United States Patent [19]

Burke et al.

[11] **3,731,777**

[45] **May 8, 1973**

[54] COIN OPERATED FLUID DISPENSER

[75] Inventors: **William F. Burke,** Westminster; **Robert C. Greenwood,** Los Angeles; **Thomas E. Jones,** Costa Mesa, all of Calif.

[73] Assignee: **Pan-Nova, Inc.,** Santa Fe Springs, Calif.

[22] Filed: **July 26, 1971**

[21] Appl. No.: **165,449**

[52] **U.S. Cl.** **194/13,** 222/2, 222/26

[51] **Int. Cl.**.....**G07f 13/00**

[58] **Field of Search**.....222/14, 15, 16, 20, 222/2, 144.5, 145, 23, 24, 25, 26–37; 194/13, 3

[56] **References Cited**

UNITED STATES PATENTS

3,036,585 5/1962 Shawhan .....222/28 X

3,130,869 4/1964 Phillips et al.....222/26

Primary Examiner—Samuel F. Coleman

Attorney—Harris, Kern, Wallen & Tinsley

[57] **ABSTRACT**

A coin operated system for selectively dispensing prenium and regular grades of gasoline utilizing a single coin handling unit, computer and dispensing control. An electronic system for registering payment, controlling the amount of fluid dispensed, and making exact change for unused payment. A dispenser adaptable to various monetary systems and to various coin input ranges and to various coin return ranges.

15 Claims, 6 Drawing Figures

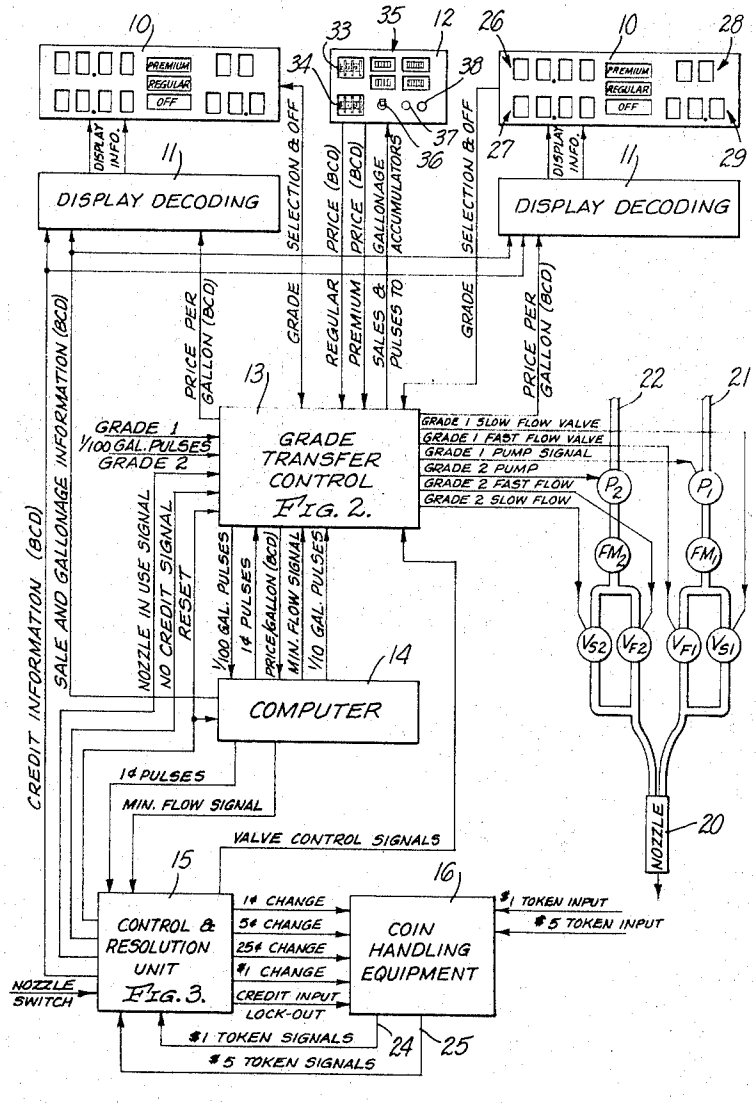
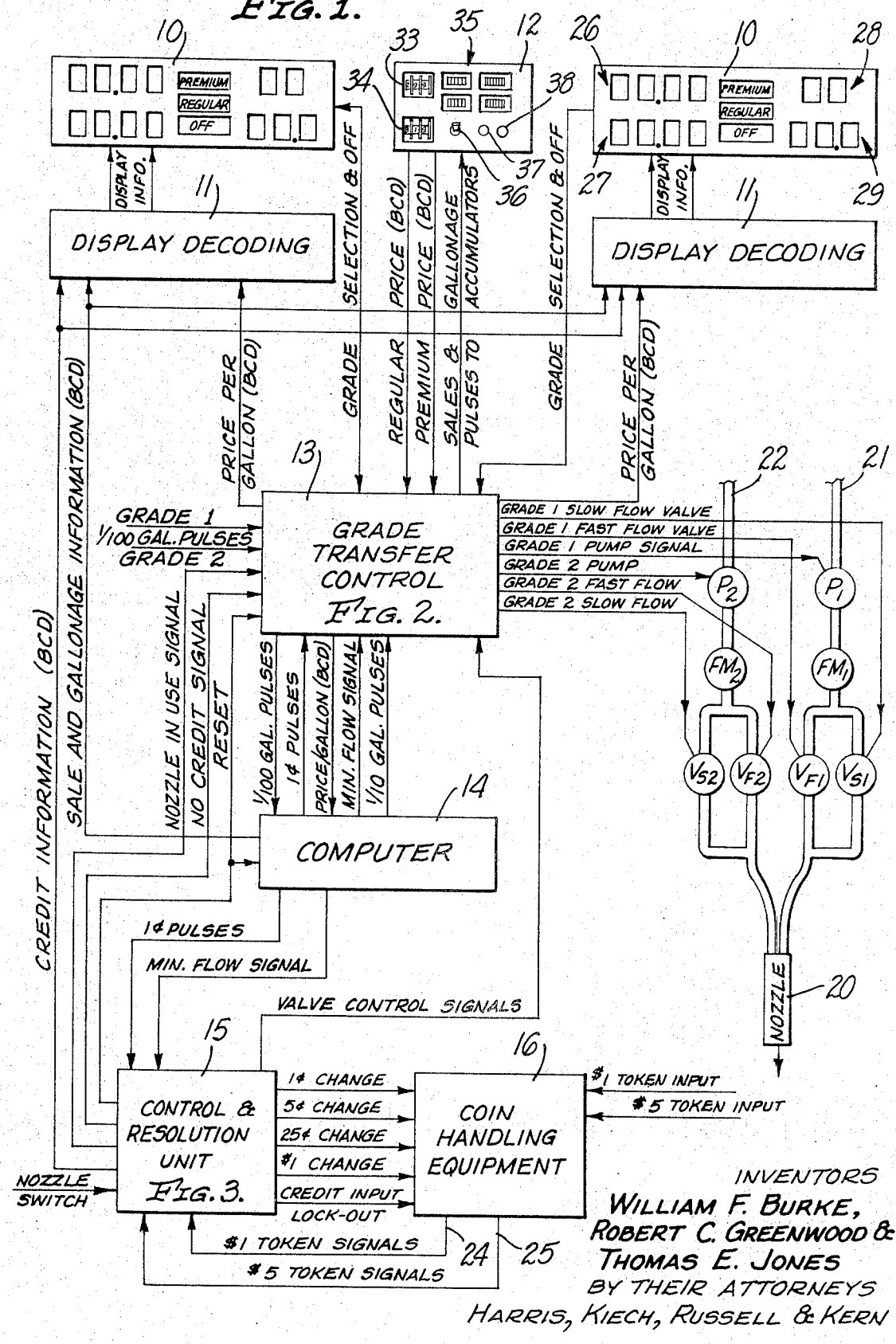
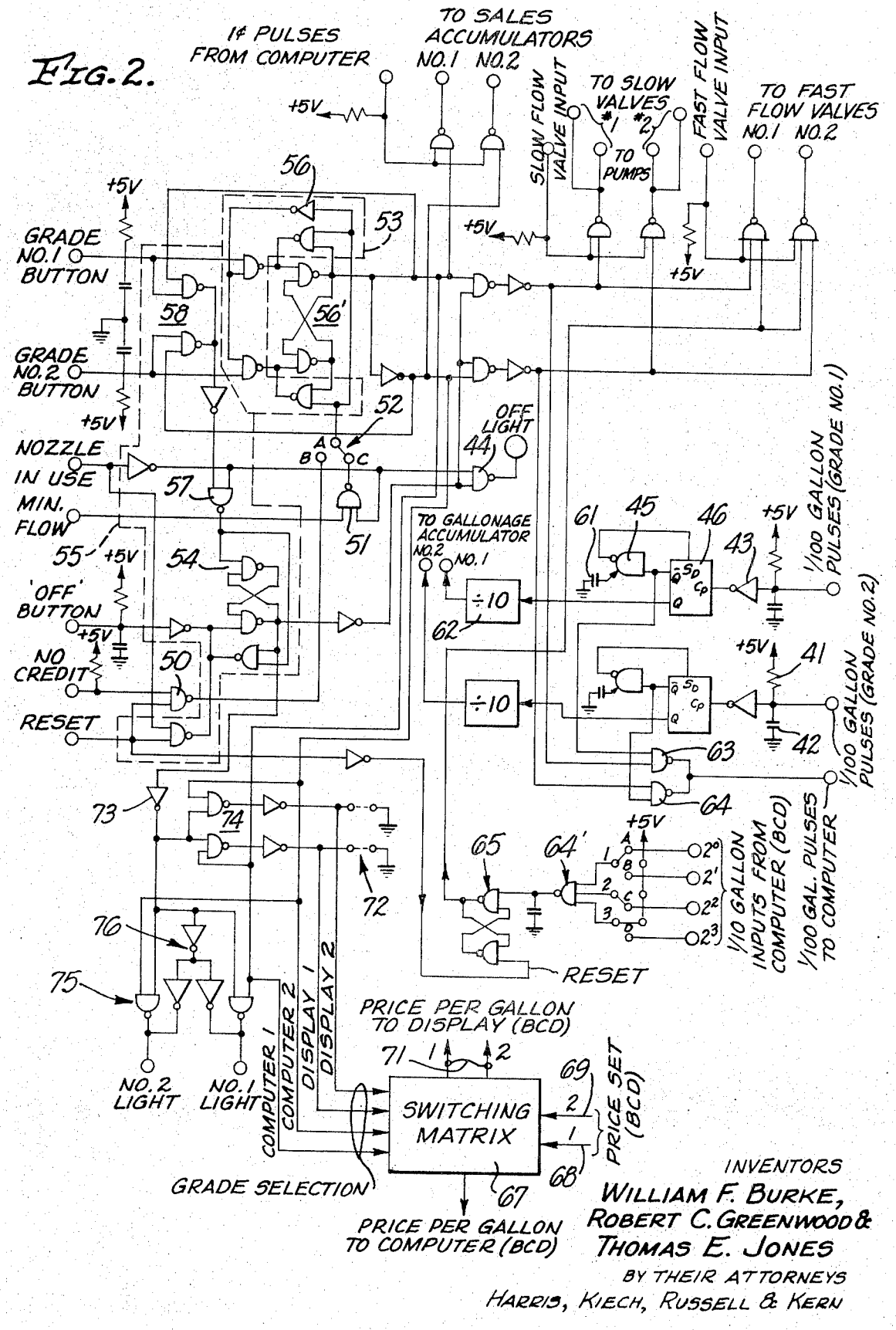


