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Mitchell

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[54] **AUTOMATIC CHANGE RETURN APPARATUS**

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[52] **U.S. Cl.** ..... **194/1 M,** 133/4, 194/13

[51] **Int. Cl.** **G07f 13/06**

[58] **Field of Search** ..... 194/1 M, 1 N, 1 D, 194/3, 5, 9, 13; 133/4

[56] **References Cited**

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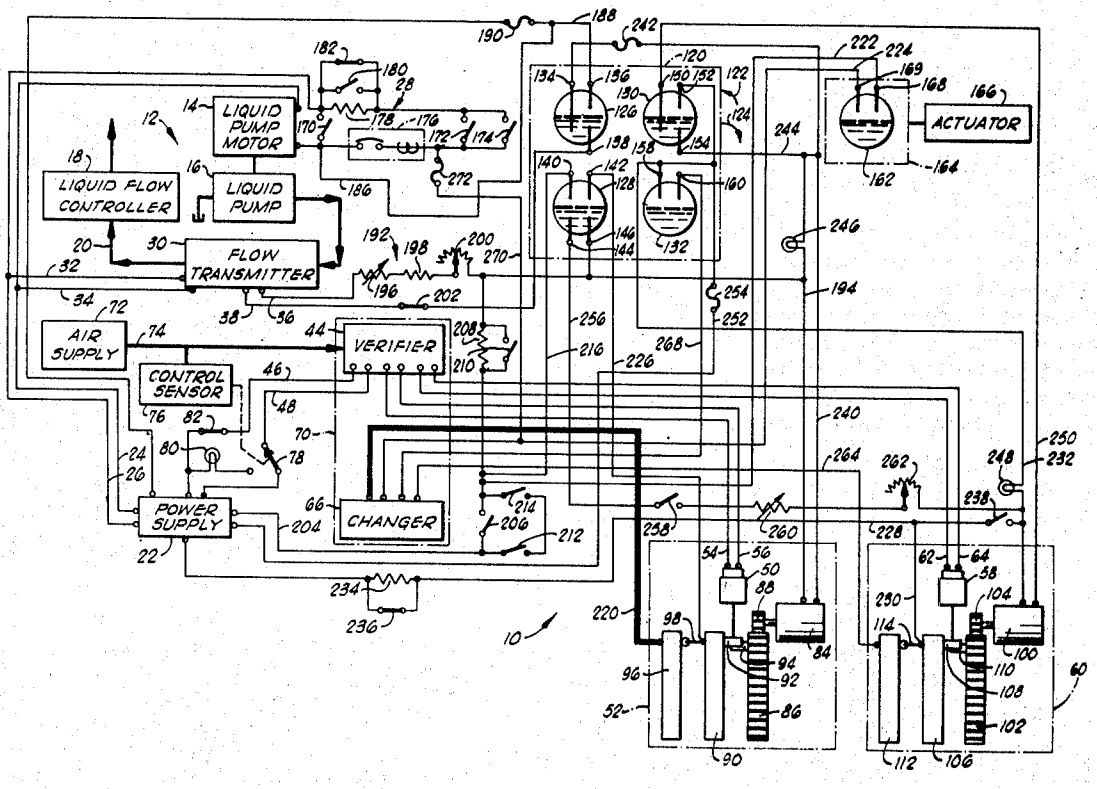
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[57] **ABSTRACT**

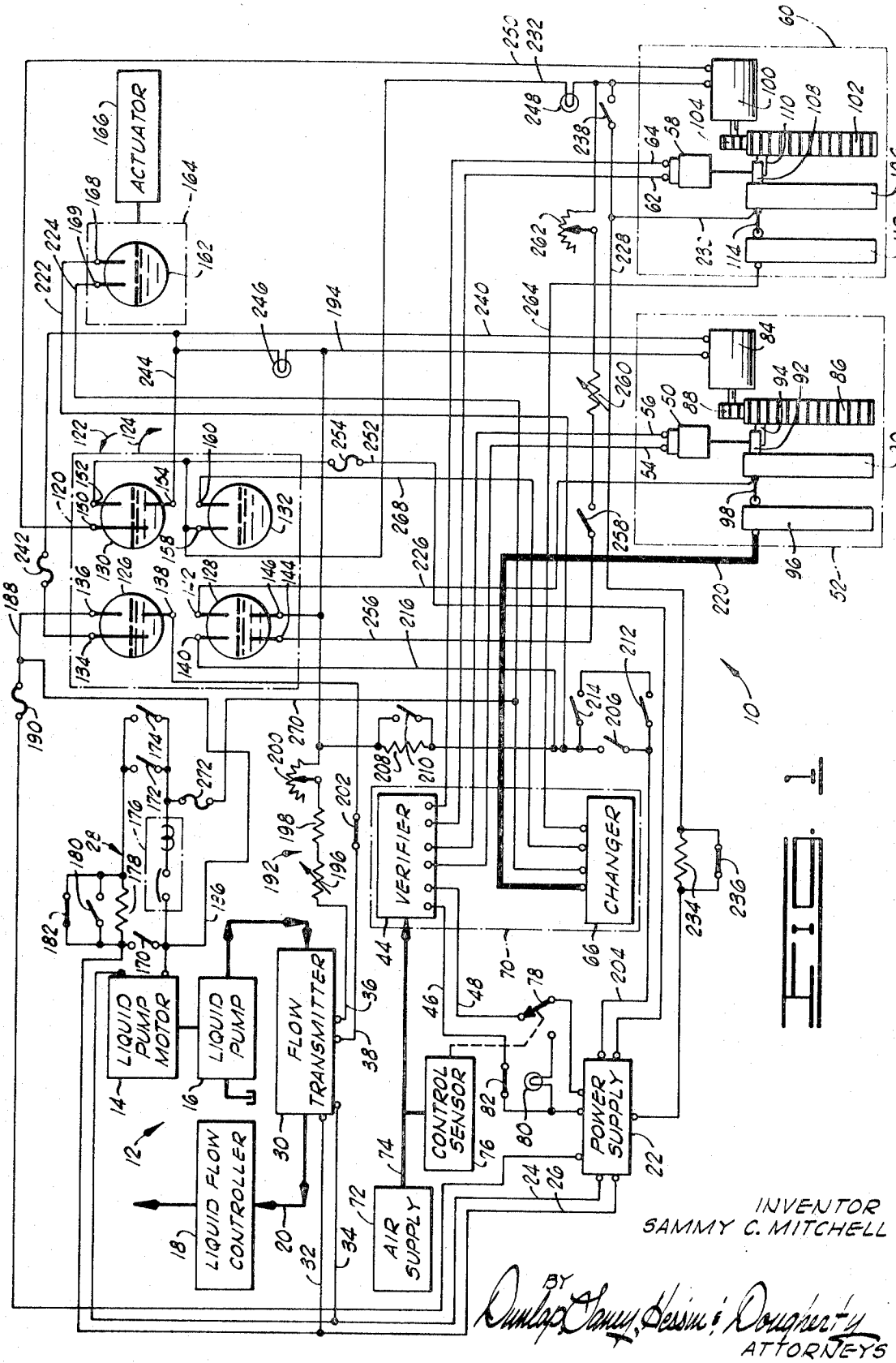
An improved automatic change return apparatus, particularly useful in cooperation with a liquid dispenser such as a gasoline pump type dispenser, wherein a verifier receives a monetary input and actuates a change calculator after verifying the genuineness of the monetary input. The change calculator includes a circuit selector having a plurality of conductive portions, and a contact movably engaging the circuit selector, the contact being moved in response to the flow of fluid through the liquid dispenser such that the contact contactingly engages predetermined conductive portions, the conductive portions being connected to various portions of a changer such that a portion of the changer is energized via the conductive portions in contact therewith to return the correct change.

17 Claims, 8 Drawing Figures



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3 Sheets-Sheet 1



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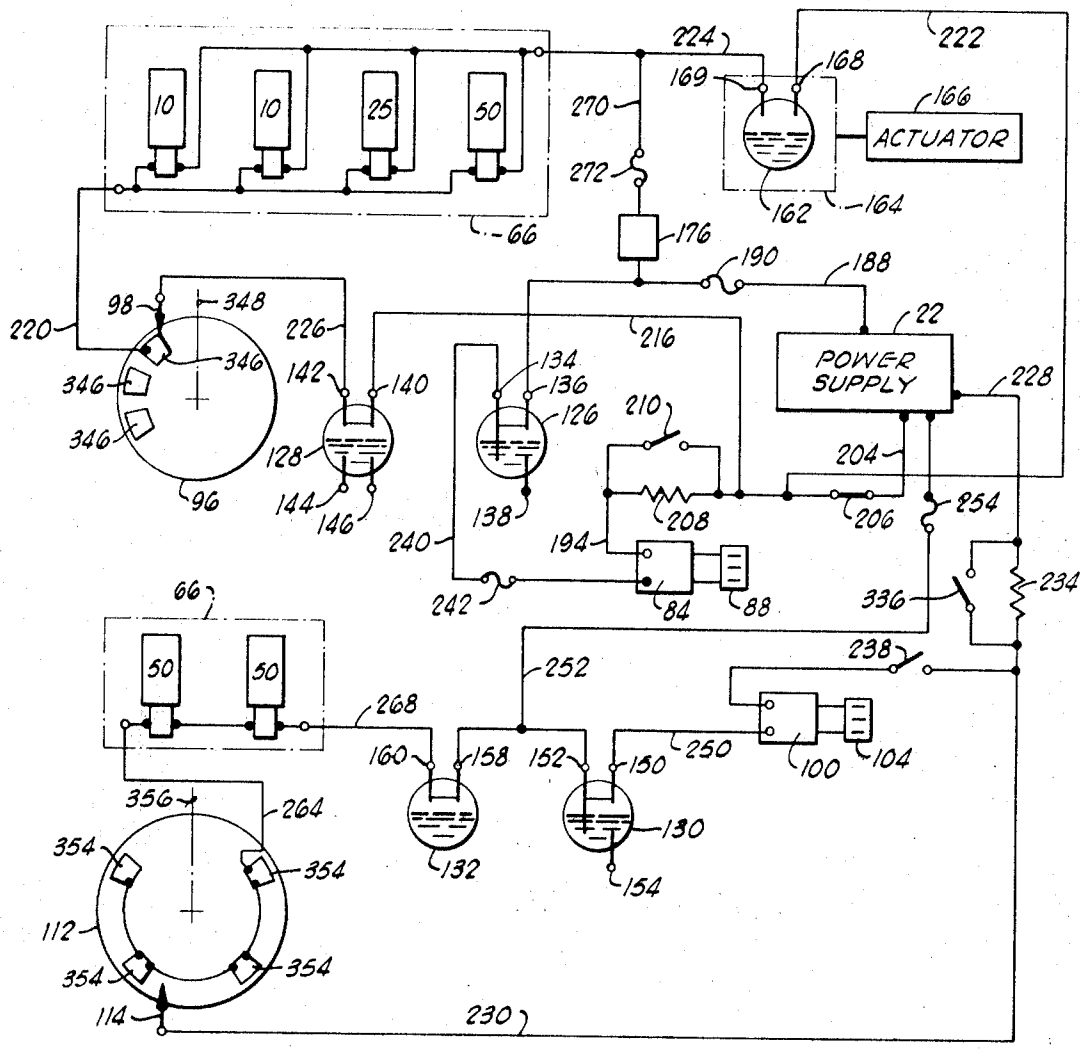


