpayment mode, the selector switch is set by means of a key so as to close all of the contacts S7 through S10 on their associated *b* contacts. The opening of the S7,*a* contacts deenergizes Circuit R so that S11 becomes ineffective; deenergizes the stop Circuit P; deenergizes Circuit E to drop relay K2; opens Circuit M to relay K4; opens Circuit D to deenergize the bill acceptor motor and the validating apparatus and opens approval Circuit G.

The concurrent closure of selector switch S7,*b* establishes a substitute power

*CIRCUIT S* from the 24 volt main 24 through these contacts and line 307 to wire 257C of Circuit M. Since G and E have a common connection with line 257C, they are also supplied by it.

The closure of Switch S9,*b* provides a supply of power to Circuit leg F1 through

*CIRCUIT T* from main **110** through these contacts and line **309** to wire **251** of Circuit F1 between K1 contacts D,*b* and reset mechanism switch **S2.**

The opening of contacts **S8,***a* opens Circuit L (line **263B**) to one side of the slow flow switch **163** while the contacts **S8,***b* establish a shunt.

*CIRCUIT U* from line **263B**, on said side of the switch **163** through line **305** to line **263C** on the opposite side thereof. Thus while **S8,***a* is in series with **163, S8,***b* is in parallel therewith, and holds pilot valve solenoid **59** open whenever **S2,***b* is closed.

The closure of switch **S10,***b* connects the Circuit leg F2 directly to neutral via

*CIRCUIT V* from line **251A** through **303** and **S10,***b* to neutral **106.** This circuit is needed only when the approval Circuit G is employed in the system. When Circuit F is completed by the line **251B** of the alternative construction, the switch **S10** is not needed.

The operation of the system in this mode is started by removing the nozzle and rotating the manual control lever **69** to its on position to close switch **S1.** This establishes the Circuits T, F1, F2 and V (which are connected in series) to start the resetting motor **253.** Upon completion of resetting of the registers, the switches **S2, S3** and **S4** are moved to close their *b* contacts. The closure of **S3,***b* establishes Circuit M to send current derived from Circuit S through the coil of relay **K4,** and closure of its contacts A,*b* establish its holding Circuit N. While relay **K2** is incidentally energized at the same time as **K4,** it has no effect since Circuit D is open. The closure of **K4-D,***b* prepares Circuit Q1 for subsequent operation upon closure of the **K6-A,***a* contacts.

The closure of **S2,***b* simultaneously with **S3,***b* energizes Circuit I and motor relay **K6** to pull in circuit J and start the pump motor **11.** It also energizes Circuit K to the slow flow valve solenoid **63** and Circuits L and U (the shunt for switch **163**) to energize the pilot valve solenoid **59.** Thus, since the solenoid valves are open and the motor **11** is operating, a delivery can be made by opening the nozzle valve. The main valve will open in response to the nozzle valve. Since relay **R1** is not energized, Circuits B and C of the bill counter and the credit lamp are not energized.

During the delivery of fuel, the registers **17** and **19** are advanced as usual, and both the disc **117** and the pulsing switch **S13** will be displaced from their initial positions. They will not be capable of exerting any control of the delivery however, since switch **163** is shunted by circuit U and both power supply lines P and P1 of the pulsing Circuit P are open. The delivery must therefore by terminated by closing the nozzle valve and hanging it on the support. To do this the manual lever **69** must be turned to its off position which opens **S1,** moves the switches **S2, S3,** and **S4** to their *a* contacts to deenergize **K6** and both solenoid valve Circuits K and LU. **K6** returns to normal, opens motor Circuit J and, as the A,*a* contacts of this relay are remade, Circuit Q1 is energized so as to feed Circuit Q through **K5-D,***a* contacts and start the cam reset motor **121.** Since Circuit P was supplied with power through Circuit P1 as the result of closing **S4,***a* the closure of cam switch **153** as the disc is reset will energize **K5** to close its contacts D,*b* and the motor will be held energized via Circuit Q, even though Q1 is opened by **K5.** When the cam **137** allows switch **153** to reopen, **K5** drops out to stop motor **121** and the cams in their initial positions. Since holding Circuit N was interrupted by the **K5-B,***a* contacts upon the energization of **K5, K2** was dropped and the dropping of **K5** to close its contacts D,*a* does not restart motor **121** because **K4-D,***b* is open and can't be reclosed until switch **S3,***b* is remade. This can occur only after the next resetting of the registers and the pulsing switch is also reset to its initial position by such resettings.

It is thus seen that even when the system is operated in the normal mode, the control mechanism **2** is zeroized after each delivery so that if the selector switch is again set for prepaid delivery, the very first delivery thereafter will be accurate. Such a delivery must obviously include a resetting of the registers which automatically zeroized the pulsing switch.

When the cash drawer is emptied, the reading on counter **247** will indicate the number of bills which should be in the drawer. This counter may be of the manually resettable type, in which case it would be zeroized each time the drawer is emptied. If the accumulative type is used, the noting of such total each time the drawer is emptied makes it possible to ascertain the number of bills which were accepted during any period by subtracting a prior total from a later one.

An electric heater **275,** controlled by thermostat **279** is connected in the A.C. mains **110, 106,** by lines **277** and **277A.** This heater is usually disposed in the bill acceptor to maintain it at operating temperature during periods of low ambient temperatures and especially when the bill acceptor is not energized.

MODIFIED FORM — CREDIT ACCUMULATING

A modified form of apparatus is capable of accepting, at the most, three $1 bills at the start of the transaction, before any liquid is dispensed. In other words, an initial credit of one, two or three dollars may be established, at the option of the customer, before the control lever **69** is turned on.

To achieve this result, the stop control mechanism has been modified and some additional controls have been added, as explained below.

In addition to the above changes, the wiring diagram has been altered so as to incorporate an improved power resetting mechanism for the computer which is disclosed in the application of Christian W. Kruckeberg, Ser. No. 038,063, filed May 18, 1970, for Fuel Dispenser Power Resetting and Control Mechanism. While either the new or the initially disclosed resetting mechanism may be used, the wiring diagram must be altered to accommodate the electrical system to the switching system employed by the resetting mechanism which is used.

Referring to FIGS. **11** & **12,** the stop control mechanism includes the disc **117** which is connected to be driven by the output shaft **115** of differential **116,** so as to be driven in a clockwise direction in response to either the money output train of the variator (FIG. **7**) or the output of the cam resetting motor **121** (FIG. **4A**). The cams **135, 137** are mounted on the hub **119** for angular adjustment thereon relative to the disc and the outer ends of the cams are disposed at a level for operating the pilot valve switch **163.** Screw **145** holds the cams in their adjusted positions.

The previously used arm **152** is replaced by a bifurcated arm **352** which is also rotatably mounted on the hub **119** and is held in adjustment by screw **351.** Arms **135** and **352** are substantially diametrically opposed because the switches actuated thereby have been rearranged. The leading fork of arm **352** is bent upwardly

and then outwardly as shown at 352A to form a cam 348A which is disposed at a level to operate the switch actuating rollers 337A and 339A of the switches S18 and S20 successively, in that order. The trailing fork of arm 352 is also bent upwardly and outwardly as shown at 352B to form a cam 348B which is disposed at a level so as to operate the 337B and 339B of switches S19 and S21, in that order. Thus as the disc rotates clockwise (FIG. 12), the order of operation of these switches will be S18, 19, 20 & 21. Further, the arm 135 will have actuated switch 163 prior to the operation of S18 as will be described.