FIG. 1.



INVENTORS
WILLIAM F. BURKE,
ROBERT C. GREENWOOD &
THOMAS E. JONES
BY THEIR ATTORNEYS
HARRIS, KIECH, RUSSELL & KERN

FIG. 2.



INVENTORS
WILLIAM F. BURKE,
ROBERT C. GREENWOOD &
THOMAS E. JONES
BY THEIR ATTORNEYS
HARRIS, KIECH, RUSSELL & KERN

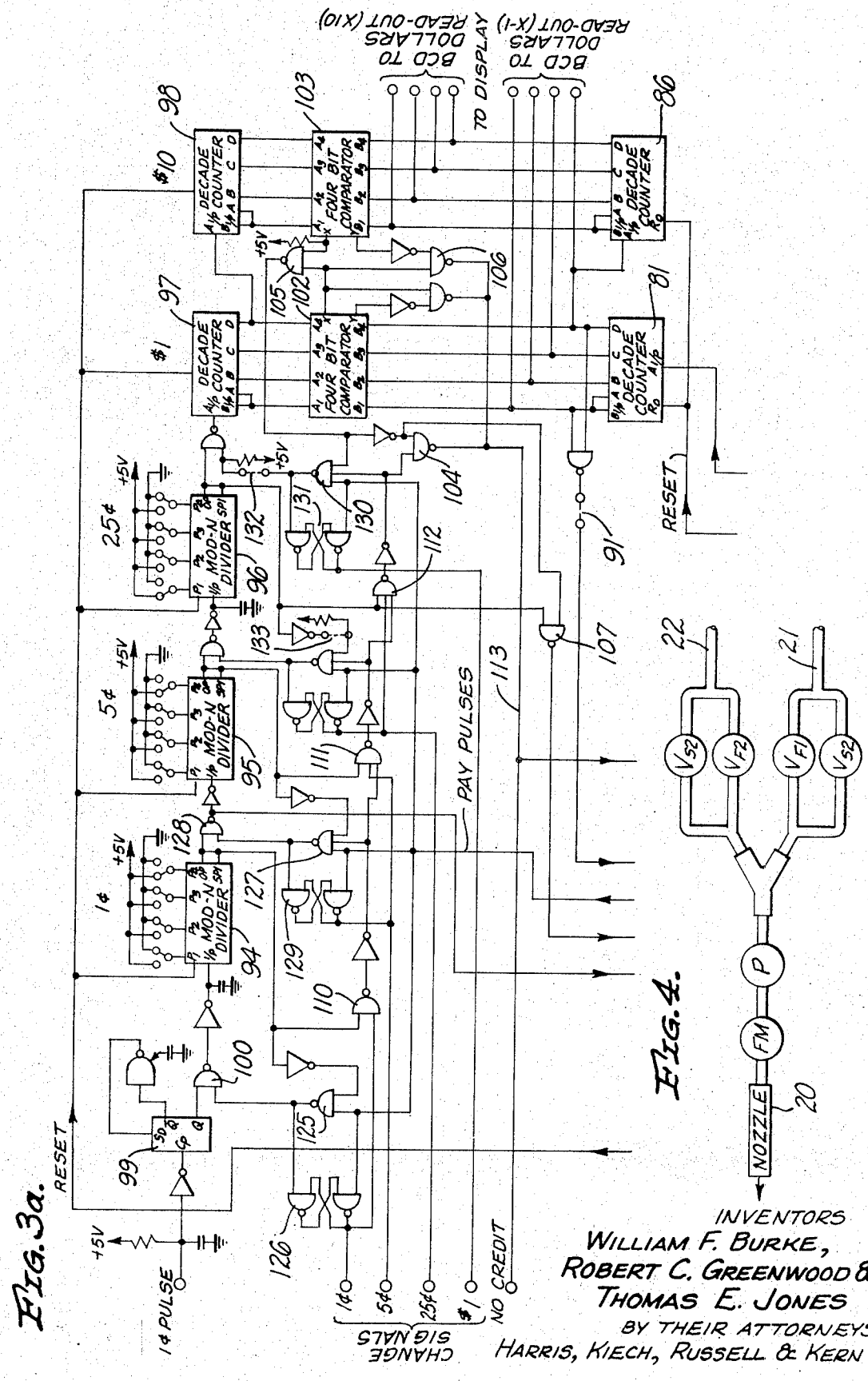


FIG. 3a.

FIG. 4.

INVENTORS
WILLIAM F. BURKE,
ROBERT C. GREENWOOD &
THOMAS E. JONES
BY THEIR ATTORNEYS
HARRIS, KIECH, RUSSELL & KERN

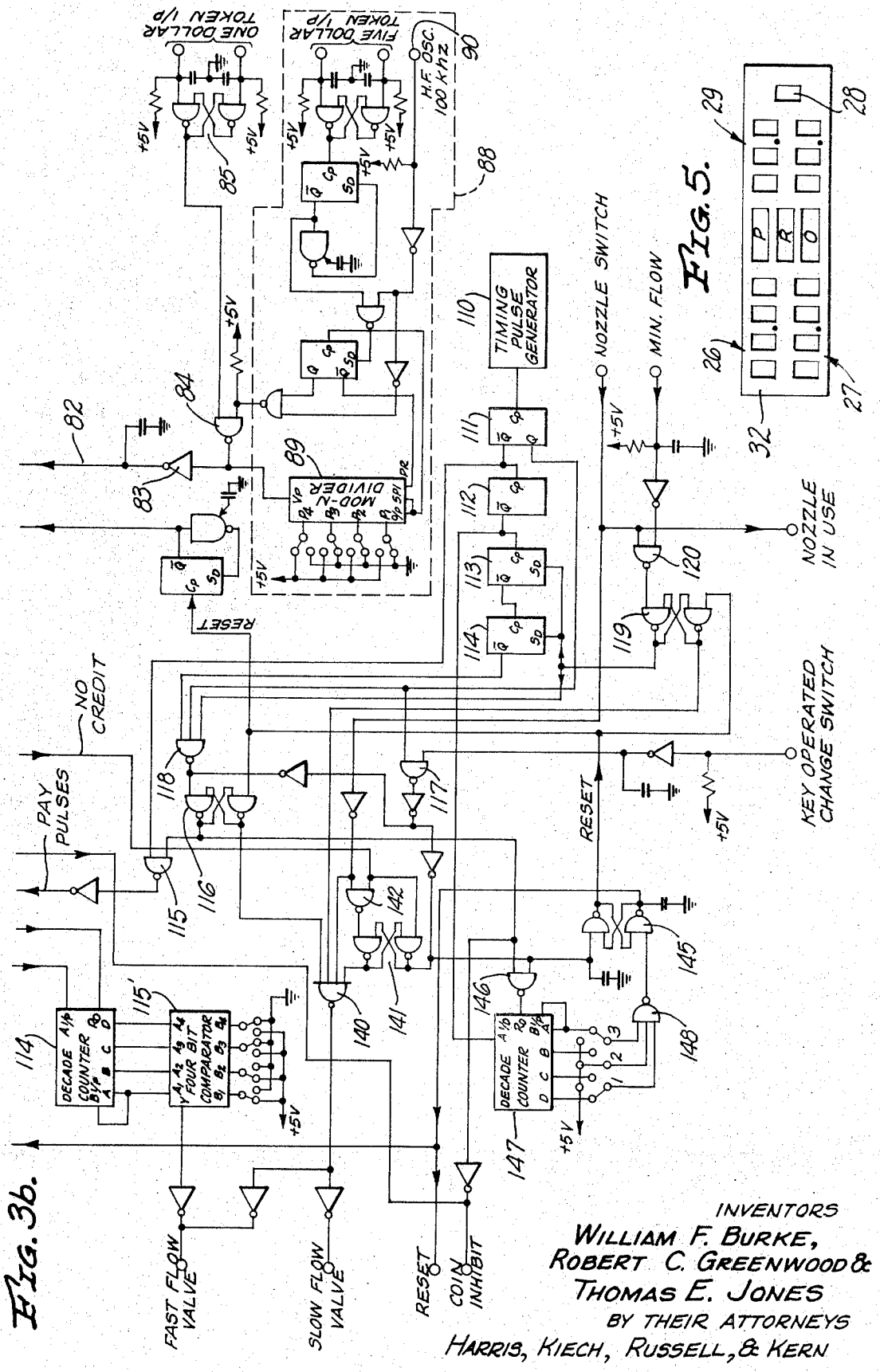


Fig. 3b.

Fig. 5.

INVENTORS
WILLIAM F. BURKE,
ROBERT C. GREENWOOD &
THOMAS E. JONES
BY THEIR ATTORNEYS
HARRIS, KIECH, RUSSELL, & KERN

COIN OPERATED FLUID DISPENSER

BACKGROUND OF THE INVENTION

This invention relates to automatic fluid dispensing systems such as are used in the gasoline pumping installations at an automobile service station. However, it will be readily recognized that the system of the invention can be utilized for dispensing other fluids in other environments. Features of the system include operation by the customer without requiring attention by station personnel, operation by depositing coins, the return of exact change when all of the fuel initially purchased is not delivered, and the dispensing of more than one grade of fuel in response to selection by the customer.