FIG. 2

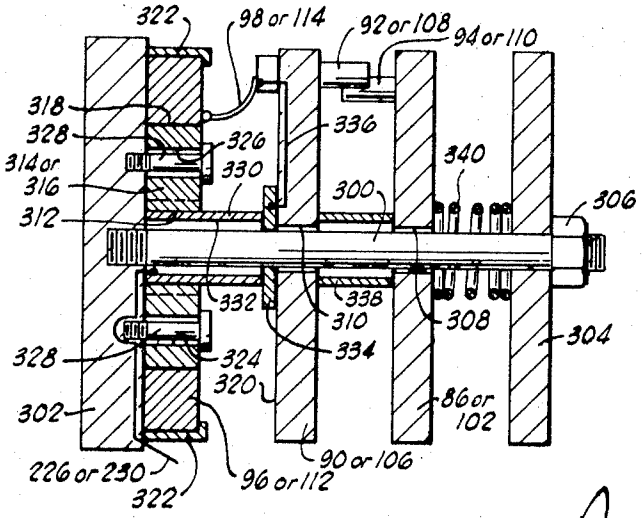


FIG. 3

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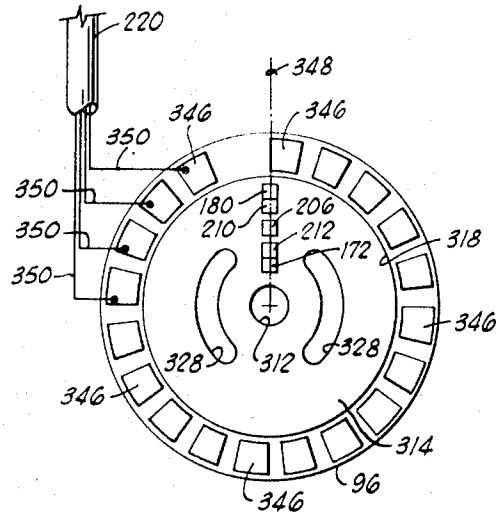


FIG. 3

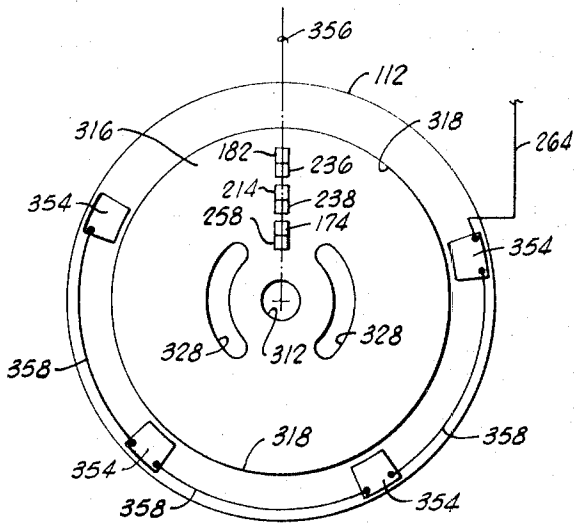


FIG. 4

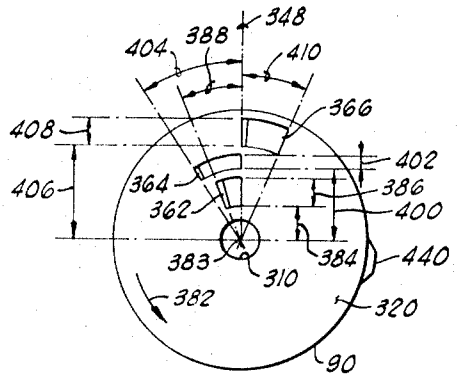


FIG. 5

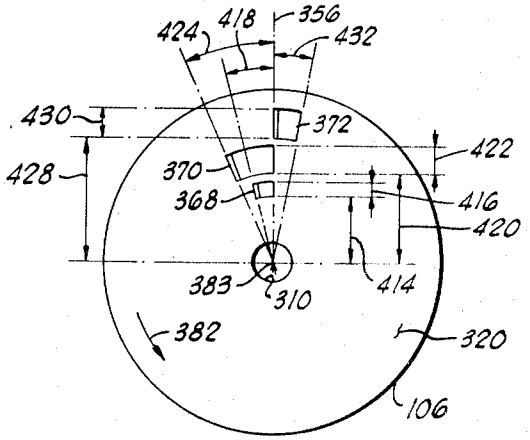


FIG. 6

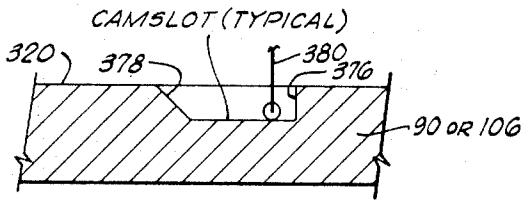


FIG. 7

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AUTOMATIC CHANGE RETURN APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to change return apparatus and, more particularly, but not by way of limitation, to an automatic change return apparatus for use in cooperation with a liquid dispenser.

2. Brief Description of the Prior Art

In the past there have been various devices constructed to return change to a customer based upon a particular monetary input. For example, there have been devices constructed to receive a 1-dollar bill or a 5-dollar bill, verify that the monetary input is genuine United States Currency, and dispense one dollar or five dollars' worth of coins. More particularly, with respect to liquid dispensers, such as gasoline pump type dispensers, various attempts have been made in the past to construct an apparatus for receiving a particular input and dispensing a predetermined amount of liquid in response thereto, and there have also been some attempts to construct an apparatus for receiving a monetary input and returning the correct change to the customer. However, most of these prior attempts have utilized extremely complicated apparatus, which required major modifications to existing dispensing equipment prior to being utilized in cooperation therewith, and a substantial investment which limited the practical utilization thereof.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an automatic change return apparatus for receiving a monetary input and returning the correct change to a customer in response to the customer's particular use.

Another object of the invention is to provide a change return apparatus for returning the correct change to a customer which is economical in construction and operation thereof.

One other object of the invention is to provide a change return apparatus for receiving a monetary input and returning the correct change to the customer in response to the amount of liquid dispensed by the customer through a liquid dispenser.

A further object of the invention is to provide a change return apparatus which can be quickly and easily installed for utilization with most existing liquid dispensers.

A yet further object of the invention is to provide an automatic change return apparatus for receiving monetary inputs of various denominations and returning the correct change to the customer in response to the amount of the liquid dispensed by the customer through a liquid dispenser.

Other objects and advantages of the invention will be evident from the following detailed description when read in conjunction with the accompanying drawings which illustrate a preferred embodiment thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial schematic, partial diagrammatical view of the automatic change return apparatus of the present invention.

FIG. 2 is a typical cross sectional view of a portion of a change calculator utilized in the automatic change return apparatus of FIG. 1.

FIG. 3 is an elevational view of one of the circuit selectors and one of the switch supports of the change return apparatus of FIG. 1.

FIG. 4 is an elevational view, similar to FIG. 3, but showing one other circuit selector and one other switch support of the change return apparatus of FIG. 1.

FIG. 5 is an elevational view of the cam utilized in cooperation with the circuit selector and the switch support of FIG. 3.

FIG. 6 is an elevational view of the cam utilized in cooperation with the circuit selector and the switch support of FIG. 4.

FIG. 7. is an enlarged, cross sectional view showing the construction of a typical cam slot, illustrative of the construction of the cam slots formed in the cams of FIGS. 5 and 6.

FIG. 8 is a partial schematic, partial diagrammatical view showing some of the components of the change return apparatus of FIG. 1, in one particular change position thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings in general, and to FIG. 1 in particular, diagrammatically and schematically shown therein and designated by the general reference numeral 10 is an automatic change return apparatus constructed to be utilized in cooperation with a liquid dispenser 12 for receiving a monetary input and returning the difference between the monetary input and the price of the specific amount of liquid dispensed through the liquid dispenser 12 or, in other words, for automatically returning the correct change. The change return apparatus 10 is particularly constructed to be utilized in cooperation with a gasoline type pump dispenser in such a manner that a monetary input, such as one dollar or a 5-dollar bill for example, is received by the change return apparatus 10 and the gasoline pump type dispenser is actuated to a pump position wherein the customer can dispense gasoline through the liquid flow controller (the nozzle) after the monetary input has been verified. After the customer has dispensed the desired amount of gasoline, the customer will deactuate the gasoline pump type dispenser, and the automatic change return apparatus 10 will automatically return the correct change to the customer, in a manner which will be described in greater detail below.

The liquid dispenser 12 generally includes a liquid pump motor 14 which is drivingly connected to a liquid pump 16, the liquid pump 16 pumping the liquid from a reservoir through a liquid flow controller 18 via a conduit 20, connecting the liquid pump 16 to the liquid flow controller 18, in a driven position of the liquid pump 16, that is a position wherein the liquid pump motor 14 is connected to the power supply and in a dispensing position of the liquid flow controller 18. In one form, the liquid flow controller 18 can be a hand-operated type valve which is connected to the liquid pump motor 14 such that, when the valve is opened, the liquid pump motor 14 is connected to the power supply, the liquid pump 14 thus pumping the liquid through the conduit 20 and through the opened valve of the liquid flow controller 18.