The power resetting mechanism for the registers is shown in FIG. 13, in which the control lever 69 is connected to rotate an actuator lever 353 which has a roller 355 extending through a cam slot 357 in lever 359 pivoted at 361. An elongated interponent 363 is pivotally mounted at one end on a pin 365 fixed on lever 359. The opposite end of the interponent defines a tooth 367 and a "nose" portion 369 which is adapted to actuate a switch S22, the push button 371 of which is spring urged outwardly so as to urge the interponent counterclockwise about pin 365, into continuous engagement with a cam 373. The upper hub 375 of the cam has diametrically opposed, dove tail slots 377A and B which are adapted to receive a rectangular drive plate 379 which extends transversely to and is fixed on the end of a drive shaft 381, the other end of which is connected to be driven by a geared down electric motor 383. This structure permits limited rotation between the cam and the shaft.

The other face of cam 373 has a hub 374 to which is fixed a switch control cam 385 which has a notch 387 formed in its periphery. A blade switch S23 has a long blade 389 which is engaged in said notch when the switch is open.

The parts are shown by solid lines in their initial positions, the lever 69 being in its normal off position. When 69 is rotated counterclockwise to its on (dashed line) position, lever 353 will be similarly rotated to cause roller 355 to rotate lever 359 counterclockwise about 361. Such rotation results in a rightward translation of the interponent 363 so that its tooth 367 engages the lobe 373A of cam 373 to rotate it counterclockwise through the angular distance permitted by the lost motion between the plate 379 and the walls of the dovetail slots. Such rotation is also transmitted to cam 385 which causes one wall of notch 387 to close the switch S23, to start motor 383. Shaft 381 is thereby rotated in the counterclockwise direction to take up the lost motion and thereafter to rotate the cams 373 and 385 in the same direction to their initial positions. Since the lobe will now engage the upper surface of the interponent between the pivot 365 and the tooth 367, the interponent will be rotated clockwise about such pivot to depress the switch button 371 to close switch S22. Meanwhile, the notch 387 has been restored to its initial position so that S23 opens to stop the resetting motor. The effect of closing S22 will be discussed in connection with the wiring diagram.

When the lever 69 is returned to its off position, the cam 357 returns lever 359 and the interponent 363 to their initial positions, with the tooth clearing the lobe 373A, so that the switch button will rise and open S22.

DIAGRAM OF CIRCUITS (FIGS. 14 & 14A)

Referring to the figures which show the various elements in their initial positions for automatic operation upon the deposit of a $1 bill, the hot line 110 and its various branches are extended through the diagram by heavy solid lines while the "neutral" and it branches are depicted by heavy dashed lines. The motor pump circuit is shown terminating across two hot lines 110 and 108 to provide 230 VAC to this motor. If a 115 VAC motor 11 is used, line 108 is omitted and a connection to neutral is substituted therefor.

Lamp L6 is energized whenever the system is ready for accepting deposits, via line 110 at K13-7,1, lines 401, 401A, L6 to 106.

Power is supplied to the bill acceptor motor 212 and validator 399 by

*CIRCUIT DD* from 110 at K15-9,3, 405B, K12-7,1, 405A, selector switch S24, 405, the motor 212 and validator 399, in parallel, manual switch S30, 407D, K11-3,9, 481, 433, K16-7,1, 485, K15-1,7, 487 to 106. These elements operate continuously except when relays K12 or K15 are energized. When a bill is inserted, it will be tested, if 212 is operating, and will be rejected and returned or deposited in the cash box 171. In the latter case, vend switch 243 closes momentarily to energize

*CIRCUIT AA* from 110 at K7, through the coil, 407, 407A, K8-3,9, 407B, K10-3,9, 407C, 243 to 106.

Lamp L1 has one side connected to 110 and the other side connected to 407C and through 243 to 106. It will be lighted for the duration of the vend pulse to indicate the acceptance of the bill.

Relay K7, when it is energized by Circuit AA, closes all of its contacts. The closure of K7-7,4, establishes a holding

*CIRCUIT AA*1 for K7 from 110, its coil, 407, 409, contacts 7,4, 409A, K15-1,7, to 106. The closure of K7-9,6, closes a deposit option

*CIRCUIT D*01 from 110 through contacts 9,6, 411, coil of K8 to 106. A shunt circuit is also closed through lamp L7 from 411 to 106 to light L7 to indicate that the initial credit has been posted. The relay K8 is a time delay relay which will actuate its contacts about one second after Circuit D01 is closed, to insure that switch 243 is open to prevent a possible double credit from being established by the initial closure of 243. The closure of K7-8,5, energized the power control leg to the dispenser.

*CIRCUIT FF* from 110 at K7-8,5, line 415 to S22 (which is open) and to S23 which is also open. since xince S23 is operated by lever 69, which is under the control of the customer, dispensing may now be started if the customer desires. He has the alternative of depositing another bill instead, because the energization of K8 opens K8-3,9, in Circuit AA and closes K8-9,6 of a deposit upcount

*CIRCUIT DU*1 from 110 at K9, the coil of K9, to line 429, K8-6,9, 407B, K10-3,9, 407C, switch 243 and to 106. Thus K9 will be energized on the next closure of vend switch 243 when another bill is accepted. K8-4,7, are closed to light lamp L2 via 110, K8-4,7 and 413, L2 to 106, to show that another $1 may be deposited.

Assuming that the customer elects to dispense the credited $1 amount, he will turn lever 69 to its horizontal on position. This closes S23 and applies power from Circuit FF to the register resetting motor 383 which is grounded via

*CIRCUIT FF1* through **417** and **K12-3,9,** to **106.** Upon completion of register resetting, **S23** will open and **S22** will close. Motor **383** is deenergized. **S22** energizes

*CIRCUIT II* from line **415** of FF through **S22, 419,** the coil of **K17** to **106.** A buzzer **420,** which is connected in parallel with the **K17** coil, is energized to indicate that the nozzle may beused to dispense fuel. This is true because the closing of **K17-5,3,** & **6,4,** energize the pump motor.

*CIRCUIT JJ* from **110** through **5,3, 421,** motor **11, 423, K17-4,6,** to **108.** Further,

*CIRCUIT KK* to the slow flow valve solenoid **63** has been closed from **419** of Circuit II through **425,** coil **63** to **106,** so that valve **61** is open. Similarly

*CIRCUIT LL* which also branches from **419** of Circuit II through **427, S25***a*, **427A,** cam switch **163** (which is closed when cams **135-7** are in their initial positions), **427B,** solenoid **59** of pilot valve **57** to **106.** Thus, upon manual opening of the nozzle valve **35,** the main valve **49** will open, so that a full flow may be dispensed.

This delivery will be terminated automatically when the **$1** credit is exhausted because, upon the closure of **S22,** a relay **K13** was energized by a

*CIRCUIT DR* from FF thru **S22, 419, 427, 445,** coil of **K13** to **106.** Energization of **K13** closes **K13-8,5,** to establish

*CIRCUIT MM* from Circuit leg FF through **447, K13-8,5, 447A,** coil of **K12** to **106.** The opening of **K13-7,1,** opens the Circuit to lamp **L6** through lines **401, 401A, L6** to **106.** The energization of **K12** opens its **1,7,** contacts to break Circuit DD so as to prevent the deposit of bills, and simultaneously closes its contacts **7,4,** to establish holding

*CIRCUIT HC3* for **K12** from **106** through its coil, **K12-7,4, 405B, K15-9,3,** to **110.** The opening of **K12-3,9,** breaks the ground Circuit FF1 of motor **383** to prevent effective operation of **S23** by lever **69.**

The penny pulsing switch **S13** is closed momentarily upon the completion of delivery of each 1 cent worth of fuel. This switch is in series with normally open cam switch **S18** which is held closed in the initial position of cam **348A** but is opened, as the first event of the cam mechanism, after a small amount of fuel is delivered. The pulsing

*CIRCUIT PP* is one leg of a stop control circuit and extends from **110** at **S26***a*, through **401C, S13, 401B,** hot side of **L6, 401A, 449,** to **S18.** This circuit is ineffective when the first pulse occurs from **S13** because the stop control

*CIRCUIT SC,* which extends from the fixed contact of **S18** through **449A, K14-5,8,** (now open), **449B, 449C,** coil of **K15** to **106,** is open. However, the condition of **K14-5,8** is altered, after **S18** is opened, by the establishment of an exhausted credit

*CIRCUIT EC* which extends from **110** at **K14,** through its coil and **451B, K11-8,2, 451A, K9-8,2, 451,** normally open cam switch **S19** to **106.** The 2nd event of the cam mechanism is the closure of **S19** by **348B** which completes Circuit EC to energize **K14. K14-7,4,** close a holding

*CIRCUIT HC4* from **110** through the **K14** coil, **K14-7,4, 453, 409A, K15-1,7,** to **106. K14-8,5,** now closes the SC Circuit to the now open **S18.** The opening of normally closed cam switches **S20** and **S21** have no effect since the credit relays **K9** and **K11** are not energized because only **$1** was deposited.