A typical gasoline dispenser includes a fluid pump and pump control switch, a hose with nozzle for insertion into the vehicle tank and a flow control on the nozzle, and one or more manually controlled levers which function to start and stop the pump and reset the system. Fluid flow through the outlet line is measured, the volume of material dispensed is calculated and displayed, the price or monetary amount of the sale of material is calculated and displayed, and the unit price of the material is displayed.

A variety of gasoline dispensers have been described in the literature and some of them have been placed in service. The earlier systems were mechanical devices and more recent systems have been electromechanical devices and typical prior art dispensers are shown in U.S. Pat. No. 3,550,743 and U.S. application Ser. No. 868,088, filed Oct. 21, 1969, now allowed, and in the references of record in these two patents. The dispensing system of the present application is a digital electronic system and is more than a mere electrical equivalent of the earlier systems, incorporating new features, new results and new combinations of elements.

SUMMARY OF THE INVENTION

The dispensing system of the invention may use conventional pumps, flow meters, valves and nozzle for handling the fluid dispensed, and conventional coin receiving and paying mechanisms, with new and improved computing and control. One important feature is the handling of two grades of fuel with a single computing and control arrangement and a single outlet nozzle, whereby the customer can use a single dispenser and select the grade of fuel desired, even after depositing the coins. Grade selection is accomplished by the customer pushing the appropriate button, and the system provides the appropriate unit price (e.g., cents per gallon) for computation and display and actuates the appropriate flow system to deliver the selected grade of fuel. Another feature is the registering of money deposited and the registering of the selling price of fuel dispensed, with the register for the latter having a series of stages corresponding to various monetary units (e.g., pennies, nickels, quarters and dollars), with coincidence in the registers providing for shut-off and with change payment accomplished by stepping the stages to achieve coincidence. The dispensing system includes means for readily changing the values of the monetary units and the interrelations of the monetary units, so that the system may be used for different values of coins and with monetary systems of different countries having different coinages. The particular embodiment illustrated and described herein is designed for operation with tokens representing $1 in value and, as an alternative, $1 and $5 tokens, and change is made in U.S. coins. Of course the system can be designed to handle any type and value of coin or token and the word coin is used herein to include any of the objects representing monetary value.

In the conventional installation, the valves and meter, computer and display, and outlet nozzle are all positioned at a single spot, resulting in the bulky pump housing unit now familiar to every motorist. In contrast, the components of the system of the present invention may be separated from each other and located as desired. The coin handling mechanism and the display may be installed adjacent the outlet nozzle or remote therefrom. The computer and control require a few electrical connections with the remainder of the system and may be disposed in any convenient location. The system also provides for remote recording of total sales and total volume and remote setting of the unit price of the grades on one or more dispensers at the same time for centralized management of a plurality of dispensing systems.

Other objects, advantages, features and results will more fully appear in the course of the following description where preferred embodiments of the present invention are given by way of illustration or example.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram of a fluid dispensing system incorporating the presently preferred embodiment of the present invention;

FIG. **2** is an electrical diagram of the grade transfer control of FIG. **1**;

FIGS. **3***a* and **3***b* are an electrical diagram of the control and resolution unit of FIG. **1**;

FIG. **4** is a diagram illustrating an alternative embodiment of the fluid flow arrangement of FIG. **1**; and

FIG. **5** is a diagram of an alternative embodiment of the display of FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The dispensing system of FIG. **1** includes two identical display panels **10**, each having a display decoding unit **11**. The system also includes an attendant control panel **12**, a grade transfer control unit **13**, a computer **14**, a control and resolution unit **15**, and coin handling equipment **16**.

A premium or grade **1** gasoline is delivered to an outlet nozzle **20** via line **21** from storage through a pump P1, flow meter FM1, and slow flow valve VS1 and fast flow valve VF1 operated in parallel. A regular or grade **2** gasoline is delivered to the outlet nozzle **20** via line **22** from storage through a similar pump, flow meter and valve arrangement. The electrical interconnections between the various elements of the system of FIG. **1** are indicated by the single lines with legends. The grade control transfer unit **13** is shown in greater detail in FIG. **2** and the control and resolution unit **15** is shown in greater detail in FIGS. **3***a* and **3***b*. A computer suitable for use as the computer **14** is shown in copending application entitled Gasoline Pump Calculator, Ser. No. 138,912, filed Apr. 30, 1971 and assigned to the same assignee as the present application.

The coin handling equipment **16** may be conventional and includes one or more slots for receiving coins, here a token representing $1 and a token representing $5, and generating an output pulse on line **24** for each one dollar token received and an output pulse on line **25** for each five dollar token received. The coin handling equipment also provides for storage of pennies, nickels, quarters and dollars, and a mechanism for dispensing each of the coins in response to a signal on a corresponding input line from the control and resolution unit **15**. Also, the coin handling equipment functions in response to a signal on the credit input lockout line from the control and resolution unit **15**, to prevent receipt of tokens, as by blocking the input slots or by rejecting the tokens.

In a typical installation, two display panels **10** may be mounted in a housing, back to back, for viewing from either side of the housing. The coin slots and return receptacle of the coin handling equipment may be positioned at one end of the housing, with a holster for the nozzle **20** at the other end of the housing. The embodiment illustrated utilizes a conventional two-channel hose with a single nozzle, which may consist of one hose positioned inside a second hose or two lengths of hose disposed side by side and joined to each other. Laws in a number of states require separate fluid paths for different grades of gasoline, with the only common portion of the paths being in the nozzle itself. An alternative flow path configuration is shown in FIG. **4** and is suitable for use where separate flow paths are not required. In this configuration, the valves are upstream of the pump and flow meter, requiring only one pump and one flow meter.

The display panel **10** includes four display areas **26**, **27**, **28**, **29**, each of which may have one or more conventional digital display elements for displaying numbers. Area **26** provides a four digit display of the volume of gasoline dispensed during a sale, in hundredths of a gallon. Area **27** provides a four digit display of the price of the gasoline dispensed, in dollars and cents. Area **28** is a two digit display of the credit received by depositing tokens. Area **29** is a three digit display of the unit price of a gallon of gasoline, in cents and tenths of a cent. The display panel also has three illuminated push button switches carrying the legends Premium, Regular, and Off. In the embodiment illustrated in FIG. **1**, the Off switch is illuminated when the system is reset and ready for use by a customer. The customer selects the grade of gasoline desired by pushing the appropriate switch. When the Premium switch is pushed, it is illuminated and the unit price of the Premium grade appears at display area **29**. When the Regular switch is pushed, it is illuminated and the unit price of the Regular grade appears at area **29**.

An alternative configuration for a display panel is shown in FIG. **5** comprising a display panel **32** with display areas **26** and **27** corresponding to those of the panel of FIG. **10**. Only a single digit is provided for the area **28**, limiting the system to **$9.00** credit. Two three-digit displays are provided for the unit price area **29**. When the system is reset and ready for a customer, the price per gallon of both grades is displayed. When a customer selects a grade by pushing the appropriate button, the unit price for the selected grade remains on display and the other price is turned off. The grade transfer control unit of FIG. **2** may be utilized with either style of display panel.