As shown in FIG. 1, the liquid pump motor 14 is connected to a power supply 22 via a pair of conductors 24 and 26. In one form, the liquid pump motor 14 is, more

particularly, connected to the power supply **22** via a motor starter or the like (not shown), rather than being directly connected thereto. A pump positioning network **28** is interposed generally between liquid pump motor **14** and the power supply **22** and, more particularly, the pump positioning network **28** is interposed in series in the conductor **26** to establish and interrupt the electrical continuity therebetween for positioning the liquid dispenser **12** in a pump position and a potential pump position, in a manner which will be described in greater detail below.

A flow transmitter **30** is hydraulically interposed in the conduit **20**, generally between the liquid pump **16** and the liquid flow controller **18**, and a portion of the flow transmitter **30** is connected to the power supply **22** via a pair of conductors **32** and **34**, the conductor **32** being connected to the conductor **26** and the conductor **34** being connected to the conductor **24**. The flow transmitter **30** is, more particularly, constructed to sense the flow of liquid through the conduit **20** or, in other words, to sense the flow of liquid being dispensed via the liquid flow controller **18**, and to provide an output signal via a pair of conductors **36** and **38**, the output signal being proportional to the rate of flow of the liquid. Flow transmitters constructed to operate in a manner similar to that described above with respect to the flow transmitter **30** are well known in the art, and a detailed description of the construction and operation thereof is not required herein.

The automatic change return apparatus **10** includes, a verifier **44** which is connected to the power supply **22** via a pair of conductors **46** and **48**. The verifier **44** is connected to a solenoid type actuator **50** of a first change calculator **52** via a pair of conductors **54** and **56**, and is connected to a solenoid type actuator **58** of a second change calculator **60** via a pair of conductors **62** and **64**. The verifier **44** is constructed to receive the monetary input and to verify the genuineness of such monetary input, the verifier **44** providing electrical continuity between the power supply **22** and the solenoid actuator **50** or **58** after verifying the genuineness of the monetary input. More particularly, and in a preferred form, the verifier **44** is constructed to receive and verify a 1-dollar bill or a 5-dollar bill; the first change calculator **52** is constructed to determine the change to be returned generally between 5 cents and 95 cents in 5-cent increments; and the second change calculator **60** is constructed to determine the change to be returned generally between 1 dollar and 5 dollars in 1-dollar increments. Verifiers constructed to receive United States currency in denominations of 1 dollar and 5 dollars and to verify the genuineness of such currency are well know in the art, and may be of the type manufactured by MICRO MAGNETIC INDUSTRIES of PALO ALTO, CALIF., for example, the construction and the operation of the first change calculator **52** and the second change calculator **60** to be described in greater detail below.

The first change calculator **52** and the second change calculator **60** are each constructed to transmit a change signal indicative of the correct monetary amount of change to be returned in a change position of the automatic change return apparatus **10**. More particularly, and in a preferred form, the change signal from the first change calculator **52** is indicative of the change to be returned from 0 to 1 dollar in 5-cent increments, and the change signal from the second change calculator **60** is indicative of the change to be returned from 0 to 5 dollars in 1-dollar increments, the change signals from the first change calculator **52** and the second change calculator **60** combining to provide a cummulative change signal indicative of the change to be returned from 0 to five dollars in 5-cent increments, in a manner to be described in greater detail below.

A changer **66** is connected to the first change calculator **52** and to the second change calculator **60** to receive the change signals therefrom. The changer **66**, in one form, has storage areas for storing various monetary change pieces having denominations of 5 cents, 10 cents, 25 cents and 50 cents, for example, and a plurality of change solenoids, each change solenoid being connected to one of the various storage areas for releasing one of the change pieces stored therein, in an actuated position of the particular change solenoid. Thus, the change signals, more particularly, selectively actuate the change solenoids to return the correct amount of change via the changer **66**. Changers constructed to receive change signals and to dispense or return change in response thereto are well known in the art, and may be of the type manufactured by STANDARD CHANGE-MAKERS of INDIANAPOLIS, INDIANA, for example. It should also be noted that, in a preferred form, the various components and the interconnections therebetween of the changer **66** and the verifier **44** are supported in a common housing, diagrammatically indicated in FIG. **1** by the general reference numeral **70**, thereby comprising a unitary assembly which, in one operational embodiment, is supported near the gasoline type pump dispenser so that the customer or operator will have access thereto, during the operation of automatic change return apparatus **10**.

A dry air supply **72** is connected to the verifier-changer housing **70** via a conduit **74**, and a control sensor **76** is interposed in the conduit **74** generally between the housing **70** and the dry air supply **72**. The control sensor **76** is connected to a switch **78** having one switch position, as shown in FIG. **1**, wherein the power supply **22** is connected to the verifier **44** via the conductor **48** through the switch **78**, and one other switch position wherein the electrical continuity between the power supply **22** and the verifier **44** is interrupted and an "out-of-order" lamp indicator **80** is connected to the power supply **22**. A cut-off switch **82** is interposed in the conductor **46**, generally between the power supply **22** and the verifier **44**, the cut-off switch **82** being hand-operated, in a preferred form, and interrupting the electrical continuity between the verifier **44** and the power supply **22** in a disconnect position of the change return apparatus **10**.

The dry air supply **72** provides dry, filtered air to the verifier-changer housing, the dry air having a pressure level slightly higher than the atmospheric pressure generally surrounding the outside of the housing **70**. The dry air inside the housing **70** is thus of a sufficient pressure level to substantially assure than any gasoline fumes existing near the housing **70** will be prevented from entering the housing **70**, thereby substantially reducing the opportunity of a fire or the like being ignited within the housing **70**, which is particularly desirable when the change return apparatus **10** is being utilized in cooperation with a gasoline type pump dispenser.

It will be apparent from the foregoing to those skilled in the art, that, during the normal operation of the

change return apparatus **10**, the switch **82** is closed and the switch **78** is positioned, as shown in FIG. **1**, to establish electrical continuity between the power supply **22** and the verifier **44** via the conductors **46** and **48**. The control sensor **76** is constructed to sense the dry air being supplied by the air supply **72** to the housing **70** via the conduit **74**, and to actuate the switch **78** to an out-of-order position wherein the electrical continuity is interrupted between the verifier **44** and the power supply **22**, thereby de-energizing the verifier **44**, and wherein electrical continuity is established between the lamp indicator **80** and the power supply **22**, thereby lighting the lamp indicator **80** to provide a visual indication that the verifier **44** is de-energized and that a malfunction has been experienced in the dry air supply **72** or the conduit **74**.

As diagrammatically shown in FIG. **1**, the first change calculator **52** also includes a first drive motor **84** which is gearingly connected to a driver **86** via a meshing drive gear **88**. The driver **86** is linkingly connected to a cam **90** via a pair of extension arms **92** and **94**; the extension arm **92** being connected to the cam **90** and extending a distance generally perpendicularly therefrom, and the extension arm **94** being connected to the driver **86** and extending a distance generally perpenducularly therefrom. The cam **90** and the driver **96** are each rotatingly supported within the first change calculator **52**, and the extension arms **92** and **94** are each disposed such that the extension arm **94** of the driver **86** will contactingly engage the extension arm **92** of the cam **90** to rotatingly drive the cam **90**, during one aspect of the operation of the first change calculator **52**, as will be described in greater detail below.

A circuit selector **96** is secured in a stationary position within the first change calculator **52**, the cam **90** being interposed generally between the driver **86** and the circuit selector **96**. A contact **98** is securely connected to the cam **90**, generally near the outer periphery thereof, a portion of the contact **98** extending from the cam **90** to a position wherein one end portion thereof movably contacts a portion of the circuit selector **96** or, more particularly, movably contacts various conductive portions of the circuit selector **96**. The various conductive portions (to be described in greater detail below) of the circuit selector **96** are each connected to the changer **66**, and the contact **98** is connected to the power supply **22**, in one position of the change return apparatus **10**, such that the contacting engagement between particular conductive portions of the circuit selector **96** and the contact **98** determines the particular change signal to be transmitted from the first change calculator **52**, in a manner to be described in greater detail below.

The second change calculator **60** is constructed similar to the first change calculator **52**, and includes a second drive motor **100** which is gearingly connected to a driver **102** via a meshing gear **104**. The driver **102** is linkingly connected to a cam **106** via a pair of extension arms **108** and **110**; the extension arm **108** being connected to the cam **106** and extending a distance generally perpendicularly therefrom. The cam **106** and the driver **102** are each rotatingly supported within the second change calculator **60**, and the extension arms **108** and **110** are each disposed such that the extension arm **110** of the driver **102** will contactingly engage the extension arm **108** of the cam **106**, during one aspect of the operation of the second change calculator **60**, as will be described in greater detail below.

A circuit selector **112** is secured in a stationary position within the second change calculator **60**, the cam **106** being interposed generally between the driver **102** and the circuit selector **112**. A contact **114** is securely connected to the cam **106**, generally near the outer periphery thereof, a portion of the contact **114** extending from the cam **106** to a position wherein one end portion thereof movably contacts a portion of the circuit selector **112** or, more particularly, movably contacts various conductive portions of the circuit selector **112**. The various conductive portions (to be described in greater detail below) of the circuit selector **112** are each connected to the changer **66**, and the contact **114** is connected to the power supply **22**, in one position of the change return apparatus **10**, such that the contacting engagement between particular conductive portions of the circuit selector **112** and the contact **114** determines the particular change signal transmitted from the second change calculator **60**, in a manner to be described in greater detail below.

A pump switch assembly **120** is rotatably supported such that the pump switch assembly **120** can be rotated in an actuated direction **122** to a "pump position," as shown in FIG. **1**, and in a deactuated direction **124** to an "off" or a "change position." Four mercury type switches **126, 128, 130** and **132** are supported on the pump switch assembly, the mercury switches **126, 128, 130** and **132** being rotated to a "pump position" and a "change position" as the pump switch assembly **120** is rotated in an actuated direction **122** and a deactuated direction **124**. In one operational embodiment, and, in a preferred form, the pump switch assembly **120** is secured to the actuating lever of a gasoline pump type dispenser, the actuating lever being that lever which the operator must turn to position the gasoline pump type dispenser in a pump position or, in other words, a position wherein gasoline is delivered through the nozzle type liquid flow controller when actuated. However, in any event, the pump switch assembly **120** is connected to the automatic change return apparatus **10** such that the mercury switches **126, 128, 130** and **132** can be positioned in a pump position and a change position, for reasons and in a manner to be described in greater detail below.