As the delivery proceeds to the 93 cents mark, there are no changes in the system except that the registers **17** and **19** accumulate the quantity and cost of the fuel as it is delivered. When 93cents worth have been delivered, cam **135** opens switch **163** to break Circuit LL. The pilot valve solenoid is deenergized and the valve **57** will close to cause closure of main valve **49.** Delivery continues at a reduced rate, through valve **61** until, within the last cent of the delivery, cam **348A** closes **S18** and at the end of delivery of the last 1cent, the pulse Circuit PP is closed by **S13** and the pulse is transmitted through the SC Circuit to energize **K15.** This opens **K15-1,7,** to break the hold Circuit AA1 of **K7** and also the hold Circuit HC4 of **K14.** Opening of **K15-3,9,** opens the hold Circuit HC3 for **K12.** The release of **K14** opens SC to drop **K15.**

The release of **K7** reopens all of its contacts so as to break Circuit FF which in turn deenergizes Circuit II and drops relay **K17** to open pump motor Circuit JJ. The deenergization of Circuit II also deenergizes Circuit DR to drop **K13** and Circuit KK to the slow flow valve which closes to terminate all flow.

The release of **K12** and **K15** recloses the DD Circuit to restart the bill acceptor and validator and, since the opening of **K7-9,6,** has deenergized **D01** and **K8,** the deposit of another bill will establish a new credit by reenergizing **K7,** however, since lever **69** was not moved to its off position, **S22** remains closed so that the deposit of another bill will reestablish the apparatus for making another delivery without the necessity of resetting the registers **17** & **19.** Further delivery will be accumulated thereon in addition to that registered on the first delivery.

MULTIPLE $1 CREDITS

Assuming that the customer exercises the option of depositing two additional **$1** bills instead of turning lever **69** on after depositing the 1st bill, as described above, the apparatus will be in the condition described just before the lever was turned on. **K7** will be energized and held by AA1; **K8** is energized by **D01;** Circuit DU1 is prepared for operation; lamp **L2** is lighted to indicate that an additional deposit may be made; Circuit DD is closed and motor **212** running; **L6** is energized through **K13-7,1,** and Circuit FF is energized to **S22** and **S23.** Thus when a second **$1** bill is accepted, the switch **243** will again be closed momentarily to light **L1** and to energize the DU1 Circuit which closes **K9** and lights **L3** to acknowledge the deposit.

Such closure establishes a **K9** holding

*CIRCUIT HC1* from **110** through coil **K9, 431, K9-4,7, 431A, 431B,** normally closed cam switch **S20, 433, K16-7,1, 485, K15-1,7, 487,** to **106.**

The opening of **K9-2,8,** opens the EC Circuit to prevent the operation of **K14** at the end of the delivery of the first **$1** delivery. The closure of **K9-6,9,** closes

*CIRCUIT D02* from **110** through **6,9, 435,** coil of **K10** to **106. K10** is a delay relay which responds after one second, to close its contacts. Closure of **K10-4,7,** lights **L4** via **110,** through **437** and **L4** to **106** to indicate that another deposit may be made. **K10-9,3,** are opened in Circuit AA and **9,6,** are closed to prepare a deposit upcount.

*CIRCUIT DU2* for operation, upon the next deposit, from **110** through coil of **K11, 439, 439A, K10-6,9, 407C, 243** to **106.** However, with the apparatus in this

condition, the customer again has the option of taking delivery or of depositing a third bill. Since the countdown for a $3 credit includes that for a $2 credit, the deposit of the third bill is assumed. The resulting closure of 243 energized Circuit DU2 to pull in K11. K11-3,9, open to break Circuit DD so that bill acceptor is rendered ineffective and no additional bills can be deposited. K11-9,6, are made to close an auxiliary ground.

*CIRCUIT AG* for K9 from 106 through 487, K15-1,7, 409A, 485, K16-1,7, 433, 481 and through K11-9,6, 443 to 431A. The EC Circuit is again opened by K11-2,8, and a holding

*CIRCUIT HC2* is closed from 110 through the coil of K11, 439, 441, K11-4,7, 441A, normally closed S21, 433, K16-7,1, 485, K15-1,7, 487 to 106. Lamp L5 is connected between 110 and to both lines 439 and 439A so that it is energized by both Circuits DU2 and HC2, to indicate the acceptance of the 3rd bill and the credit therefor.

The customer must now turn lever 69 on. This results in the closure of S23, the operation of the register resetting motor 383 as described above and the automatic closure of S22 and opening of S23 at the completion of resetting.

S22 connects the power leg FF with Circuits II, KK, LL and DR to energize K17, which closes JJ to start motor 11; the slow flow solenoid 63; pilot valve solenoid 59 and the dispensing relay K13, so that dispensing occurs with the opening of nozzle valve 35. Relay K13 has energized Circuit MM to pull in K12 which establishes its hold Circuit HC3 and opens the acceptor Circuit DD to prevent acceptance of additional bills. K12-3,9, open the ground Circuit FF1 to the resetting motor 383. The opening of K13-7,1, has also disconnected L6 from the 110 source at K13.

CREDIT DOWNCOUNT BY REVOLUTIONS OF CAMS

FIRST REVOLUTION

The initial positions of cams 135, 137, 348A and 348B are shown in FIG. 14A. Normally closed switches 163, S20 and S21 are closed as is normally open S18. S19 is in its normal, open position. As noted above, pulse switch S13 closes at the end of the delivery of each 1 cent increment of fuel. Even though S13 is providing a pulse through closed S18 to the stop control Circit SC, it would be ineffective because K14 is not energized. The *first* event of the cam mechanism cycle is the opening of S18. The *second* event is the closure of S19 by cam 348B which controls the EC Circuit, but it produces no result since the EC Circuit is opened by K9-2,8, and K11-2,8.

The *third* event, the opening of S20 by cam 348A breaks the ground Circuit HC1 for K9, but no action results because the auxiliary ground Circuit AG through K11-9,6, prevents dropping K9. HC1 is therefore reestablished when cam 348A passes S20.

The *fourth* event is the opening of S21 by cam 348B, which breaks hold Circuit HC2 to drop relay K11. This closes the DD Circuit to 243, but no additional bill can be deposited because the DD Circuit is open at K12-7,1. The AG Circuit for K9 is broken at K11-9,6, and the EC Circuit contacts K11-2,8, are closed. Lamp L5 is extinguished to show the subtraction of a $1 credit.

The *fifth* event is the opening of switch 163 by cam 135 at about the 93 cent point. This is without result because Relay K14 is not energized at this stage and its contacts 3,9, are closed to provide an auxiliary power.

CIRCUIT AP from line 427A of the LL Circuit on one side of switch 183, via 457, K14-9,3, 457A to line 427B on the other side of 163. The circuit LL for the pilot valve solenoid 59 is therefore not interrupted and delivery proceeds at the rate determined by the nozzle valve opening.