The display decoding unit **11** is a conventional unit which accepts the display data in binary coded decimal form and converts it to the form suitable for use with the particular display elements incorporated in the display panel.

The attendant control panel **12** is suitable for installation at a central location, such as the office of the service station. The panel includes a unit price setting switch **33** for grade **1** gasoline and a similar switch **34** for grade **2** gasoline. Each of the switches **33**, **34** may be a three-digit, 10-position switch for generating a price per gallon in binary coded decimal for the grade transfer control unit of FIG. **2**, and also provide a visual indication of the switch setting for the station attendant. The panel also includes four accumulators **35** for registering the total sales in dollars and gallons of both grades of gasoline. The panel **12** may also include an on-off switch **36**, a standby battery test switch **37**, and a refund switch **38** which may be used by the station attendant to provide a refund, as described hereinafter.

Each of the flow meters provides an electrical output signal which varies as a function of the fluid flow therethrough. The flow meters may be conventional units with conventional pulse generators and, in the embodiment illustrated, each pulse generator produces pulses at a rate of 100 pulses per gallon or a pulse for every one-hundredth gallon, and the pulse output from the flow meters are connected as inputs to the grade transfer control unit **13**. The grade transfer control unit selects either the grade **1** pulses or the grade **2** pulses for connection to the computer **14**.

A preferred embodiment of the grade transfer control unit **13** is shown in detail in FIG. **2**, where conventional circuit symbols are utilized including resistor **41**, capacitor **42**, inverter **43**, nand gate **44**, nand with expander **45**, and flip-flop **46**.

When the grade **1** or Premium button is pushed at the display panel, a signal appears at the grade **1** button terminal in FIG. **2**. This signal passes through some interlocking circuitry and appears as one input to the gate for the sales accumulator No. **1** terminal, to the gate for the No. **1** pump terminal and the No. **1** slow flow valve terminal, and to the gate for the No. **1** fast flow valve terminal. When the Regular or grade **2** button is pushed, a similar signal appears at the grade **2** button terminal and at the gates for the corresponding No. **2** terminals for sales accumulator, fast and slow flow valves, and pump.

When fuel is being dispensed, the computer produces an output pulse for each cent of sale. These one cent pulses are connected as inputs to each of the gates for the sales accumulator terminals and are selectively directed to the grade **1** sales accumulator or the grade **2** sales accumulator, depending upon the grade selected by the customer. The control and resolution unit **15** determines when the slow flow valve is to be opened and closed and when the fast flow valve is to be opened and closed. The signal for opening the slow flow valve is connected at the slow flow valve input terminal and to each of the gates for the slow flow valves and pumps. The signal for the fast flow valve is connected to the fast flow valve input terminal and to the gates for the fast flow valves. The grade selection by the customer determines which slow valve and pump is energized by the slow flow valve signal and which fast flow valve is energized by the fast flow valve signal.

The customer may select either grade of fuel by pressing the appropriate button, and in one embodiment, may change his mind as often as he wishes until fuel delivery actually commences. In another embodiment, the grade transfer cannot be accomplished after a token is deposited and credit established. Gates **50** and **51** and jumper connections at **52** control the time at which grade transfer is permitted. With a jumper connection at **52** between A and C, the gate **51** is in control and will permit transfer only if the nozzle is in use and minimum delivery of fuel has not been accomplished. When the nozzle is removed from the holster, a nozzle is use signal is provided in the conventional manner, as one input to the gate **51**. The computer **14** calculates fluid flow and when a predetermined amount of fuel has been delivered at the beginning of a delivery cycle, a minimum flow signal is provided as another input to the gate **51**. Typically this may be accomplished by providing an output from the computer volume register when a tenth of a gallon or a twentieth of a gallon or some other predetermined volume has been delivered. Hence when there is a nozzle in use signal and a minimum flow signal, the output of the gate **51** blocks further transfer from either grade to the other, even though a grade selection button is pushed.

When a jumper is connected between A and B of **52** rather than between A and C, the gate **50** controls when grade transfer can occur. When a customer has no credit, that is when no tokens have been deposited or when all of the fuel purchased has been delivered or a refund has been made, a no credit signal is produced in the control and resolution unit **15** and appears as one input to the gate **50**. After a fuel delivery and change payout is completed, a reset signal is developed in the control and resolution unit and appears as another input to the gate **50**. When there is credit and the system is reset, the gate **50** will permit transfer of grade.

Grade transfer blocking or grade lock-in is controlled by the gates in section **53**. When the signal at A of **52** is high, calling for transfer blocking, grade transfer is not permitted since both the left gates in **53** are disabled through the inverter **56**. The pair of gates at **56'** function as a latch so that the customer does not have to keep his finger on the grade button during delivery. The possibility of noise transferring grade selection once the output of A at **52** has gone high, is suppressed by the two right hand gates in **53**.

The gates in section **55** control the turn-off and restart flow conditions. The pair of gates at **54** form an off button latch which is in the off state inhibiting flow whenever the off button in the display panel is pressed, or when the nozzle is not in use and the system is reset. At this time, the off light will be energized through the gate **44**. At the start of a dispensing operation when the nozzle is removed from the holster and a grade has been selected, the gate **57** will be enabled and will clear the off latch **54**, enabling fluid flow.

If the customer wishes to stop fluid flow without replacing the nozzle, he may press the off button on the display panel, which sets the off latch, stops flow, and lights the off light. In order to restart flow, the customer must now press the grade selection button for the grade which he previously selected. The gates **58** determine which grade select button can clear the off latch; only the gate for the grade previously selected can be enabled by a grade select button. Pressing this grade button will cause the gate **57** to be enabled and clear the off latch. If however, the customer had replaced the nozzle in the holster after pressing the off button, the gate **57** would be disabled and the off latch could not be cleared. If the customer then wished more fuel, he would have to wait until the change payout was completed and the system reset, after which one or more tokens would be inserted and a grade selected to start a new dispensing cycle.

The grade transfer control unit **13** includes means for coupling the outputs of the pulse generators of the flow meters to the computer **14** and to the volume or gallonage accumulators of the attendant control panel **12**. The 100 gallon pulses from the grade **1** flow meter FM1 are connected as an input to the flipflop **46** through the inverter **43**. The gate **45** is connected between an output and an input of the flipflop **46** to provide a reset pulse a predetermined time after each set pulse through the inverter **43**, with the time delay determined by the capacitor **61**. One output of the flipflop **46** is connected as an input to a decade divider **62** which provides one tenth gallon pulses as an output to the gallonage accumulator. A similar circuit is provided for the hundredth gallon pulses from the pulse generator for the flow meter FM2, providing tenth gallon pulses to the grade **2** gallonage accumulator. The other output of flipflop **46** is connected to gate **63** and this gate is enabled to pass the hundredth gallon pulses to the computer when grade **1** is selected. Similarly, grade **2** hundredth gallon pulses are passed by gate **64** to the computer when grade **2** is selected. The gates **63**, **64** prevent the transfer of any volume pulses of one grade when the other grade has been selected.