The mercury switch **126** has three terminals **134, 136** and **138**, and is positioned on the pump switch assembly **120** such that, in a "pump position" (shown in FIG. **1**), electrical continuity is established therethrough between the terminals **134** and **138**, and such that, electrical continuity is established therethrough between the terminals **134** and **136**, in a "change position" of the pump switch assembly **120**. The mercury switch **128** has four terminals **140, 142, 144** and **146**, and is positioned on the pump switch assembly **120** such that, in a "pump position," electrical continuity is established therethrough between the terminals **144** and **146**, and electrical continuity is established therethrough between the terminals **140** and **142**, in a "change position" of the pump switch assembly **120**. The mercury switch **130** has three terminals **150, 152** and **154**, and is positioned on the pump switch assembly **120** such that, in a "pump position," electrical continuity is established therethrough between the terminals **150** and **154**, and electrical continuity is established therethrough between the terminals **150** and **152**, in a

"change position" of the pump switch assembly **120**. The mercury switch **132** has two terminals **158** and **160**, and is positioned on the pump switch assembly **120** such that, in the "pump position," electrical continuity between the terminals **158** and **160** is interrupted, and electrical continuity is established between the terminals **158** and **160**, in the "change position" of the pump switch assembly **120**.

The change return apparatus **10** also includes one other mercury type switch **162** which is supported on a switch support **164**. The switch support **164** is connected to a switch actuator **166**, the switch actuator **166** rotating the switch **162** to an actuated status wherein electrical continuity is established between a pair of terminals **168** and **169** of the switch **162**, and to a deactuated status, as shown in FIG. **1**, wherein the electrical continuity is interrupted between the terminals **168** and **169**. In one form, the switch **162** is positioned in the changer **66** such that the returning change therefrom actuates the switch actuator **166** via an interconnecting trigger or lever arm or the like; however, in any event, the actuator **166** is constructed to move the switch **162** to an actuated status after the correct change has been returned to the customer, for reasons which will be made more apparent below.

The pump positioning network **28**, mentioned before, includes three switches **170**, **172** and **174**, each switch being connected to the conductor **26** such that electrical continuity is established between the liquid pump motor **14** and the power supply **22** in the closed position of any one of the switches **170**, **172** and **174**. A circuit breaker **176** is interposed in the conductor **26**, generally between the switch **170** and the switch **172**, the circuit breaker **176** interrupting the electrical continuity between the liquid pump motor **14** and the power supply **22** in an open position thereof, and in an opened or a closed position of the switches **172** and **174**. However in a closed position of the switch **170**, electrical continuity is established between the liquid pump motor **14** and the power supply **22**, in an opened or a closed position of the circuit breaker **176**. The switch **170** is, in a preferred form, a hand-operated type switch and is positioned to bypass the switches **172** and **174** and the circuit breaker **176** in a closed position thereof, the switch **170** being positioned such that the liquid dispenser **12** can be operated independent of the first change calculator **52** and the second change calculator **60**. The switches **172** and **174** are positioned in the first change calculator **52** and the second change calculator **60**, respectively, each switch **172** and **174** being automatically actuated by one of the change calculators **52** and **60**, in a manner to be described in greater detail below.

A resistor **178** is interposed in series in the conductor **26**, generally between the liquid pump motor **14** and the power supply **22**, the resistor **178** being sized to reduce the speed of the first drive motor **84** and the second drive motor **100** when electrically connected in the conductor **26**. A switch **180** and a switch **182** are each connected in parallel with the resistor **178** such that, in a closed position of the switch **180** or the switch **182**, the resistor **178** is bypassed or, in other words, not electrically connected in the conductor **126**. The switch **180** is positioned in the first change calculator **52** and the switch **182** is positioned in the second change calculator **60**, each switch **180** and **182** being automatically actuated by one of the change calculators **52** and **60**, in a manner to be described in greater detail below.

The conductor **26** is connected to the terminal **136** of the mercury switch **126** via a pair of conductors **186** and **188**, the conductor **186** being connected to the conductor **26** generally between the circuit breaker **176** and the switch **170**, and the conductor **188** connecting the terminal **136** of the switch **126** to the power supply **22**. A fuse **190** is interposed in the conductor **188**, generally between the connection between the conductors **186** and **188** and the power supply **22**.

A liquid price change network **192** is interposed in the conductor **36**, the conductor **36** being connected to a conductor **194** and the conductors **36** and **194** connecting the flow transmitter **30** to the first drive motor **84**. The liquid price change network **192** includes a variable resistor **196**, a resistor **198** and another variable resistor **200**, the resistors **196**, **198** and **200** each being interposed in series in the conductor **36**. In a preferred form, the variable resistor **196**, more particularly, is comprised of a decade type resistor box wherein various resistance values are selected by turning a knob, for example, and the variable resistor **200** is, more particularly, a pot-type variable resistor.

The liquid price change network **192** is thus interposed generally between the first drive motor **84** and the flow transmitter **30**, and the rotational, driving speed of the first drive motor **84** is, therefore, responsive to the resistance setting of the liquid price network **192**. In this manner, should the price per gallon of the liquid be changed for any reason, the automatic change return apparatus **10** can be quickly and easily modified so that the first change calculator **52** determines the correct change to be returned in accordance with various, predetermined liquid price changes. The resistor **200** is, in a preferred form, utilized for fine calibration adjustments between the flow transmitter **30** and the first change calculator **52**, the variable resistor **196** being utilized for liquid price change correlation.

A normally closed switch **202** is interposed in the conductor **38** generally between the flow transmitter **30** and the mercury switch **126**, the conductor **38** being connected to the terminal **138** of the switch **126**. The switch **202** is, in a preferred form, a hand-operated type of switch which is connected to the flow transmitter **30** such that the automatic change return apparatus **10** can be disconnected from the liquid dispenser **12**.

The power supply **22** is connected to the conductor **36**, generally between the liquid price control network **192** and the first drive motor **84** or, more particularly, the connection between the conductors **36** and **194**, via a conductor **204**. A switch **206** and a resistor **208** are interposed in series in the conductor **204**, a switch **210** being connected in parallel with the resistor **208** to bypass the resistor **208** in a closed position of the switch **210**. A pair of switches **212** and **214** are connected in series, and the switches **212** and **214** are connected in parallel with the switch **206** such that, in a closed position of the switches **212** and **214**, the switch **206** is bypassed. The switches **206**, **210** and **212** are each disposed within the first change calculator **52** to be automatically actuated thereby during the operation thereof, and the switch **214** is disposed within the second change calculator **60** to be automatically actuated thereby during the operation thereof, for reasons and in a manner which will be made more apparent below.

A conductor **216** is connected to the conductor **204**, generally between the switch **206** and the resistor **208**.

The conductor 216 connects the conductor 204 with the terminal 140 of the mercury switch 128.

The changer 66 is connected to each of the conductive portions of the circuit selector 96 of the first change calculator 52 via a cable 220. The terminal 168 of the mercury switch 162 is connected to the conductor 204, generally between the switch 206 and the connection of the conductors 204 and 216, via a conductor 222, and the terminal 169 of the mercury switch 162 is connected to the changer 66 via a conductor 224, the mercury switch 162 being connected to the changer 66 to create an electrical short about the solenoids therein, during one aspect of the operation of the automatic change return apparatus 10.

The contact 98 of the first change calculator 52 is connected to the terminal 142 of the mercury switch 128 via a conductor 226, and the contact 114 of the second change calculator 60 is connected to a conductor 228 via a conductor 230. The conductor 228 is connected to the power supply 22 and to a conductor 232, thereby connecting the contact 114 to the power supply 22.

A resistor 234 is interposed in the conductor 228 and a switch 236 is connected in parallel with the resistor 234 to bypass the resistor 234 in a closed position of the switch 236. A switch 238 is interposed in the conductor 228, generally between the connection of the conductors 228 and 230 and the connection of the conductors 228 and 232. The switches 236 and 238 are each supported within the second change calculator 60 and actuated thereby during the operation thereof, in a manner to be described in greater detail below.

The first drive motor 84 is connected to the terminal 134 of the mercury switch 126 via a conductor 240 and a fuse 242 is interposed in the conductor 240. A conductor 244 is connected to the conductor 240, generally between the first drive motor 84 and the mercury switch 126, the conductor 244 also being connected to the terminal 154 of the mercury switch 130. A lamp indicator 246 is interposed in the conductor 194, generally between the connection of the conductors 36 and 194 and the connection of the conductors 194 and 244.

The conductor 232 is connected to the second drive motor 100 and to the terminal 158 of the mercury switch 132, a lamp indicator 248 being interposed in the conductor 232, generally between the second drive motor 100 and the mercury switch 132. The second drive motor 100 is also connected to the terminal 150 via a conductor 250. The conductor 232 is also connected to a conductor 252, the conductor 252 being connected to the power supply 22 through a fuse 254 and to the terminal 152 of the mercury switch 130.

The terminal 146 of the mercury switch 128 is connected to the conductor 36, generally between the connection of the conductors 36 and 204 and the connection of the conductors 36 and 194. The terminal 144 of the mercury switch 128 is connected to the conductor 232, generally between the connection of the conductors 228 and 232 and the lamp indicator 248, via a conductor 256.

A switch 258, a variable resistor 260 and a variable resistor 262 are interposed in the conductor 256 generally between the second drive motor 100 and the mercury switch 128, the variable resistor 262 being, in a preferred form, a pot-type variable resistor. The switch 258 is, in a preferred form, disposed in the second change calculator 60 and automatically actuated thereby, in a manner to be described in greater detail below.

The changer 66 is connected to the conductive portions of the circuit selector 112 of the second change calculator 60 via a conductor 264. A conductor 268 connects the changer 66 to the terminal 160 of the mercury switch 132. A conductor 270 is connected to the conductor 224, generally between the changer 66 and the mercury switch 162, the opposite end of the conductor 270 being connected to the conductor 26 generally between the circuit breaker 176 and the switch 172. A fuse 272 is interposed in the conductor 270, as shown in FIG. 1.