The *sixth* event is the reclosing of S18 by cam 348A within the last 1 cent increment of the 1st $1 credit, followed by the pulse from S13 through the PP Circuit to S18 at the end of delivery of that increment. Again, this pulse has no effect because K14-8,5, is open and the SC Circuit is not energized by the pulse.

SECOND REVOLUTION

The first and second events of this revolution produce no results for the same reasons stated in connection with the first revolution.

The third event, opening of S20, breaks the hold Circuit HC1 for K9 which drops out. The EC contacts K9-2,8, remake Lamp L3 is extinguished to indicate subtraction to another $1 credit. K9-6,9, opens to drop relay K10, L4 is deenergized and K10-9,3, of Circuit AA are made.

The fourth event produces no result since HC2 is already open. The fifth and sixth events produce no results other than the maintaining of Circuit AP around switch 163 as above.

THIRD REVOLUTION

The first event of this revolution produces no result but the second event, the closure of S19, now energizes the EC Circuit because both K9-2,8, and K11-2,8, are closed. K14 is accordingly energized. K14-9,3, open the AP Circuit which is in parallel with switch 163, so that the latter will be effective to close the pilot and main valve during this revolution. K14-8,5, close to prepare the stop control Circuit SC for operation. K14-7,4, close to establish the HC4 Circuit for holding K14.

The third and fourth events produce no result since their functions have already been performed. The fifth event, opening of 163, now opens the pilot valve circuit LL to close pilot valve 57 which results in closing the main valve 49. A flow of fuel continues through valve 61, but at a reduced rate, until the sixth event occurs, whereupon the pulse from Circuit PP is conducted via Circuit SC to K15 which becomes energized to open all of its contacts.

As was explained in detail above in connection with the delivery of fuel in response to a $1 credit, the action of K15 deenergizes Relays K7, K8, K12, K13, K14 and K17. The delivery Circuits FF, II, JJ, KK, DR and LL are thus all broken to restore the apparatus to its initial condition except that the switch S22 remains closed. Since the DD Circuit was restored, the bill acceptor and validator are operative so that further deposits may be made, if desired, and additional fuel may be delivered without resetting the registers.

If no further delivery is desired, the customer will restore the nozzle to its support 65. In order to do so, he must return lever 69 to its off position. This action opens S22 so that the transaction is terminated and another delivery cannot be started without first resetting the registers 17 & 19.

It is desired to note that Lamp L6, is connected with the pulse Circuit PP at the junction of wires 401A &

401B. Since the other side of L6 is grounded, and since its supply through K13-7,1, is interrupted during dispensing, the lamp will be energized each time the pulse switch S13 is closed.

It will also be obvious that the various lamps serve to disclose the particular phase of its overall cycle the apparatus happens to have completed at a particular time. This not only aids the customer in determining which options are open to him at such times but also facilitates servicing the apparatus in case a malfunction or improper operation has occurred.

TERMINATION OF TRANSACTION WITH UNUSED CREDIT REMAINING

It is possible that the customer may be unable to accept delivery of all of fuel represented by the established credit because he misjudged the amount required to fill his tank, or for some other reason. In such case the cams of the automatic stop mechanism will not have returned to their initial positions and this would cause an inaccurate delivery during the next transaction. In order to prevent this result, provision is made for resetting the cams in response to the return of the control lever 69 to its off position. The lever has to be returned to such a position before the nozzle can be returned to its support 65.

As noted above, such return of lever 69 opens switch S22 which deenergizes all of the delivery circuits II, KK, etc., which are fed from Circuit FF. This includes the delivery relay Circuit DR, which drops out to reclose K13-7,1, and 8,2. The latter contacts establish a cam resetting

*CIRCUIT QQ* from line 415 of Circuit FF through 447, K13-8,2, 461, K12-5,8, 461A, K15-2,8, 461B, coil of K16 to 106. The K16-9,6 contacts close to establish

*CIRCUIT QQ1* from line 461B of QQ through 463, K16-9,6, 463A, cam reset motor 121 to 106.

The dropping of K13 also prepares a resetting motor stop

*CIRCUIT RS* from 110 at K13-7,1, through 401, 449, S18 (now open) 449A, 467, K16-8,5, 467A, 449C, coil of K15 to 106.

Thus the energization of K16 will, by opening its contacts 7,1, break the holding Circuits HC1 and HC2 for K9 and K11 which drop out to erase any credit which might have remained posted thereon; by closing contacts 9,6, closes QQ1 to start motor 121 and by closing 8,5, prepares the RS Circuit to energize K15 so as to restore the system for a subsequent transaction when the switch S18 is closed by the return of cam 348A to its initial position. The breaking of all of the contacts of relay K15 clears the credit established by K7 in the same manner as described in detail with respect to an automatic stop by exhaustion of the established credit, and returns all of the relays to their initial conditions. In this case register resetting is compelled by the open S23 and S22 to secure delivery after new credit has been posted.

In the event that the lever 69 should be turned off when exactly $1 of more dollars of unused credit remains, the Circuits QQ1 and RS will be energized simultaneously but since the latter will immediately energize K15 which, in turn, drops K16, motor 121 will not operate and the cams will remain in their initial positions, or at the worst will be substantially in their initial positions so that the subsequent delivery is in tolerance.

OPERATION AS A NORMAL DISPENSER

The above described form of the invention may be operated in a normal manner by merely setting the selector switch 229 to its left hand position, FIG. 14A.

This opens the power switch S26*a* and closes S26*b* which connects 110 via line 469 to line 415 of the leg FF, which is supplied through K7-8,5 to line 415 during automatic operation with a credit established. S24 opens to break the acceptor and validator Circuit DD.

S27 is also closed to connect the ground Circuit FF1 of the register reset motor 383 through 471 to ground 106. Thus as soon as the nozzle is removed from the hook 65 and lever 69 is turned on, to close S23, the motor 383 will reset the registers and close S22. Power will be applied immediately from 415 of FF to Circuit II to energize K17 which starts the pump motor 11; to Circuit KK to open the slow flow valve 61 and to Circuit DR to energize the dispensing relay K13. While S25*a* has opened Circuit LL, the contacts S25*b* close to establish a shunt line 468 from 427 to 427B of LL so that the pilot valve 57 is also opened immediately. Thus fuel will be delivered upon opening the nozzle valve 35.

Since manual operation frequently results in random instead of even dollar deliveries and since the restoration of the selector switch 229 to its automatic delivery position can occur with the cams 348A, 348B, 135 and 137 away from their initial or "home" positions, which would result in an inaccurate automatic delivery, it is necessary to reset these cams automatically at the end of each normal delivery. Such resetting is triggered by the turning of the lever 69 to its off position at the end of each normal delivery.

During a normal delivery, dispensing relay K13 is energized as noted above. Its 8,5, contacts are thus closed and have energized Circuit MM to energize relay K12. Power is applied to MM through S26b, 469 and 415 rather than through K7-8,5. The K12-4,7, contacts establish its holding Circuit HC3 through K15-3,9. K12-8,5, is held closed to condition Circuits QQ and QQ1 for closure when K13 is dropped upon the opening of S22 at the termination of a normal delivery.

Thus when 69 is turned off, S22 opens to deenergize Circuits II, KK, JJ, the shunt for LL and DR to R13, which recloses its contacts 7,1 and 8,2. The latter contacts close Circuit QQ to energize K16 which closes its contacts 9,6, to close Circuit QQ1 to energize the cam reset motor 465. This motor rotates the cams clockwise (FIG. 14A) and when the cam 348A closes S18, it closes the reset stop Circuit RS to energize the coil of K15 which opens all of its contacts. This deenergizes Circuits QQ and QQ1 to drop K16 and to stop the motor 465, to break Circuit HC3 and, since K13-8,5, are open, K12 is dropped. Accordingly, if the selector switch 229 should now be set for automatic operation, the cams are in their proper starting positions to make an accurate delivery. The opening of K16-8,5, breaks Circuit RS to drop K15 and since K13 is dropped, the apparatus is ready either for another normal delivery or, if Switch 229 is set to its automatic delivery position, for operation upon the deposit of one or more dollar bills.

s SUMMARY OF AUTOMATIC OPERATION (FIGS. 14 & 14A)

Assuming that selector switch 229 is set for automatic delivery and that power is available between lines

110 and 106 (115V), and between 110 and 108 (230V).