When the configuration of FIG. **4** is utilized with a single flow meter, the gates **63**, **64** are not required; however, another pair of gates will be utilized for selectively directing the volume pulses to the grade **1** and grade **2** gallonage accumulators, under the control of the grade selection circuit.

While the preferred embodiment of the dispensing system utilizes the slow valve and the fast flow valve connected in parallel to provide a high rate of flow during most of the dispensing cycle and a reduced rate of flow near the end of the cycle, the system could utilize a single flow control valve with a single rate of flow if desired. The system provides for having the initial flow rate low and changing to the higher flow rate after a predetermined short period of time, typically after the first half gallon has been dispensed. The grade transfer control unit **13** provides for this control function and also provides for changing the time at which the fast flow valve opens. The gates controlling the slow flow valves have the slow flow valve signal and the grade selection signal as inputs. The gates controlling the fast flow valves have the fast flow valve signal and the grade selection signals and an initial flow signal as inputs. The initial flow signal is provided by gate **64'** and a pair of gates operated as a latch **65**. Tenth gallon signals are provided from the computer in binary coded decimal to terminals A, B, C and D at the input of gate **64**. By selectively connecting the gate inputs **1**, **2** and **3** to the terminals A–D and a reference voltage, the gate **64** can be enabled for any volume from one tenth gallon through nine tenths of a gallon. The connection shown

in FIG. 2 provides for enabling the fast flow valves through gate 64' and the latch 65 when five-tenths of a gallon have been dispensed. The circuit remains in the enabling position throughout the remainder of the dispensing cycle, until the latch is reset by a signal on the reset line.

The unit price or price per gallon for each of the grades of gasoline is set by the attendant at the control panel 12 and is directed to the display panels and to the computer as required by the grade selection, through a switching matrix 67 which may be a conventional switching circuit for binary coded decimal information. The unit prices for grades 1 and 2 are provided to the matrix 67 on lines 68, 69, respectively. One or the other of these unit prices is connected to the computer as determined by the grade selection signals on the computer 1 and computer 2 inputs to the matrix 67. One or the other of the unit prices is selected for the price per gallon at the display panel 10, in the switching matrix 67 under the control of the grade selection signals at inputs display 1 and display 2. A selection signal on the display 1 input to the switching matrix connects the price per gallon for grade 1 to the output line 1. Similarly, a selection signal on the display 2 input connects the grade 2 price to the output line 2. For the display panel 10 of FIG. 1, output lines 1 and 2 are connected by a jumper 71, since only the selected grade price is displayed. For the display panel 29 of FIG. 5, the jumper 71 is omitted. At the time the customer approaches the dispenser, the system is reset and the Off latch 54 is set. The input to inverter 73 is therefore high making an input of both gates 74 low and their outputs both high thus enabling the display of both grade prices. When the nozzle is raised and a grade selected, the off latch will be reset and inverter 73 disabled making the common inputs to gate 74 high. Now the unselected grade price will be extinguished and the selected grade price will remain. If desired, the unit price for both grades can be displayed continuously by connecting the display 1 and display 2 inputs to circuit ground with jumpers at 72.

The lights for the premium or grade 1 push button and the regular or grade 2 push button are energized by the grade selection signals through gates 75 and inverters 76. When the off button is pushed, the off light is energized.

By way of example, the inverters may be a DM936N, the two input hand gates may be a DM946N, the three input nand gates may be a DM963N, the nand gates with expander may be a DM932N, the flipflops may be a DM9093N, and the decimal dividers 52 may be a SN7490 decade counter.

A preferred circuit for the control and resolution unit 15 is shown in detail in FIGS. 3*a* and 3*b*. Each time a $1 token is deposited, the coin handling equipment 16 provides a pulse signal to the $1 token input terminals (FIG. 3*b*). This pulse is coupled as an input to a decade counter 81 via line 82, inverter 83, gate 84 and latch 85. One input terminal to the latch goes low with the $1 token signal and the other input terminal goes low at the end of the pulse signal, with the latch functioning to prevent multiple signals to the decade counter which might be caused by contact bounce and the like in the coin handling equipment. The decade counter 81 provides for receiving up to $9 in credit. If the system is to handle a larger amount of credit, a second decade counter 86 is provided, with the D output of counter 81 connected as an input to counter 86. The units digit for the credit area 28 of the display panel 10 is provided in binary coded decimal at the A, B, C, D outputs of counter 81. Similarly, the tens digit is provided by the corresponding outputs of the counter 86.

The section 88 of FIG. 3*b* provides for handling another token of a different value, in the embodiment illustrated, a $5 token. A pulse for each $5 token received appears at the $5 token input terminals and the section 88 functions as a pulse generator to provide five pulses on the line 82 for each input pulse. The ratio of output pulses to input pulses is controlled by a modulo–*n* divider 89 which can be set to divide by any number 1 through 15 by appropriately connecting the terminals P1–P4 to +DC and circuit ground. The connection as shown in FIG. 3*b* is for a $5 token, providing five output pulses for each pulse at the input terminals, with an oscillator input at terminal 90 providing the pulse train for the divider.

When the system is operated for a $9 maximum input, without the counter 86, a jumper is installed at 91 to provide a coin inhibit signal when counter 81 has counted to nine, with the coin inhibit signal preventing receipt of further tokens. A similar source for a coin inhibit signal could be provided for the counter 86 if it was desired to prevent establishing more than ninety-nine dollars credit. This would not be needed for a gasoline dispenser utilizing the present dollar monetary system, but might be desired for dispensing other products and/or for dispensing with other monetary systems.

Dividers 94, 95, 96 and counters 97, 98 are connected serially to form a register for the penny pulses from the computer which are coupled as an input to the divider 94 through a flipflop 99 operated as a one shot, and a gate 100. The input-output ratio of the dividers is selected depending upon the monetary system utilized and the particular coins to be utilized in making change. This selection is accomplished by appropriately connecting the terminals P1–P4 to circuit ground and +DC and, in the embodiment illustrated, dividers 94 and 95 have a ratio of five to one and divider 96 has a ratio of four to one for counting and making change in pennies, nickels, and quarters. The counters 97 and 98 are decade counters for dollars and tens of dollars. Of course, other ratios could be used for the counters 81, 86, 97, and 98, depending upon the monetary system being used.

The count states of the counters 81 and 97 are compared in a comparator 102 and the count states of the counters 86 and 98 are compared in a similar comparator 103. When there is coincidence in both comparators, a stop signal is provided as one input to gate 104 via gate 105. Where a $9 maximum input system is used, the counters 86, 98, the comparator 103 and the gate 106 are omitted. The dividers and counters 94–98 are connected so that when the first penny of the last dollar of credit is used, the counter 97 is stepped to provide coincidence at the comparators. The system continues to dispense fuel until the dividers 94, 95 and 96 count to the last step, developing another stop signal through gate 110, gate 111 and gate 112 for an input to

the gate **104**. When both stop signals are present as inputs to the gate **104**, this gate is enabled producing a no credit signal on line **113**.