As mentioned before, the first change calculator 52 and the second change calculator 60 are each constructed in a similar manner, a preferred construction of each being partially shown in FIG. 2. More particularly, shown in FIG. 2 is a preferred construction of the drive gear 86 or 102, the cam 90 or 106, and the circuit selector 96 or 112 showing the assembly of the components on a shaft 300 generally between a front support plate 302 and a rear support plate 304. One end of the shaft 300 is threadingly secured in the front support plate 302 and the opposite end thereof extends through the rear support plate 304 and is secured therethrough via a nut 306. The shaft 300 extends through an opening 308 formed in a central portion of the drive gear 86 or 102, through an opening 310 formed in a central portion of the cam 90 or 106 and through an opening 312 formed through a central portion of a switch support 314 or 316, the switch support 314 or 316 being secured in a central opening 318 formed through the circuit selector 96 or 112. It should be noted that the double numeral designations utilized in FIG. 2 to designate particular components, denote a common, similar assembly of those components, and has been utilized for the purpose of clarity.

The switch support 314 and 316 is constructed to provide a support structure for some of the switches (not shown in FIG. 2) of the automatic change return apparatus 10, and to position those switches to contactingly engage a cam surface 320 of the cam 90 or 106, the cam surface 320 being shaped to selectively actuate the switches supported on switch support 314 or 316 during the operation of the automatic change return apparatus 10. It should be noted that the switches supported on the switch support 314 or 316 could be supported on the circuit selector 96 or 112, thereby eliminating the necessity of a separate component, the switch support 314 or 316, in one form of the invention; however, the switch support 314 or 316 is utilized in a preferred form for calibration purposes and for economy of manufacture.

The switch support 314 is, more particularly, secured to the circuit selector 96 of the first change calculator 52, and the switch support 316 is, more particularly, secured to the circuit selector 112 of the second change calculator 60. The circuit selector 96 or 112 is secured in a stationary position to the front support plate 302 via a plurality of clips 322, the clips 322 being spaced about the outer periphery of the circuit selector 96 or 112 and retainingly engaging a portion thereof. The switch support 314 or 316 has a pair of elongated, arcuately shaped apertures 324 and 326, a screw 328 being disposed through each aperture 324 and 326 and threadingly engaging the front support plate 302 to ad-

justingly and securely position the switch support **314** or **316** to the front support plate **302.**

A cylindrically shaped conductive spacer **330** having an opening **332** extending therethrough is disposed generally between the circuit selector **96** or **112** and the cam **90** or **106.** More particularly, one end of the conductive spacer **330** is disposed through the opening **312** in the switch support **314** or **316,** the end of the conductive spacer **330** abutting the front support plate **302.** The end of the conductive spacer **330,** opposite the end thereof disposed through the switch support **314** or **316,** abuts and slidingly contacts a bushing **334** which is secured to the cam surface **320** of the cam **90** or **106,** generally about the opening **310** therethrough.

As shown in FIG. **2,** a portion of the shaft **300,** more particularly, extends through the bushing **334** and through the conductive spacer **330.** The conductor **226** or **230** is embedded in the front support plate **302** and connected to a portion of the conductive spacer **330.** A conductor **336** is connected to the bushing **334** and to the contact **98** or **114.** The conductive spacer **330** and the bushing **334** are each constructed of an electrically conductive material, and the conductor **226** or **230** is thus connected to the contact **98** or **114** via the conductive spacer **330,** the bushing **334** and the conductor **336.** The conductive spacer **330** maintains a predetermined spacing between the cam **90** or **106** and circuit selector **96** or **112** to maintain the contact **98** or **114** in proper, contacting engagement with the circuit selector **96** or **112,** and yet allow the cam **90** or **106** to be rotated relative to the circuit selector **96** or **112** while providing an electrical path therebetween.

A spacer **338** is interposed about a portion of the shaft **300,** generally between the driver **86** or **102** and the cam **90** or **106,** one end of the spacer **338** contacting the cam **90** or **106** and the opposite end of the spacer **338** contacting the driver **86** or **102.** The spacer **338** maintains a predetermined distance between the driver **86** or **102** and the cam **90** or **106** to assure the proper orientation thereof and to assure proper, predetermined contacting engagement between the extension arm **92** or **108** and the extension arm **94** or **110** during the operation of the automatic change return apparatus **10.**

A bias spring **340** is disposed about a portion of the shaft **300** and interposed generally between the rear support plate **304** and the driver **86** or **102.** The bias spring **340** engages the driver **86** or **102** to biasingly move the driver **86** or **102** generally toward the front support plate **302** and into an assembled position.

Thus, the driver **86** or **102,** the cam **90** or **106,** the circuit selector **96** or **112,** and the switch support **314** or **316** are secured in an assembled position, generally between the front support plate **302** and the rear support plate **304,** the front support plate **302** and the rear support plate **304** being secured in an assembled position by a plurality of interconnecting bolts, for example. The driver **86** or **102** and the cam **90** or **106** are each, more particularly, rotatingly supported on a portion of the shaft **300,** and the circuit selector **96** or **112** and the switch support **314** and **316** are each supported in a stationary position about the shaft **300,** during one aspect of the operation of the change return apparatus **10.**

A preferred embodiment of the circuit selector **96** and the switch support **314** of the first change calculator **52** is shown in FIG. **3.** The circuit selector **96** is generally circularly shaped, and has a plurality of conductive portions **346** spaced thereabout generally near the outer periphery thereof (only some of the conductive portions **346** being designated in FIG. **3** for the purpose of clarity). As mentioned before, the circuit selector **96** is, in a preferred form, constructed to provide a change signal determinative of the change to be returned generally between 0 and one dollar in 5 cent increments. Thus, each conductive portion **346** is spaced about the circuit selector **96** to be contactingly engaged by the contact **98** after the cam **90** has been driven a predetermined number of degrees indicating that an additional 5 cents' worth of liquid has been dispensed via the liquid dispenser **12.** The cam **90** and the circuit selector **96** are initially positioned and calibrated in an assembled position, as shown in FIG. **2,** wherein the contact **98** engages a nonconductive portion of the circuit selector **96** generally along an initial or starting position **348.**

Each of the conductive portions **346** are connected to predetermined portions of the changer **66** via a conductor **350,** only a few of the conductors **350** being diagrammatically shown in FIG. **3** for the purpose of clarity. The conductors **350** form the cable **220,** as shown in FIGS. **1** and **3.**

The switch support **314** is secured in the opening **318** of the circuit selector **96,** and the switches secured thereto are generally positioned along a radius through the starting position **348,** as shown in FIG. **3.** More particularly, the switches **172, 212, 206, 210** and **180** are secured to the switch support **314.**

A preferred embodiment of the circuit selector **112** and the switch support **316** of the second change calculator **60** is shown in FIG. **4.** The circuit selector **112** is generally circularly shaped and has a plurality of conductive portions **354** spaced thereabout generally near the outer periphery thereof. The circuit selector **112** is, more particularly, constructed to provide a change signal determinative of the change to be returned generally between 0 and 5 dollars in 1-dollar increments. Thus, each conductive portion is spaced about the circuit selector **112** to be contactingly engaged by the contact **114** after the cam **106** has been driven a predetermined number of degrees indicating that an additional 1 dollar's worth of liquid has been dispensed via the liquid dispenser **12.** The cam **106** and the circuit selector **112** are initially positioned and calibrated in an assembled position, as shown in FIG. **2,** wherein the contact **114** engages a non-conductive portion of the circuit selector **112** at an initial or starting position **356.** The conductive portions **354** are interconnected by conductors **358,** and the conductor **264,** connecting the circuit selector **112** with the changer **66** is, more particularly, connected to the last conductive portion **354** contacted by the contact **114** during one complete revolution of the cam **106.**

The switch support **316** is secured in the opening **318** of the circuit selector **112,** and the switches secured thereto are generally aligned along a radius through the starting position **356.** More particularly, the switches **258, 174, 238, 214, 236** and **182** are secured to the switch support **316.**

The cam **90** includes three cam slots **362, 364,** and **366,** and the cam **106** includes three cam slots **368, 370** and **372,** as shown in FIGS. **5** and **6.** Each cam slot **362, 364, 366, 368, 370** and **372** is formed in a portion of the cam surface **320** of one of the cams **90** or **106,** a de-

tailed view of a typical cam slot being shown in cross section in FIG. 7.

As shown in FIG. 7, each cam slot is countersunk or depressed in the cam surface **320**, and has one wall **376** extending generally perpendicular to the cam surface **320** and one inclined wall **378** formed on a generally 45° inclination with respect to the cam surface **320**. Each cam slot is particulary sized to receive a switch arm **380** of one or more of the switches secured to the switch support **314** or **316**, the inclined wall **378** providing a path for the switch arm **380** to travel generally out of the cam slot and into engagement with the cam surface **320**, during the operation of the automatic change return apparatus **10**.

The conductive spacer **330** is thus, more particularly, sized to space the cam surface **320** of the cam **90** or **106** a predetermined distance from the switch support **314** or **316** such that the switch arms **380** are disposed within the cam slot (FIG. 7) in one actuated position of the switches, and such that the switch arms **380** engage the cam surface **320** in one other actuated position of the switches. Since the circuit selector **96** or **112** and the switch support **314** or **316** are each secured in a stationary position during the operation of the change return apparatus **10**, the cam **90** or **106**, more particularly, is drivingly rotated by the driver **86** or **102** to position the various cam slots in a switch arm receiving position with respect to predetermined switches and at predetermined cycle times, that is to position the various cam slots with respect to the switch arms **380** such that the switch arms **380** are disposed generally within the cam slots, as shown in FIG. 7. In other words, the switch arms **380** of the various switches secured on the switch support **314** or **316** engage the cam surface **320** of the cam **90** or **106**, and are disengaged from the cam surface **320** via the cam slots at predetermined cycle times during the operation of the change return apparatus **10**.

In a preferred form, as shown in FIGS. **2** and **5**, the cam **90** is driven in a counterclockwise rotational direction **382** about a rotational axis **383**, during the operation of the change return apparatus **10**, the starting position **348** of the cam **90** intersecting the rotational axis **383** and extending generally radially therefrom. The cam slot **362** is spaced a radial distance **384** from the rotational axis **383** of the cam **90**, the cam slot **362** having a radial width **386** and extending from the starting position **348** an angular distance **388**, in a generally counterclockwise direction. The cam slot **364** is spaced a radial distance **400** from the rotational axis **383** of the cam **90**, the cam slot **364** having a radial width **402** and extending from the starting position **348** an angular distance **404** in a generally counterclockwise direction. The cam slot **366** is spaced a radial distance **406** from the rotational axis **383** of the cam **90**, the cam slot **366** having a radial width **408** and extending from the starting position **348** an angular distance **410** in a generally counterclockwise direction.