Lamp L6 is glowing continuously to indicate that the apparatus is operable.

Circuit DD is closed so that the bill acceptor motor 212 and the validator are operative. Upon deposit of a bill, the motor moves it through the validator and the bill is either rejected and returned or accepted and deposited in the money receptacle. In the latter case, the vend switch 243 is momentarily closed to energize Circuit AA and K7. K7-7,4, with 15-7,1, establish the hold Circuit AA1 for K7.

K7-8,5, extend power from 110 through Circuit FF to the register reset motor switch S23 which, if it is closed by turning lever 69 on, will energize motor 383 to reset the registers. This motor is grounded to 106 by Circuit FF1 through K12-3,9. The customer has the option of delivering the credited amount or of inserting a second bill. K7-9,6, have closed a deposit option Circuit D01 which lights L7 to acknowledge the $1 credit and have energized delay relay K8. The contacts K8-4,7, light lamp L2 to indicate that another deposit may be made and contacts K8-9,6, have prepared the deposit upcount Circuit DU1 to receive the next vend pulse if a second bill is accepted.

Such second pulse will energize DU1 to energize K9, which is then held by HC1, which includes switch S20 and the normally closed contacts K16-7,1, 485, K15-1,7, 487 to 106. HC1 also grounds L3 which lights to acknowledge the second deposit. Contacts K9-6,9, also energize a second option Circuit D02 to the coil of delay relay K10 which becomes energized. Its contacts 4,7, light L4 to indicate that a third bill may be deposited while contacts 9,6, are closed to divert the next vend pulse through a second deposit upcount Circuit DU2. If a third bill is deposited, the pulse through DU2 energizes the coil of K11, contacts 4,7, of which establish a hold circuit HC2 for K11 through normally closed cam switch S21 and K16-7,1, 485, K15-1,7, 487. The K11-6,9, establish an auxiliary ground Circuit AG for the K9 hold circuit HC1 to prevent HC1 from being opened before K11 has been dropped out as the result of the first downcount of the credited amount. K11-9,3, is opened to disable the Circuit DD so that motor 212 and validator 399 deenergize. Lamp L5 is lighted by HC2 to indicate the credit of the third deposit.

Since no more bills can be deposited for credit, the customer will start delivery by turning lever 69 to on position. This closes S23 in Circuits FF-FF1 to energize motor 383 to reset registers 17,19 to zero and upon completion of resetting, to automatically close S22. This switch extends power from FF to all of the delivery circuits, II, JJ, KK, LL, and delivery relay K13, to energize the pump motor 11, to open the pilot and slow flow valves 57, 59 and to start buzzer 420. Relay K13 contacts 8,5 close Circuit MM to energize K12 which closes its contacts 7,4 for establishing its hold Circuit HC3, through K15-3,9. K12-1,7 open to break the DD Circuit and disable the bill acceptor, while K12-3,9 break the Circuit FF1 to prevent improper manipulation of the motor 383.

The opening of the nozzle valve 35 will open valve 49 so that full flow will be available at the nozzle. The delivery will be registered on 17 and 19, and the penny wheel 6 of the cost register will cause the pulsing switch S13 to close at the end of the delivery of each 1 cent increment. These pulses will also produce flashes in L6.

One of the main functions of S18 is to transmit that pulse from S13, which represents the complete delivery of the last increment of the credited amount, to the stop control Circuit SC to energize K15. The opening of all of the K15 contacts terminates delivery by restoring all of the parts of the control apparatus, except lever 69 and S22 to their initial positions, thereby making it possible to post additional credit and secure additional delivery without resetting the registers. It is only when lever 69 is turned off that the transaction is fully terminated. It is probable that S18 and S13 may remain closed after K15 has been actuated as described, but this has no effect because the SC Circuit is opened when K14 has dropped out.

The downcount of the $3 credit posted as described above is controlled by the cam mechanism which is driven in a clockwise direction (FIG. 14A) in synchronism with the cost register penny wheel 6. Switch S18 will be opened almost immediately at the start of delivery by the passing of cam 348A. Cam 348B will then close S19 of the exhausted credit Circuit without result because the EC contacts of K9 and K11, which are in series with S19 and each other to the coil of K14, are open because a credit is posted on K9 & K11. Cam 348A next opens S20 which is in the hold Circuit HC1 of K9. However, K9 will not drop out because there is a credit on K11 represented by the energized condition of K11, so that the anxiliary ground Circuit AG through K11-6,9 holds K9. Cam 348B will next open S21 in holding Circuit HC2 for K11. This relay drops out extinguishing L5 to indicate the subtraction of $1 from the posted credit.

Cams 135-7 open switch 163 without result because the auxiliary power Circuit AP is closed through K14-9.3 to shunt 136. The closure of S18 by cam 348A and the pulse from S13 complete the first revolution of the cams without result because the EC Circuit is still open at K9-2,8. Cam 348B next closes S19 of the open EC Circuit without result. Cam 348A opens S20 to break HC1 and drop K9, extinguishing L3 to indicate the subtraction of a second $1 credit. The actuation of S21 and 163 produce no results because HC2 is already open and 163 is still shunted by the AP Circuit. The closure of S18 and the pulse from S13 complete the second cycle of the cams and have no result because the EC Circuit has not yet been energized.

On the third cycle of the cams S18 reopens. S19 is closed and since the EC contacts 2,8, of K9 and K11 are closed, Circuit EC energizes K14 which is then held by HC4. The AP Circuit, shunting switch 163, is opened by K14-3,9, while K14-8,5, close to condition the SC Circuit for operation. The opening of S20 and S21 has no effect but the opening of 163, which occurs when about 93 cents of the last $1 credit is delivered, opens Circuit LL to drop solenoid 59 and closes the pilot and main valves 57, 49. A reduced rate of delivery continues through the slow flow valve 61 until S18 recloses and S13 sends the final pulse through S18 and the SC Circuit to energize K15. The opening of all of its contacts by K15 drops out the relays which have remained energized, including itself, and opens all of the dispensing circuits to terminate flow. The opening of K12 reestablishes the DD Circuit to start the bill acceptor, so that the control apparatus is restored to its initial condition except lever 69 which remains on and S22 which remains closed so that the transaction may be extended by further deposit. Should the lever 69 be

turned off without a deposit being made, the transaction would be terminated, and the registers would show the total volume delivered and the cost thereof. A new transaction, which includes the resetting of the registers would have to be started to secure a delivery.

In the event that the customer turns the handle **69** off while a credit of any amount remains on the apparatus, the cams will be reset to their initial positions automatically, because **69** has opened **S22.** This action deenergizes all of the delivery circuits along with the DR Circuit to the delivery relay **K13.** Relay **K12** remains energized along with **K7** because **K15** has not been actuated to drop them. The closure of **K13-8,2** by the dropping of **K13,** energizes Circuit QQ to energize **K16.** The closure of **K16-9,6** closes Circuit QQ1 to energize the cam reset motor **121** which, through differential **116,** rotates the cams in the same direction as they are driven by the cost register. Since power is applied from **110** through **K13-7,1** to **S18** and since **K16-8,5** is closed, the RS Circuit through these elements to **K15** will be closed when **S18** is closed by the return of cam **348A** to its initial position. Since all the parts are normalized by the opening of **K16-1,7** and the energization of **K15** and since **S22** is open, the transaction is completed and a new one will have to be started to secure another delivery.