The system provides for shutting off the fast flow valve before completion of dispensing so that the rate of flow will drop off in two steps rather than in one large step. A decade counter **114** (FIG. 3*b*) is reset via gate **107** by the first stop signal from the gate **105** and when the first penny of the last quarter has been used denoted by the output of divider **96**. The 5 cent pulses from the output of divider **94** are connected as inputs to the counter **114**, with the count state of the counter compared with a preset count state in a comparator **115'**. When there is coincidence, the fast flow valve is turned off. The point at which the fast flow valve is closed may be preset by appropriately connecting the B1–B4 terminals of comparator **115'** to +DC and circuit ground. As illustrated in FIG. 3*b*, the fast flow valve will be turned off when there is fifteen cents credit remaining.

If the customer replaces the nozzle in the holster before all of the credit has been used, the system will automatically pay out change to the exact penny for the credit remaining. Pay pulses are used in lieu of the penny pulses as an input to the dividers and counters **94–98** to generate the change signals. The timing for the pay pulses is provided by the pulse generator **110** and flipflops **111–114**. The pay pulses are produced by the output of flipflop **111** through gate **115**. The pulse rate may be changed by changing the frequency of the generator **110**. Gate **115** is enabled by the latch **116**, which may be switched to the pay condition by the station attendant with the key operated change switch **38** on the control panel **12** through gate **117**, and by gate **118**. Flipflops **113**, **114** and gate **118** are blocked by latch **119** until after minimum flow has occurred and the nozzle has been replaced so that a refund cannot be made until these conditions have occurred. The nozzle switch signal and the minimum flow signal are combined at gate **120** for actuating the latch **119**. Another input for gate **118** comes from flipflop **114** which provides a delay in enabling gate **118** for a period of time after the nozzle has been replaced. The third input for the gate **118** comes from flipflop **111** which permits a pay cycle to start only after a change in state of flipflop **111** so that a full period of time is available for the initial pay pulse.

Pay pulses are connected as an input to divider **94** through gate **100** and gate **125**. The pay pulses also provide one cent change signals via latch **126**. Up to four pennies will be paid out, depending upon the state of the divider **94**. When a full count is achieved in the divider **94**, gate **125** is disabled and gate **110** is enabled, permitting pay pulses to be connected as inputs to the divider **95** through gate **127** and gate **128**. The pay pulses are now connected as 5 cent change signals through latch **129**. The operation of the system in paying out nickels and quarters is the same as in paying out pennies. With the system connected as shown in FIG. 3*a*, only pennies, nickels and quarters will be paid out in change, four quarters being paid for every dollar of credit remaining. The system can be changed to pay out dollars also via gate **130** and latch **131** by inserting jumpers at **132**, **133**.

Both the slow flow valve and the fast flow valve are controlled by gate **140**. The valves are maintained closed while change is being made, with a signal from the latch **116**. The valves are maintained closed if minimum flow has occurred and the nozzle is replaced, by a signal from latch **119**. The valves are maintained closed when the nozzle is in the holster, by a signal direct from the nozzle switch. The valves are maintained closed when there is no credit, by a signal from the latch **141** and gate **142**.

The reset pulses for the entire system are produced by latch **145**. Reset occurs a predetermined period of time after gate **146** is enabled. Flipflop **112** provides a pulse train as an input to decade counter **147**, with the counters reset being removed when gate **146** is enabled. At a particular count state, as determined by the inputs to gate **148**, the reset latch **145** is actuated to produce the reset pulses. The duration of delay in the reset cycle can be adjusted by suitably connecting the counter outputs A–D to the gate terminals 1–3. The gate **146** is enabled when the nozzle is replaced, via latch **116**, and when there is no credit, via latch **141**. Gate **146** can also be enabled when the nozzle is replaced, by the key operated change switch.

By way of example, the modulo–*n* dividers may be DM8520, the decade counters may be SN7490, and the comparators may be DM8200.

In operation, the systems will be reset and the station attendant will set the price per gallon at the switches **33**, **34** of the control panel **12**. A customer approaches and may deposit one or more tokens. The number of tokens deposited is registered in the counters **81**, **86** to establish the credit. The customer removes the nozzle from the holster, actuating the nozzle switch, puts the nozzle in the tank, and selects the grade of fuel desired. When a grade is selected, the appropriate indicators and controls are enabled. The appropriate pump and slow flow valve are energized and, when the manual valve at the nozzle is opened, fuel is delivered. Tokens can be deposited before or after a grade is selected. After a predetermined minimum amount of fuel has been delivered, the fast flow valve is also opened, and after another predetermined minimum amount of fuel is delivered (which may be the same or more or less than that for opening fast flow valve), grade selection is blocked out. The flow meter produces volume pulses for the computer which utilizes the volume pulses and the unit price to calculate the sale price and sale volume. Penny pulses from the computer are counted in the multi-stage register **94–98** to produce the no credit signal for stopping fuel delivery when all of the credit is used. Also, the fast flow valve is closed a predetermined time prior to consumption of the total credit. The slow flow valve is closed and the pump is shut off when there is no credit remaining. When the customer replaces the nozzle in the holster, actuating the nozzle switch, the system is automatically reset for the next customer.

If fuel delivery is terminated prior to using all the credit, and the nozzle is replaced in the holster, change will be refunded to the customer for the amount of credit remaining. Fuel delivery can be terminated at any time by pressing the off button on the display panel. If the nozzle is replaced, a refund will be made for the remaining credit, providing the initial minimum

flow of fuel has occurred. If a customer wishes a refund after depositing one or more tokens and before taking any fuel, the station attendant can provide the refund with the switch at the control panel **12**.

Although exemplary embodiments of the invention have been disclosed and discussed, it will be understood that other applications of the invention are possible and that the embodiments disclosed may be subjected to various changes, modifications and substitutions without necessarily departing from the spirit of the invention.

We claim

1. In a system for selectively dispensing first and second fluids through an outlet line, the combination of:

meter means for measuring flow of the first and second fluids in the outlet line and generating a flow signal varying as a function of fluid dispensed;

first and second valve means for controlling flow of the first and second fluids, respectively, in the outlet line;

price means for generating a unit price signal for each of the first and second fluids;

computer means having a flow signal and a unit price signal as inputs and providing as outputs, a sale price signal and a sale volume signal;

fluid selection means for generating first and second fluid signals for selecting one of the first and second fluids for dispensing;

display means for displaying unit price, sale price, sale volume and fluid selected in response to unit price, sale price, sale volume and fluid signals, respectively, as inputs;

transfer control means having unit price, flow and fluid signals as inputs and providing as outputs to said computer means, selected unit price and flow signals, and as outputs to said display means, selected unit price and fluid signals, and providing a control signal to the corresponding one of said valve means, in response to the selected one of said fluid signals, for dispensing a selected fluid and computing and displaying the unit price, sale price and sale volume of the fluid dispensed; and

means for connecting unit price signals from said price means, flow signals from said meter means and fluid signals from said fluid selection means to said transfer control means, and for connecting selected unit price and flow signals from said transfer control means to said computer means and selected unit price and fluid signals from said transfer control means and sale price and sale volume signals from said computer means to said display means.