More particularly, the radial distance **384** positions the cam slot **362** on the cam **90**, and the cam **90** is positioned with respect to the switch support **314** such that the switch arms of the switches **172** and **212** are disposed within the cam slot **362** when the cam **90** is positioned at the starting position **348** thereof, the switches **172** and **212** being constructed to be opened in this position. The switch arms of the switches **172** and **211** will remain disposed within the cam slot **362** until the cam **90** has been rotated an angular distance corresponding to the angular width **388** of the cam slot **362**, the switch arms of the switches **172** and **212** engaging the inclined wall **378** and being moved into contacting engagement with the cam surface **320** in this position of the cam **90**. The switches **172** and **212** are constructed to be closed when the switch arms thereof are contactingly engaged by the cam surface **320** of the cam **90**.

The radial distance **400** of the cam slot **364** positions the cam slot **364** on the cam **90**, and the cam **90** is positioned with respect to the switch support **314** such that the switch arm of the switch **206** is disposed within the cam slot **364** when the cam **90** is positioned at the starting position **348** thereof, the switch **206** being constructed to be opened in this position. The switch arm of the switch **206** will remain disposed within the cam slot **364** until the cam **90** has been rotated an angular distance corresponding to the angular width **404** of the cam slot **364**, the switch arm of the switch **206** engaging the inclined wall **378** and being moved into contacting engagement with the cam surface **320** in this position of the cam **90**. The switch **206** is closed when the switch arm thereof is contactingly engaged by the cam surface **320** of the cam **90**.

The radial distance **406** of the cam slot **364** positions the cam slot **364** on the cam **90**, and the cam **90** is positioned with respect to the switch support **314** such that the switch arms of the switches **180** and **210** are disposed within the cam slot **364** when the cam **90** has been rotated to a position an angular distance from the starting position **384**, the angular distance corresponding to the angular width **410** of the cam slot **364**. In this position, the switch arms of the switches **180** and **210** will remain within the cam slot **364** as the cam **90** is rotated through an angular distance corresponding to the angular width **410** of the cam slot **364**, the switch arms of the switches **180** and **210** engaging the inclined wall **378** and being moved into contacting engagement with the cam surface **320** as the cam **90** is rotated to the starting position **348**. The switches **180** and **210** are constructed to be closed when the switch arms thereof are contactingly engaged by the cam surface **320**, and to be closed when the switch arms thereof are disposed within the cam slot **366**.

The cam **106** is also rotated in a counterclockwise rotational direction **382** about the rotational axis **383** via the driver **102**, during the operation of the change return apparatus **10**, the starting position **356** of the cam **106** intersecting the rotational axis **383** and extending radially therefrom. The cam slot **368** is spaced a radial distance **414** from the rotational axis **383** of the cam **106**, the cam slot **368** having a radial width **416** and extending from the starting position **356** an angular distance **418** in a generally counterclockwise direction. The cam slot **370** is spaced a radial distance **420** from the rotational axis **383** of the cam **106**, the cam slot **370** having a radial width **422** and extending from the starting position **356** an angular distance **424** in a generally counterclockwise direction. The cam slot **372** is spaced a radial distance **428** from the rotational axis **383** of the cam **106**, the cam slot **372** having a radial width **430** and extending from the starting position **356** an angular distance **432** in a generally clockwise direction.

The radial distance **414** of the cam slot **368** positions the cam slot **368** on the cam **106**, and the cam **106** is positioned with respect to the switch arms of the switches **258** and **174** such that the switch arms thereof

are disposed within the cam slot **368** when the cam **106** is positioned at the starting position **356**, the switches **258** and **174** being constructed to be opened in this position. The switch arms of the switches **258** and **174** will remain disposed within the cam slot **368** until the cam **106** has been rotated an angular distance corresponding to the angular width **418** of the cam slot **368**, the switch arms of the switches **258** and **174** engaging the inclined wall **378** and being moved into contacting engagement with the cam surface **320** in this position of the cam **106**. The switches **258** and **174** are in the closed position when the switch arms thereof are contactingly engaged by the cam surface **320** of the cam **106**.

The radial distance **420** of the cam slot **370** on the cam **106**, and the cam **106** is positioned with respect to the switch arms of the switches **238** and **214** such that the switch arms thereof are disposed within the cam slot **370** when the cam **106** is positioned at the starting position **356**, the switches **238** and **214** being constructed to be opened in this position. The switch arms of the switches **238** and **214** will remain disposed within the cam slot **370** until the cam **106** has been rotated an angular distance corresponding to the angular width **424** of the cam slot **370**, the switch arms of the switches **238** and **214** engaging the inclined wall **378** and being moved into contacting engagement with the cam surface **320** in this position of the cam **106**. The switches **238** and **214** are in the closed position when the switch arms thereof are contactingly engaged by the cam surface **320** of the cam **106**.

The radial distance **428** of the cam slot **372** positions the cam slot **372** on the cam **106**, and the cam **106** is positioned with respect to the switch support **314** such that the switch arms of the switches **236** and **182** are disposed within the cam slot **372** when the cam **106** has been rotated to a position an angular distance from the starting position **356**, the angular distance corresponding to the angular width **432** of the cam slot **372**. In this position, the switch arms of the switches **236** and **182** will drop into the cam slot **372**, the switches **236** and **182** being constructed to be actuatingly opened when the switch arms thereof are disposed within the cam slot **372**. The switch arms of the switches **236** and **182** will remain within the cam slot **372** as the cam **106** is rotated through an angular distance corresponding to the angular width **432** of the cam slot **372**, the switch arms of the switches **236** and **182** engaging the inclined wall **378** and being moved into contacting engagement with the cam surface **320** as the cam **106** is rotated to the starting position **356**. The switches **236** and **182** are constructed to be closed when the switch arms thereof are contactingly engaged by the cam surface **320**.

It should be noted that the switches **172** and **212**, the switches **210** and **180**, the switches **258** and **174**, the switches **238** and **214**, and the switches **236** and **182** could each be a double-pole, single throw type of micro-switch in lieu of the two switch combinations mentioned above and shown in the drawings. In this manner, the necessity of utilizing two separate switches, each of which must be securely mounted on the switch support **314** or **316**, is eliminated, thereby reducing the cost of manufacture, the two separate switches being described and shown for the purpose of clarity of description.

The actuated position of the switches **172, 212, 206, 210,** and **180** of the first change calculator **52** and the switches **258, 174, 238, 214, 236** and **182** of the second change calculator **60** as the cams **90** and **106** are being driven in the counterclockwise direction can thus be summarized as follows:

Switch designation Angular position of cam 106	258	174	238	214	236	182
1. Starting position 356	opened	opened	opened	opened	opened	opened
2. After rotation through angular distance 418	closed	closed	closed	closed	closed	closed
3. After rotation through angular distance 424	closed	closed	closed	closed	closed	closed
4. Angular distance 432 from starting position 356	closed	closed	closed	closed	closed	closed

Switch designation Angular position of cam 90	172	212	206	210	180
1. Starting position 348	opened	opened	opened	opened	opened
2. After rotation through angular distance 388	closed	closed	opened	closed	closed
3. After rotation through angular distance 404	closed	closed	closed	closed	closed
4. Angular distance 410 from starting position 348	closed	closed	closed	opened	opened

In one form, as mentioned before, the cam **90**, the circuit selector **96** and the switch support **314** are, more particularly, constructed to determine the correct change from 0 to 1 dollar in 5 cent increments; and the cam **106**, the circuit selector **112** and the switch support **316** are, more particularly, constructed to determine the correct change from 0 to 5 dollars in 1 dollar increments. In this embodiment of the invention the following angular dimensions have been determined to provide satisfactory results, for example:

Angular distance or width	Corresponding Degrees from the Starting Positions
388	15°
404	30°
410	15°
418	10°
424	15°
432	3°

In this embodiment of the invention, the first conductive portion **346** encountered moving in a counterclockwise direction from the starting position **348** of the circuit selector **314** is located 24° from the starting position **348**. Each conductive portion **346** has an angular width of 12°, and each conductive portion **346** is spaced 6° from the adjacent conductive portion **346**, with the exception of the space between the last conductive portion **346** encountered moving in a counterclockwise direction and the first conductive portion **346**, this later distance being 12°, as mentioned above.

Referring again to the particular embodiment of the invention mentioned above, the first conductive portion **354** encountered moving in a counterclockwise direction from the starting position **356** of the circuit selector **316** is located 60° from the starting position **356.** Each conductive portion **356** has an angular width of 12°, and each conductive portion **356** is spaced 60° from the adjacent conductive portion **356,** with the exception of the space between the last conductive portion **356** encountered moving in a counterclockwise direction and the first conductive portion **356,** the last conductive portion **356** being spaced 72° from the starting position **356** in a counterclockwise direction **382.**

OPERATION OF THE PREFERRED EMBODIMENT

The automatic change return apparatus **10,** described before, is constructed to receive a monetary input from a customer, verify that the monetary input is genuine, and to automatically return the correct change to the customer after the customer has dispensed a desired amount of the liquid. In one form, as mentioned before, the change return apparatus **10** is utilized in cooperation with a gasoline pump type dispenser, and the change return apparatus **10** is, more particularly, constructed to receive a 5-dollar bill or a 1-dollar bill from the customer, verify that the 5-dollar bill or the 1-dollar bill is genuine United States Currency, and automatically return the correct change to the customer after the customer has dispensed the desired amount of gasoline (the change being the difference between the monetary input, the 5-dollar bill or the 1-dollar bill and the sales price per gallon of gasoline multiplied by the number of gallons of gasoline actually dispensed by the customer). Utilizing the change return apparatus **10** of the present invention in a manner last-mentioned above, the first change calculator **52** is particularly constructed to calculate the change between zero and 1 dollar, and the second change calculator **60** is particularly constructed to calculate the change between zero and 5 dollars, in a manner discussed above, the operation of the change return apparatus **10** being described below with respect to this particular application for the purpose of clarity.