SUMMARY OF NORMAL OPERATION

The apparatus may be operated in a normal or manual manner by setting the selector switch **229** to its left hand position (FG. **14**) at the start of a new transaction. This switch is preferably a lock switch and can be operated only by a person having the proper key.

In this position of the switch, the Circuit leg FF is supplied from **110** through **S26*b*** to line **415** and motor **383** is grounded through **FF1,** line **471** & **S27,** so that the registers will be reset immediately upon the closure of **S23** by turning the handle **69** on. At the completion of resetting, **S23** is opened and **S22** is closed automatically. Closure of **S22** immediately energizes all of the delivery control circuits such as II, KK, JJ, DR and LL. Switch **163** of Circuit LL is shunted by a line which extends from line **427** on one side, through **S25*b*** and **468** to **427B.** The energization of the delivery relay **K13** closes Circuit MM which energizes **K12,** and **HC3** which holds it. **S24** of the selector opens the DD Circuit to the bill acceptor to prevent deposits.

Accordingly, any number of deliveries may be made, in any amounts, merely by turning lever **69** on to start and turning it off to stop a delivery. However, since the selector switch **229** may be set to automatic delivery at the will of the person having the key and since many of the manual deliveries will not be even dollar deliveries, the cams of the stop mechanism may be out of their initial positions at the end of manual delivery. It is necessary, therefore, to reset the cams after each normal delivery to insure that an automatic delivery which might be made at any time will be accurate.

The dropping of **K13** each time the lever **69** is turned off, after a manual delivery, closes its contacts **8,2** to energize Circuit QQ to pull in **K16** which closes its contacts **9,6** and thereby Circuit QQ1 to the cam reset motor **121.** The **K13-7,1** contacts supply power to **S18** so that when the cams return to their initial positions, **S18** will close Circuit RS to energize **K15** and open all of its contacts to interrupt QQ, QQ1 and **HC3** so that motor **121** is stopped, **K16** is dropped as is **K14** and the deenergization of **K16** drops **K15** so that the system is normalized to permit an accurate automatic delivery should this be desired.

Should **S18** happen to be closed at the end of a manual delivery, Circuits QQ1 and RS would be energized substantially simultaneously and would be broken at once by the energization of **K15** to retain the cams in their initial positions.

While specific structures embodying the invention have been set forth herein for purposes of illustration, the protection granted by any patent issued on this application should not be limited to such specific structures but should extend to any structures which fall fairly within the scope of the claims which are appended hereto.

I claim:

**1.** A system for dispensing a quantity of liquid having a predetermined total value, consisting of a predetermined number of small monetary units of value, in response to the collection of a valid bill of equal total value, said system comprising:

a. a bill acceptor which includes means to receive a deposited bill, means to determine its validity and value, means to collect a valid bill of proper value and means to thereupon produce a first signal,

b. a dispensing apparatus having a manually operable nozzle valve, means for supplying a flow of liquid to said valve, said latter means being actuable between flow and stop flow conditions,

c. said dispensing apparatus also having means for measuring the amount of liquid dispensed, a resettable value register, computing means connected to be driven by said measuring means and connected to drive register in accordance with the value of the liquid dispensed and means for resetting said register to zero,

d. first control means having normal and first conditions, means operable after the resetting of said register for establishing said first control means in said first condition, and manually operable means for restoring said first control means to said normal condition,

e. second control means having normal and first conditions, and means for establishing said second control means in said first condition in response to said first signal,

f. means responsive to said first and second control means in said normal and first conditions, respectively, to permit operation of said register resetting means,

g. means responsive to said first and second control means in said first conditions for actuating said flow supplying means to said flow condition,

h. means operable in time with said value register to produce a second signal upon the complete delivery of the amount of liquid represented by each unit of value,

i. means for transmitting said second signal, including transmission timing means mounted for movement between initial and signal transmitting conditions, first driving means connected to be driven by said register and connected to drive said timing means so as to reach said signal transmitting condition after the beginning of, but before the completion of the delivery of the last unit of said total value, and

j. signal responsive means having normal and activated conditions, and connected to be activated in

response to said transmitted second signal, means responsive to the activation of said signal responsive means, for restoring said second control means to said normal condition, and means for thereupon restoring said flow supplying means to said stop flow condition.

2. The structure defined by claim 1 which includes a digital counter and means connecting said counter with said bill acceptor so as to advance said counter by one digit in response to the collection of a bill.

3. The system of claim 1 wherein the means for producing said first signal includes a normally open switch which is closed momentarily by said acceptor when a bill is accepted and a visible signal is connected with said switch so as to be energized momentarily each time said switch is closed.

4. The structure defined by claim 1 which includes means responsive to the activated signal responsive means for moving said transmission timing means to said initial condition, to interrupt the transmission of said second signal.

5. The structure defined by claim 4 wherein said first control means remains in said first condition and wherein said means for establishing said second control means in said first condition includes means responsive to said first signal for placing said second control means in said first condition and means, responsive to said second control means in said first position and said second signal responsive means in said normal condition, for holding said second control means in said first condition, whereby the occurrence of another first signal subsequent to the interruption of said second signal will reestablish said second control means in said first condition and said flow supplying means in said flow condition without resetting said register.

6. The structure defined by claim 1 which includes means responsive to said first signal for preventing the collection of another bill by said bill acceptor.

7. The structure defined by claim 6 which includes means responsive to said second control means in said normal condition for disabling said bill collection preventing means.

8. The structure defined by claim 1 which includes third control means having normal and first conditions, key operable means for establishing said third control means in said first condition including releasable means for holding same in said first condition independently of said key operable means, and means responsive to said first control means in said normal condition and said second and third control means in said first conditions, to condition said register resetting means for operation.

9. The structure defined by claim 8 wherein said manually operable means is mounted for movement between on and off positions, and which includes means operable thereby as it moves to said on position, to cause said conditioned resetting means to reset said register and establish said first control means in said first condition.

10. The structure defined by claim 9, which includes means responsive to said first and second control means in said first conditions for releasing said third control holding means and means for thereupon restoring said third control means to said normal condition.

11. The structure defined by claim 1 wherein said flow supplying means includes first and second valve means connected in parallel to supply liquid to said nozzle valve at relatively large and small rates of flow respectively, and wherein said flow supplying means includes stop means, operable from a normal to a first condition to close said first valve, and wherein said timing means includes means for operating said stop means to said first condition as said timing means nears said transmitting condition.

12. The structure defined by claim 11 which includes means responsive to said transmitted signal and to said second control means in its normal condition, for restoring said timing and stop operating means to their initial and normal conditions respectively.

13. The structure defined by claim 11 wherein said manually operable means is movable between on and off positions, and which includes selector means selectively settable to predetermining and normal conditions, said selector means, in said normal condition, including means for disabling said bill acceptor and said second signal producing means, and for rendering said stop means ineffective to close said first valve,

a. means responsive to said first control means and said selector means in said normal conditions and said manually operable means in the on position for resetting said register,

b. means responsive to said first control means in said first condition and said selector means in said normal condition, for actuating said flow supply means to flow condition, and

c. means responsive to said manually operable means in its off position for moving said first control means to normal condition to return said flow supplying means to said stop flow condition.

14. The structure defined by claim 1 in which said signal responsive means includes a first actuator having normal and activated conditions, means connecting it to be activated by said transmitted second signal, and wherein siad means for establishing said second control means in said first condition includes a normally closed first switch adapted to be opened by said first actuator when activated, and wherein said timing means comprises a switch control element mounted for movement therewith, a normally open second switch disposed so as to be closed by said element to establish said transmitting condition,

a. means connecting said second switch between said second signal producing means and said first actuator so as to open said first switch upon transmission of said second signal, and means for returning said second control means to normal condition upon the opening of said first switch.