2. A system as defined in claim **1** wherein said meter means includes

a first flow meter upstream of said first valve means for measuring flow of the first fluid and generating a first flow signal, and

a second flow meter upstream of said second valve means for measuring flow of the second fluid and generating a second flow signal,

with said first and second flow signals connected as inputs to said transfer control means for providing a selected one of said flow signals to sad computer means.

3. A system as defined in claim **1** wherein said meter means includes a flow meter downstream of said first and second valve means for measuring fluid flow and generating a flow signal for connection as an input to said computer means.

4. A system as defined in claim **1** wherein said display means includes means for displaying simultaneously first and second unit prices in response to first and second unit price signals from said transfer control means,

with said transfer control means including means for providing as output to said display means, both of said unit price signals when no fluid is selected for displaying both unit prices, and the selected one of said unit price signals when a fluid is selected for displaying the corresponding unit price.

5. A system as defined in claim **1** wherein said display means includes means for displaying one unit price in response to a unit price signal from said transfer control means,

with said transfer control means including means for providing as output to said display means, a selected unit price signal only when a fluid is selected.

6. A system as defined in claim **1** including:

first circuit means for blocking operation of said fluid selection means in generating said first and second fluid signals;

second circuit means for generating a minimum flow signal when a predetermined minimum amount of fluid has been dispensed; and

third circuit means connecting said minimum flow signal to said first circuit means for preventing fluid selection after said minimum amount of fluid has been dispensed.

7. A system as defined in claim **1** including:

a second display means remote from said one display means and having first and second sale volume registers and first and second sale price registers, and

with said price means including at said second display means, manually adjustable means for changing said unit price signals; and

circuit means connecting flow signals for the first and second fluids to the first and second sale volume registers, respectively, and connecting sale price signals for the first and second fluids to said first and second price registers, respectively.

8. In a coin-operated fluid-dispensing system including pump, flow meter, flow control valve, outlet line, a computer producing monetary pulses as a function of fluid dispensed, and a coin dispenser for dispensing coins of various monetary units, the combination of:

a first register for registering sales units, with a sales unit being a predetermined multiple of the monetary pulse;

means for receiving coins and advancing said first register a number of sales units corresponding to the coins received;

a second register for registering monetary pulses, said second register including a plurality of serially connected stages corresponding to monetary units including said sales unit, said first and second registers having count states;

a comparator having the states of said first register and the sales unit stage of said second register as

inputs for generating a first stop signal when there is coincidence in sales units registered therein;

said second register including means for advancing the sales unit stage thereof a sales unit with the first monetary pulse of a sales unit, producing said first stop signal when less than one sales unit remains for dispensing, said second register including means for generating a second stop signal when the less than sales unit stages advance to the complete count state;

first means having said first and second stop signals as inputs to provide a no credit signal when both stop signals are generated; and

second means responsive to the no credit signal for closing the flow control valve.

9. A system as defined in claim **8**, including:

third means responsive to closure of the flow control valve in the absence of a no credit signal for generating pay pulses; and

fourth means for connecting said pay pulses to successive stages of said second register for advancing each stage to the complete count state when the flow control valve is closed in the absence of a no credit signal, and to the coin dispenser inputs for dispensing coins corresponding to the monetary units of the stages.

10. A system as defined in claim **9** in which said first register includes means for registering in sales units and in a multiple of sales units, and

in which said second register includes a stage corresponding to sales units and a succeeding stage corresponding to said multiple of sales units, and

in which said comparator includes means for generating said first stop signal when there is coincidence in sales units and multiples of sales units.

11. A system as defined in claim **9** wherein the coin dispenser includes means for dispensing coins of different monetary values, with each value a whole number multiple of the next lower value, and

with said second register having a stage for each whole number multiple and with each stage requiring a quantity of input pulses corresponding to its whole number multiple to produce an output pulse to the next stage.

12. A system as defined in claim **11** wherein the whole number multiples of said second register stages may be changed to correspond to coins of different monetary values.

13. A system as defined in claim **9** wherein said fourth means includes means for blocking and unblocking pay pulses in response to a control signal; and

said system includes:

first circuit means for generating a minimum flow signal when a predetermined minimum amount of fluid has been dispensed;

second circuit means for generating a nozzle signal when the outlet line nozzle is not in use; and

third circuit means having said minimum flow and nozzle signals as inputs to provide said control signal to said fourth means for unblocking pay pulses after said minimum amount of fluid has been dispensed and the nozzle is not in use.

14. In a coin-operated system for selectively dispensing first and second fluids through an outlet nozzle, and including pump, flow meter, outlet line, and a coin dispenser for dispensing coins of various monetary units, the combination of:

means for generating a flow signal varying as a function of fluid dispensed through the flow meter;

first and second valve means for controlling flow of the first and second fluids, respectively, in the outlet line;

price means for generating a unit price signal for each of the first and second fluids;

computer means having a flow signal and a unit price signal as inputs and providing as outputs, a sale price signal, a sale volume signal, and monetary pulses as a function of fluid dispensed;

fluid selection means for generating first and second fluid signals for selecting one of the first and second fluids for dispensing;

display means for displaying unit price, sale price, sale volume and fluid selected in response to unit price, sale price, sale volume and fluid signals, respectively, as inputs;

transfer control means having unit price, flow and fluid signals as inputs and providing as outputs to said computer means, selected unit price and flow signals, and as outputs to said display means, selected unit price and fluid signals, and providing a control signal to the corresponding one of said valve means, in response to the selected one of said fluid signals, for dispensing a selected fluid and computing and displaying the unit price, sale price and sale volume of the fluid dispensed;

means for connecting unit price signals from said price means, flow signals from said meter means and fluid signals from said fluid selection means to said transfer control means, and for connecting selected unit price and flow signals from said transfer control means to said computer means and selected unit price and fluid signals from said transfer control means and sale price and sale volume signals from said computer means to said display means;

a first register for registering sales units, with a sales unit being a predetermined multiple of the monetary pulses of said computer means;

means for receiving coins and advancing said first register a number of sales units corresponding to the coins received;

a second register for registering monetary pulses from said computer means, said second register including a plurality of serially connected stages corresponding to monetary units including said sales unit, said first and second registers having count states;

a comparator having the states of said first register and the sales unit stage of said second register as inputs for generating a first stop signal when there is coincidence in sales units registered therein;

said second register including means for advancing the sales unit stage thereof a sales unit with the first monetary pulse of a sales unit, producing said first stop signal when less than one sales unit remains for dispensing, said second register including means for generating a second stop signal when the less than sales unit stages advance to the complete count state;

first means having said first and second stop signals as inputs to provide a no credit signal when both stop signals are generated; and

second means responsive to the no credit signal for terminating dispensing through said valve means.

15. A system as defined in claim **14**, including:

third means responsive to closure of the flow control valve in the absence of a no credit signal for generating pay pulses; and

fourth means for connecting said pay pulses to successive stages of said second register for advancing each stage to the complete count state when said valve means are closed in the absence of a no credit signal, and to the coin dispenser inputs for dispensing coins corresponding to the monetary units of the stages.

* * * * *