Assuming a customer has inserted a 1-dollar bill in the verifier **44,** the verifier will scan the inserted monetary input and, upon determining the monetary input to be genuine United States Currency, the verifier **44** will close a circuit (not shown) connecting the power supply **22** to the solenoid actuator **50** via the conductors **46, 48, 54** and **56,** thereby energizing the solenoid actuator **50.** In the actuated position of the solenoid actuator **50,** a portion of the solenoid actuator **50** will engage the extension arm **92** of the cam **90,** causing the cam **90** to be rotated a predetermined number of degrees in a counterclockwise direction or, more particularly, causing the cam **90** to be rotated a number of degrees corresponding to the angular width **388** of the cam slot **362,** thereby closing the switches **172** and **212** in a manner as described before.

The closing of the switch **172** provides electrical continuity between the liquid pump motor **14** and the power supply **22,** thereby giving the liquid pump **16** potential power to operate. As briefly mentioned before, the liquid dispenser **12** is constructed such that the liquid flow controller **18** cannot be actuated to dispense liquid therefrom until a lever arm (not shown) has been properly positioned (rotated).

The operator will then rotate the lever arm, mentioned above, thereby rotating the pump switch assembly **120** in an actuated direction **122** and thus rotating the mercury switches **126, 128, 130** and **132** to the pump position, as shown in FIG. **1.** In this position, the operator can dispense liquid from the liquid dispenser **12** via the liquid flow controller **18.**

The liquid dispensed by the liquid dispenser **12** flows through the flow transmitter **30,** the flow transmitter **30** providing an output flow signal via the conductors **36** and **38** proportional or responsive to the rate of the flow of liquid therethrough. The flow signal is transmitted through the liquid price change network **192,** and is transmitted to the first drive motor **84** via the conductors **36** and **240** via the mercury switch **126.** The voltage of the transmitted flow signal is thus controlled via the settings of the resistors **196, 198** and **200** of the liquid price change network **192,** the voltage finally applied to the first drive motor **84** determining the output rotational speed thereof.

Since the output flow signal of the flow transmitter **30** is responsive to the rate of the flow of liquid through the liquid dispenser **12,** the flow signal finally applied to the first drive motor **84** will be responsive to the rate of the flow of the liquid and the unit price thereof or, in other words, the price per gallon of the liquid as determined by the price control network. Thus, assuming that the variable resistor **196** has been set in accordance with the desired price of the liquid per unit of volume, the driver **86** will be rotatingly driven at a speed responsive to the price per unit of the liquid so that the cam **90** will rotate through one complete cycle (360°) as 1 dollar's worth of the liquid is dispensed via the liquid dispenser **12,** for example.

It is particularly important to note that the cam **90** was moved through the angular width **388** to initially actuate the change return apparatus **10** in an operational mode. Thus, if the cam surface were formed directly on the driver **86,** thereby eliminating the separate cam element and the interconnecting extension arms **92** and **94,** the first drive motor **84** would drive the modified cam-driver through the angular width **388,** and would then drive the modified cam-driver through one complete cycle (360°) less the angular width **388** as 1 dollar's worth of liquid is dispensed through the liquid dispenser **12.** Thus, utilizing the separate units; the driver **86,** the cam **90,** and the interconnecting extension arms **92** and **94,** the first drive motor **84** will drive the driver **86** through one complete cycle (360°), thereby reducing the cost of manufacture (the additional circuitry, the mechanical actuators and devices necessary to actuate the change return apparatus **10** in the operational mode) while simultaneously providing a more accurate first change calculator **52.** It should also be noted that the extension arms **108** and **110** provide the driving interconnection between the driver **102** and the cam **106** of the second change calculator **60** for substantially the same reason as described above with respect to the first change calculator **52.**

The driver **86** will rotatingly drive the cam **90,** and, after the cam **90** has been rotated through the angular width **404,** the switch **206** is closed. The switch **206** electrically connects what is sometimes referred to below as "the override system" to the change return

apparatus **10.** It should be noted that the switch **206** is closed after the cam **90** has been driven through a predetermined number of degrees since, if the switch **206** were in the closed position at the beginning of the operational cycle, the first drive motor **84** would be connected to the power supply **22** via the switch **206** and the mercury switch **126.** In this latter-mentioned event, the driver **86** and the cam **90** would be rotated even though the customer had not actuated the liquid flow controller **18.**

Assuming the customer continues to dispense the liquid via the liquid flow controller **18,** the cam **90** will continue to be drivingly rotated in a counterclockwise direction **382,** the contact **98** continually contacting the circuit selector **96** as the cam **90** is being thus rotated. When the cam **90** has been rotated to a position generally within an angular width **410** from the starting position **348,** the switches **180** and **210** are actuatingly opened via the cam slot **366.** The opening of the switch **180** will electrically place the resistor **178** in the pump positioning network **28** to reduce the power applied to the liquid pump motor **14,** thereby reducing the flow of liquid through the liquid dispenser **12** and, particularly, through the flow transmitter **30.** In this manner, the output rotational speed of the first drive motor **84** will be reduced so that the rotational speed of the cam **90** is reduced as the cam **90** approaches the completion of the cycle (360*D*) or, more particularly, approaches the starting position **348.**

When the cam **90** has been rotated one complete cycle and is repositioned at the starting position **348** thereof, the cam surface **320** and the cam slots **362** and **364** position the switches **172, 212, 206, 210** and **180** accordingly. In this position, the customer will have dispensed 1 dollar's worth of liquid through the liquid dispenser **12,** and the automatic change return apparatus **10** is positioned to receive additional monetary inputs thereto.

Referring to a portion of FIG. **8,** and, more particularly, the diagrammatical showing of the circuit selector **96** and the contact **98** which is in contacting engagement with the first conductive portion **346** (only some of the conductive portions **346** being shown in FIG. **8** for the purpose of clarity), the cam **90** has been driven via the first drive motor **84** to a position indicating that the customer has dispensed one increment of the liquid. More particularly, assuming that the first change calculator **52** is constructed to determine change in 5-cent increments, mentioned before, the position of the contact **98,** as shown in FIG. **8,** indicates that the cam **90** has been rotated through a predetermined number of degrees corresponding to the dispensing of 5 cents' worth of liquid through the liquid dispenser **12.** If, in this position of the cam **90** and the contact **98,** the liquid flow controller **18** is positioned on the liquid dispenser **12** or, more particularly, if the pump switch assembly **120** is rotated in a deactuated direction **124,** the mercury switches **126, 128, 130** and **132** are moved to the change position, thereby indicating the customer has dispensed the desired amount of liquid (5 cent's worth).

In the change position of the automatic change return apparatus **10,** the contact **98** is connected to the power supply **22** via the mercury switch **128** (the conductors **226, 216,** and **204**) and the switch **206.** The first conductive portion **346** is connected to the changer **66,** as shown in FIG. **8,** via the cable **220** and through the circuit breaker **176,** thereby connecting a portion of the changer **66** to the power supply **22.**

The conductive portions **346** are connected to various predetermined solenoids in the changer **66,** as mentioned before, and, therefore, the particular solenoids in the changer **66** connected to the particular conductive portions **346** of the circuit selector **96** in contacting engagement with the contact **98** when the change return apparatus **10** is moved to the change position will be energized and will return to the customer the change associated therewith, the power supply **22** thus energizing a particular portion of the changer **66** via the contacting engagement between the contact **348** and the particular conductive portion **346.** Referring to the example shown in FIG. **8,** the first conductive portion **346** is, more particularly, connected to two 10-cent solenoids, one 25-cent solenoid, and one 50-cent solenoid, and the changer **66** will thus dispense 95 cents in change, the correct change since the customer had dispensed 5 cents' worth of liquid in this example, as mentioned before.

The dispensing of change from the first change calculator **52** will cause the actuator **166** to move the mercury switch **164** to the actuated position wherein electrical continuity is established between the contacts **168** and **169** thereof. In this position of the mercury switch **164,** the conductor **224** is connected to the conductor **222,** thereby establishing an electrical short circuit around the changer **66** to essentially disconnect the changer **66** from the power supply **22.**

The fuse **272** has, in a preferred form, a higher amperage rating than the circuit breaker **176;** therefore, the circuit breaker **176** will be moved to an opened position establishing an electrical discontinuity through the conductor **270,** when the mercury switch **164** establishes the electrical short circuit, referred to above. The electrical discontinuity through the conductor **270** holds or maintains the solenoids in the changer **66** in a de-energized position or, in other words, disconnects the changer **66** from the power supply **22.** Thus, the automatic change return apparatus **10** is positioned to prevent the returning of change to the customer during the operation of the "override system" or, in other words, will not dispense change to the customer each time the contact is established between the contact **98** and one of the conductive portions **346** of the cam **90,** as the cam **90** is rotated to the starting position **348.** Further, since the liquid pump motor **14** is connected to the power supply **22** via the circuit breaker **176,** the electrical discontinuity established by the circuit breaker **176** will also establish an electrical discontinuity between the liquid pump motor **14** and the power supply **22,** thereby positioning the liquid dispenser **12** in a nonoperative mode wherein liquid cannot be pumped or dispensed therethrough.

In the change position of the automatic change return apparatus **10,** the first drive motor **84** will remain in an operative mode or, in other words, the electrical continuity between the first drive motor **84** and the power supply **22** is maintained via the mercury switch **126** and the switch **206.** The first drive motor **84** will, thus, continue to rotatingly drive the driver **86** and the cam **90** after the change has been dispensed via the changer **66,** the cooperation between the various switches and the electrical position of the circuit breaker **176** each cooperating to functionally provide a portion of the "override system" mentioned above.

When the cam **90** has been rotated to a position within a predetermined angular distance from the starting position **348**, the angular distance more particularly corresponding to the angular width **410**, the switches **210** and **180** are opened via the engagement thereof with the cam slot **366**. In this position of the switches **210** and **180**, the resistors **208** and **178** are electrically connected to the control circuit of the automatic change return apparatus **10**, thereby reducing the rotational speed of the first drive motor **84** prior to the instant when the cam **90** has been rotated to the starting position **348**. In this manner, the cam **90** is more accurately positioned in the starting position **348**, and the various switch arms of the switches on the switch support **314** are more precisely positioned on the cam surface **320** or in the slots **362** and **364**, as described before.