15. The structure defined by claim 14 which includes means for relatively adjusting said second switch and said control switch element, so as to adjust the time of occurrence of said signal transmitting condition.

16. The structure defined by claim 14 wherein said means for producing said second signal includes a normally open third switch, means for connecting it in series with said second switch, an actuating element for said third switch, means mounting said actuating element for movement in a predetermined path to a first point therein at which it closes said third switch and thereafter to a second point therein at which releases said switch to reopen, means for driving said actuating element in time with said value register so as to close said third switch at the completion of delivery of each small monetary unit of value and means for adjusting

said element along said path, relative to said drive means, so as to correlate said switch closure with the completion of said delivery.

**17.** The structure defined by claim **1** which includes selector means selectively settable to predetermining and normal operating conditions, said manually operable means being movable between on and off positions, said selector means, in its normal condition having means for disabling said bill acceptor and for rendering said second signal producing means ineffective,

a. means responsive to said first control means and said selector means in said normal conditions, and said manually operable means in its on position, for operating said register resetting means to reset said register,

b. means responsive to said first control means in its first condition and said selector means in said normal condition, for actuating said flow supplying means to the flow condition, and

c. means responsive to the movement of said manually operable means to its off position for returning said first control means to normal condition to restore said flow supplying means to stop flow condition.

**18.** The structure defined by claim **17** which includes means operable by said register resetting means for resetting said second signal producing means to its signal producing condition.

**19.** The structure defined by claim **17** which includes means responsive to said first control means in said normal condition for applying a third signal to said signal transmitting means, second driving means connected to drive said transmission timing means independently of said value register,

a. first actuating means, responsive to said second control means in said normal condition and said activated signal responsive means, for actuating said second driving means to move said timing means to its initial condition, to interrupt signal transmission,

b. second actuating means, responsive to said first control means and said signal responsive means in said normal conditions, for actuating said second driving means, to move said timing means to said signal transmitting condition, whereby said second driving means is actuable by said first and second actuating means to restore said timing means to said initial condition from any condition of displacement from said initial condition.

**20.** The structure defined by claim **19** wherein said second actuating means includes a device actuable between first and second conditions in which it respectively permits and prevents operation of said second actuating means to actuate said second driving means,

a. means responsive to said first control means in said first condition and said selector means in said normal condition for moving said device to said first condition, means responsive to said device in said first condition and said signal responsive means in said normal condition, for holding said device in said first condition,

b. means responsive to said activated signal responsive means for disabling said holding means, and means operable thereupon for returning said device to said second condition.

**21.** The structure defined by claim **1** which includes second driving means connected to move said transmission timing means independently of, but in the same direction said first driving means, first actuating means, including means responsive to said second control means in said normal condition and said signal responsive means in said activated condition, for actuating said second driving means, and means for stopping said second driving means with said transmitting means in said initial condition.

**22.** The structure defined by claim **21** wherein said second driving means includes an electric motor, said first actuating means includes a normally open switch which is adapted to be closed by said signal responsive means in said activated condition, and said stopping means includes said transmission timing means in said initial condition.

**23.** The structure defined by claim **21** wherein said manually operable means includes an element which is movable between on and off positions and causes said first control means to occupy said normal condition upon movement of said element to its off position, means responsive to said first control means in said normal condition for applying a third signal to said signal transmitting means, second actuating means, including said first control means and said signal responsive means in said normal conditions, for actuating said second driving means to drive said transmission timing means to said signal transmitting condition, to cause said third signal to activate said signal responsive means, and means responsive to such activation to disconnect said second actuating means from, and connect said first actuating means to said second driving means, to restore said transmission timing means to said initial condition.

**24.** The structure defined by claim **23** wherein said second actuating means includes additional means, having normal and activated conditions, for rendering said second actuating means ineffective and effective respectively, means responsive to said first control means in said first condition for activating said additional means, means responsive to said signal responsive means, in said normal condition, and said activated additional means, for holding said additional means activated, whereby said second actuating means is rendered effective to actuate said second driving means upon movement of said first control means to said normal condition with said transmission timing means in a condition other than said transmitting condition.

**25.** The structure defined by claim **24** which includes a third control means having normal and first conditions, key operable means for establishing said third control means in said first condition, means for releasably holding it in said first condition, said establishing and holding means including a normally closed switch controlled by said additional means and adapted to be opened thereby upon activation thereof, said third control means in said first condition, with said first and second control means in their normal and first conditions respectively being connected to condition said resetting means to reset said register, and means responsive to said first control means, in said first condition for activating said additional means to open said normally closed switch to restore said third control means to said normal condition.

**26.** The system of claim **1** which includes a delivery relay having normal and 1st states, means responsive to said first control means in its first condition, for establishing said delivery relay in 1st state, a second relay

having normal and 1st states, means, including said second control means in its first condition and said delivery relay in its 1st state to establish said second relay in its 1st state and means responsive to said second relay in its 1st state and said signal responsive means in its normal condition for holding said second relay in its 1st state.

**27.** The system of claim **26** which includes electrical means for starting and stopping said bill acceptor comprising a normally closed switch and means responsive to said second relay in its 1st state for opening said switch.

**28.** The system of claim **26** wherein said means to permit the operation of said register resetting means includes an electric motor and circuitry for operating said motor, which includes a normally closed switch and means responsive to the establishing of said second relay in its 1st state for opening said switch.

**29.** The system of claim **26** wherein said first and second control means are in their first conditions and which includes

a. a normally open power supply switch which is held closed by said second control means in its first condition,

b. said delivery relay having a normally closed switch which is open when said relay occupies its 1st state; said second relay including a normally open switch which is closed by said relay in its first state; said signal responsive means including a normally closed switch which is opened upon activation of said means; a reset relay having normal and 1st states and having first and second normally open switches which are closed by the relay in its first state,

c. means connecting said power supply switch with the delivery relay switch and through the second relay switch, the signal responsive means switch and said reset relay so as to establish said reset relay in its first state to close its normally open switches, a reset motor connected to the timing means,

d. means connecting the first of said reset relay switches with a supply of power and with said reset motor to cause said motor to restore said timing means to its initial condition when said manual means is operated to restore said first control means to its normal condition while said second control means occupies its first condition.

**30.** The system of claim **29** which includes means for supplying power to said first reset relay switch from the switch of said signal responsive means so that the supply will be interrupted when said means is activated.

**31.** The system of claim **29** wherein the second switch of said reset relay is connected to one side of said transmit switch and to said signal responsive means, and wherein said delivery relay includes a normally closed power switch, means connecting said power switch to the other side of said transmit switch so as to transmit a pulse to said pulse responsive means when said timing means is restored to its initial condition by said reset motor, thereby activating said pulse responsive means to normalize said system.

**32.** The system of claim **31** which includes a multipole selector switch means which is manually settable to automatic and to normal operation positions, said switch means in its automatic setting serving to

a. transmit power to said second signal producing means and

b. permit energization of said bill acceptor, and wherein said means in its normal setting serves to

c. isolate said second signal producing means and supply power directly to said register resetting means and to the normally open and the corresponding normally closed contacts of said delivery relay, independently of said second control means;

d. prevent energization of said bill acceptor and

e. positively complete the ground circuit leg of the register resetting means so as to render said means responsive solely to said manually operable means, and wherein

said establishment of the first control means in its first condition, in response to the resetting of the registers, energizes said delivery relay to establish said second relay in its 1st state and wherein the restoration of first control means to its normal condition restores said dispensing relay to its normal state to cause said timing means to be reset to its initial condition at the end of each normal operation of said dispensing apparatus.

**33.** The system of claim **1** which includes credit posting means in addition to that provided by said second control means in its first condition, said additional posting means comprising

a. first and second devices each having first and second states, means responsive to said second control means in its first condition for establishing said first device in its second state, means established by said first device in its second state to divert another first signal to said second device to establish it in its second state to post an additional credit.

**34.** The system of claim **33** which includes means responsive to said first control means in its first condition, for preventing the establishment of said second device in its second state.

**35.** The system of claim **33** which includes means responsive to said second device, in its second state, to render the transmission of said first transmitted second signal ineffective to activate said signal responsive means to interrupt delivery.

**36.** The system of claim **35** which includes means operable by said transmission timing means for restoring said second device to its first state, and which includes additional means operable by said timing means after passage thereof through its transmitting condition, for conditioning said signal transmitting means to activate said signal responsive means upon the next subsequent movement of said timing means to its transmitting condition.

**37.** The system of claim **36** which includes third and fourth devices, each having first and second states, means responsive to said second device in its second state for establishing said third device in its second state,

a. means established by said third device in said state for diverting a third first signal to said fourth device to establish it in its second state,

b. means responsive to said fourth device in its second state for preventing restoration of said second device to its first state until after the first passage of said timing means through its transmitting condition,

c. said additional means being operable after the second passage of said timing means through its signal transmitting condition, to condition said signal transmitting means to activate said signal responsive means upon the third movement of said timing means to its transmitting condition.

**38.** The system of claim **33** which includes third and fourth devices, each having first and second states, and which includes means responsive to said second device in its second state, for establishing said third device in its second state and

a. means established by said third device in its second state for diverting a third first signal to said fourth device to establish it in its second state, to post a further credit.

**39.** The system of claim **38** which includes means responsive to said fourth device in its second state for disabling said bill acceptor.

**40.** The system of claim **38** which includes means responsive to said first control means in its first condition for preventing the establishment of said fourth device in its second state.

**41.** The system of claim **38** wherein said first and third devices include means for delaying the establishment thereof in their respective second states.

**42.** The system of claim **33** wherein said means for transmitting said second signal includes a normally open transmit switch connected in series with a normally open stop control switch and wherein said timing means includes means for closing said transmit switch when said timing means moves to its transmitting condition and for opening it when it passes said condition, and wherein the means for closing said stop control switch includes:

a. a coil connected in a circuit which comprises a normally closed switch which is opened by said second device in its second state and a normally open credit switch which is disposed for closure by said timing means subsequent to the reopening of said transmit switch and to reopen as said timing means continues in motion,

b. means for holding said second device in its second state, said means comprising a normally open switch which is closed by said second device in its second state and which is in series with a normally closed first hold switch, said hold switch being disposed so as to be opened by said timing means after said credit switch is reopened and said second device restored to its first state, whereby:

1. The first closing of said credit switch is ineffective to close said stop control switch; the first opening of said hold switch restores said second device to its first state and the first subsequent closure of said transmit switch has no effect, and whereby

2. The second closure of said credit switch will energize said coil to close said stop control switch so that the next subsequent closure of said transmit switch will be effective to transmit the next second signal to activate said signal responsive means.

**43.** The system of claim **42** wherein said timing means includes rotary cam means which rotate one revolution as said timing means move from initial to signal transmitting condition, said cam means and transmit switch being disposed so that said switch is closed in the initial and transmitting conditions of said timing means and is opened as the first event of a revolution, means for disposing said credit switch to be closed and opened by said cam means after said transmit switch is opened, means for disposing said first hold switch to be opened and closed by said cam means, after said credit switch has been opened, to restore said second device to its first state.

**44.** The system of claim **42** wherein said flow supplying means includes a normally closed main valve and a slow flow valve connected to bypass said main valve, and wherein the means for actuating said flow supplying means includes motor operated means for opening and closing said main valve as said motor is energized and deenergized respectively,

a. means for energizing said motor including said first and second means in their first conditions and a normally closed first switch connected so as to supply said motor,

b. a normally closed second switch connected in parallel with said first switch, means responsive to the energization of the coil for closing said stop control switch and for opening said second switch,

c. means operable by said timing means for opening said first switch after said second switch is opened and before said timing means reached its transmitting condition, so as to deenergize said motor and close said main valve prior to the subsequent closure of said transmit switch.

**45.** The system of claim **42** which includes a delivery relay having normal and first states, means responsive to said first control means in its first condition for establishing said relay in its first state, a second relay having normal and first states, means including said second control means in its first condition and said delivery relay in its first state to establish said second relay in its first state and means responsive to said second relay in its first state and said signal responsive means in its normal condition for holding said second relay in its first state,

a. means for resetting said timing means to its initial condition, including a reset motor connected to drive said timing means, a reset relay having normal and first states and having first and second normally open switches and a third normally closed switch, said means for holding said second device in its second state including said third switch in series with the hold switch thereof,

b. energizing means for said reset relay including a power switch which is closed by said second control means in its first condition, a normally closed switch of said delivery relay, a normally open switch of said second relay and a normally closed switch of said signal responsive means,

c. means connecting said reset relay first switch to said energizing means and said reset motor to energize the motor when said first switch is closed,

d. means for supplying a substitute second signal to said signal responsive means comprising a normally closed power switch of said delivery relay, said transmit switch and said reset relay second switch whereby

a. upon restoration of said first control means to normal condition while said second control means occupy said first condition, said reset relay will be energized to open said second device to restore it to its first state, and to energize said reset motor,

2. said motor will actuate said transmit switch upon return of said timing means to initial condition to transmit the substitute signal to activate said second signal responsive means.

**46.** The system of claim **45** which includes third and fourth devices each having first and second states, wherein said second device in its second state is connected to establish said third device in its second state for diverting a third first signal to establish said fourth device in its second state, said fourth device including a normally open switch, means connecting said switch in series with a source of power and through a normally closed second hold switch and said normally closed third switch of the reset relay so as to hold said fourth device in its second state, said third switch serving to return said fourth device to its first state upon energization of said reset relay.

**47.** The system of claim **42** which includes third and fourth devices each having first and second states, means responsive to said second device in its second state for establishing said third device in its second state, means established thereby for diverting a third first signal to said fourth device to establish it in its second state to post a third credit, said fourth device including

a. a normally closed switch connected in series with said coil and the normally closed switch of said second device, a normally open auxiliary switch connected in parallel with said normally closed first hold switch, and a normally open switch in series with a normally closed second hold switch, for holding said fourth device in its second state, said second hold switch being disposed for operation by said timing means so as to be opened thereby after the first hold switch is reclosed upon continued operation of said timing means,

1. said auxiliary switch thus serving to retain said second device in its second state during the initial opening of said first hold switch, so as to require a third closure of said credit switch to effect the closure of said stop control switch and a subsequent third closure of said transmit switch to activate said signal responsive means.

**48.** The system of claim **47** wherein said fourth device includes a normally closed switch, said bill acceptor having electric driving means and said switch connected therewith so as to disable said drive means when said fourth device is in its second state.

**49.** The system of claim **47** which includes means responsive to the energization of the coil of said stop control switch and to said signal responsive means in its normal condition, for maintaining said coil energized.

**50.** The system of claim **47** wherein said timing means includes rotary cam means which rotate one revolution as said timing means move from initial to signal transmitting condition, said cam means and transmit switch being disposed so that said switch is closed in the initial and transmitting conditions of said timing means and is opened as the first event of a revolution, means for disposing said credit switch to be closed and opened by said cam means after said transmit switch is opened, means for disposing said first hold switch to be opened and closed by said cam means after said credit switch has been opened and means for disposing said second hold switch so as to be opened by said cam means after said first hold switch has been reclosed and before said transmit switch is reclosed.

**51.** The system of claim **47** which includes a visible signal for each of said devices and means for energizing the signal of each device as said device is established in its second state.

**52.** The system of claim **51** which includes a second visible signal for said first device and means for energizing said signal when said second control means is in its first condition, to indicate that said first device should be in its second state.

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