The cam **90** also has a lobe or protrusion **440** formed on a portion thereof, as shown in FIG. **5**. The protrusion **440** is positioned on the cam **90** and the circuit breaker **176** is positioned with respect to the cam **90**, such that the protrusion **440** contacts a portion of the circuit breaker **176** to reset the circuit breaker **176** or, more particularly, to re-establish electrical continuity therethrough immediately prior to the time when the cam **90** has been rotated back to the starting position **348**.

Referring particularly to the example, operational embodiment mentioned above, and further assuming, for example, if the customer inserts a 5-dollar bill in the verifier **44**, the verifier **44** will verify that the inserted 5-dollar bill is genuine United States Currency and, after this verification, will establish electrical continuity between the power supply **22** and the solenoid actuator **58** of the second change calculator **60** via the conductors **62, 64, 46** and **48**. In the energized position of the solenoid actuator **58**, a portion thereof will contact a portion of the extension arm **108** of the cam **106** and move the cam **106** a predetermined number of degrees in a counterclockwise direction, in a manner similar to the solenoid actuator **50** and the extension arm **92** described above.

More particularly, the solenoid actuator **58** will move the cam **106** a predetermined number of degrees substantially corresponding to the angular width **418** of the cam slot **368**. In this position of the cam **106**, a portion of the switches **174** and **258** will be moved generally out of the cam slot **368** and be actuatingly engaged via the cam surface **320** of the cam **106**, thereby closing the switches **174** and **258**. The closing of the switch **258** establishes electrical continuity between the second drive motor **100** and the power supply **22** via the mercury switches **128** and **130**, the price control network **192**, the flow transmitter **30** and the variable resistors **260** and **262**. It should be noted that the switch **258** is positioned to maintain electrical discontinuity between the power supply **22** and the second drive motor **100** during the operation of the change return apparatus **10** after the customer has inserted a 1-dollar bill. The closing of the switch **174** establishes electrical continuity between the liquid pump motor **14** and the power supply **22**, the switch **174** electrically bypassing the switch **172** due to the parallel interconnection therebetween.

After the customer has rotated the pump switch assembly **120** in the actuating direction **122**, the mercury switches **126, 128, 130** and **132** are positioned in the pump position, as shown in FIG. **1**, and as described before. The first drive motor **84** is also connected to the power supply **22** and, therefore, the first drive motor **84** and the second drive motor **100** are each positioned in an operative mode, the first drive motor **84** and the second drive motor **100** each driving the cam and the driver connected thereto, during the operation of the change return apparatus **10**. It should be noted, however, that the first drive motor **84** is connected to drive the driver **86** and the cam **90** at a rotational speed generally five times faster with respect to the rotational speed established via the interconnection between the second drive motor **100** and the driver **102** and the cam **106**, since the cam **90** will be rotated through five cycles (360° each) as the cam **106** is rotated through one complete cycle (360°).

After the cam **106** has been rotated through an angular distance corresponding to the angular width **424** of the cam slot **370**, the switch arms of the switches **238** and **214** will be actuatingly engaged via the cam surface **320** of the cam **106**, thereby actuating what is sometimes referred to below as the "override system" of the second change calculator **60**. Thus, when the customer inserts a 5-dollar bill and after verification thereof, the first change calculator **52** and the second change calculator **60** are each positioned to cooperate in determining the correct change to be returned to the customer after the customer has dispensed the desired amount of liquid.

Since the cam **90** will be rotated through five complete cycles as the cam **106** is rotated through one complete cycle, the switch **180** will be actuatingly opened each time the cam **90** approaches a position within an angular width **410** from the starting position **348** thereof, thereby attempting to reduce the rotational speed of the first drive motor **84**, in a manner as described before. However, since the switch **182** is in electrical parallel with the switch **180**, the rotational speed of the first drive motor **84** will not be reduced due to the overriding function of the switch **182** which is controlled via the cam **106** of the second change calculator **60**. After the cam **106** has been rotated to a position within an angular distance corresponding with the angular width **432**, the switches **236** and **182** will be actuatingly opened, thereby electrically connecting the resistors **178** and **234** in the control circuit of the automatic change return apparatus **10** to reduce the rotational speed of the first drive motor **84** and the second drive motor **100**, for substantially the same purposes as mentioned before.

For example, it will be assumed that the customer has inserted a 5-dollar bill into the verifier **44** and has dispensed $2.95 worth of liquid through the liquid dispenser **12**. After the customer has actuated the pump switch assembly **120** in the deactuated direction **124**, the mercury switches **126, 128, 130** and **132** will be positioned in the "change return position," as described before.

In this position of the change return apparatus **10**, the contact **98** will be positioned in contacting engagement with the first conductive portion **346**, thereby actuating the solenoids in the changer **66** to return 95 cents in change to the customer, in a manner as described before and as shown in FIG. **8**. The contact **114** of the second change calculator **60** will be positioned generally between the first two conductive portions **354** and the last two conductive portions **354** of the circuit selector **112** or, more particularly, will be positioned such

that the contact **114** will contact two conductive portions **354** as the cam **106** is rotated to the starting position **356**, the number of conductive portions **354** contacted by the contact **114** in returning to the starting position **356** determining the number of dollars change to be dispensed via the changer **66**.

The change return position generally described above is also partially shown in FIG. **8**, and, in this particular change position, electrical continuity between the second drive motor **100** and the power supply **22** via the mercury switch **130** and the switch **238** so that the second drive motor **100** will continue to drive the driver **102** and the cam **106** to return the cam **106** to the starting position **356** thereof. As the cam **106** is rotated in the counterclockwise direction **382** toward the starting position **356**, the contact **114** will contactingly engage two of the conductive portions **354** on the circuit selector **112**. Each time the contact **114** contacts one of the conductive portions **354**, the solenoids in the changer **66** (the two 50-cent solenoids being diagrammatically shown in FIG. **8** and electrically connected so that the changer **66** dispenses one dollar in change when the solenoids are energized) are connected to the power supply **22** via the contacting engagement between the contact **114** and the particular conductive portion **354**, the conductors **230, 264, 268, 252** and **254** and the mercury switch **132**. In the operational example described above and shown in FIG. **8**, the second change calculator **60** will dispense two dollars in change, and the first change calculator **52** will dispense 95 cents in change, the total change thus dispensed being $2.95, the correct change considering a purchase of $2.05 worth of the liquid.

After the cam **106** has been rotated to a position within an angular distance corresponding to the angular width **432** from the starting position **356**, the switches **182** and **236** will be actuatingly engaged via the cam slot **372**, thereby opening the switches **236** and **182**. In the opened position of the switch **182**, the switch **180** will again control the electrical bypass about the resistor **178** so that the rotational speed of the first drive motor **84** and the rotational speed of the second drive motor **100** is reduced, for reasons and in a manner as described above. The opening of the switch **236**, more particularly, electrically connects the resistor **234** in the control circuit of the automatic change return apparatus **10** to reduce the rotational speed of second drive motor **100**.

It should be noted that the switches **206, 212**, and **214** have been included in the control circuit and actuated by the cam **90** and the cam **106**, to compensate for the initial movement of the cam **90** when the solenoid actuator **50** is first energized. For example, should the customer insert a 5-dollar bill in the verifier **44**, actuate the change return apparatus **10** to the pump position, and then dispense $1.05 worth of liquid via the liquid dispenser **12**, in this event, the second change calculator **60** would indicate that three dollars in change should be returned to the customer; however, the first change calculator **52** will not have been rotated to the position wherein the contact **98** is in engagement with the first conductive portion **346**. Thus, assuming the switches **212** and **214** were not included in the override network of the change return apparatus **10**, the customer would receive only 3 dollars in change. The switches **212** and **214** cooperate to override switch **206**, thereby postioning the first change calculator **52** to return 95 cents in change, the customer thereby receiving the correct change $3.95.

It should also be noted that, in one form, the switches **172** and **174** are constructed to be a relay operated type of switch, and, in this form, a switch is supported on each of the switch supports **314** and **316**, one switch energizing one relay to open and close a switch connected in the pump positioning network **28** in a manner similar to the switch **172**, and one other switch energizing one other relay to open and close a switch connected in the pump positioning network **28** in a manner similar to the switch **174**. This type of construction utilizing relay operated switches is particularly desirable where the switch is positioned in the automatic change return apparatus **10** such that the switch would require a relatively large amperage rating thereby increasing the size of the switch to such an extent that it would be difficult to support that particular switch on the switch support **314** or **316** for cooperation with the cam **90** or **106**. It will be apparent to those skilled in the art, from the foregoing that, in one other form, any one of the switches **172, 212, 206, 210** or **180** supported on the switch support **314** and any one of the switches **258, 174, 238, 214, 236** or **182** supported on the switch support **316** can be of the relay operated type of switch, and connected in the automatic change return apparatus **10** in a manner similar to that described above with respect to the switches **172** and **174**. However, in any event, the function and operational connection of the switches supported on the switch support **314** and **316** will remain essentially as described in detail before.

In utilizing the change return apparatus **10** in cooperation with particular gasoline pump type dispensers it may be desirable to modify the connection of the liquid price change network **192**. For example, assuming the change return apparatus is to be utilized in cooperation with two separate liquid dispensers, one liquid dispenser for dispensing a relatively higher grade of gasoline with respect to the other liquid dispenser, two liquid price change networks can be connected in parallel and a switch disposed in each parallel network such that the closing of one of the switches operatively connects one of the liquid price change networks in the change return apparatus. In this form of the invention last-mentioned, each liquid price change network would be constructed similar to the liquid price change network **192**; however, each liquid price change network would cooperate with one of the gasoline pump type dispensers since the pricing of the two grades of gasoline are usually different. In some other forms of particular gasoline pump type dispensers, a customer can turn a selector switch handle to position a single pump for dispensing various grades of gasoline. Utilizing the change return apparatus of the present invention in combination with a liquid dispenser of the type last-mentioned, a plurality of variable resistors can be connected such that one variable resistor is operatively connected in the change return apparatus for each grade of gasoline so selected each variable resistor functioning in a manner similar to that described before with respect to the variable resistor **196** when operatively connected.

Finally, the automatic change return apparatus **10** can be disconnected from the liquid dispenser **12** by opening the switch **82**, thereby disconnecting the verifier **44** from the power supply **22**; closing the switch **170** to bypass the pump positioning network **28**; and

opening the switch **202**, thereby disconnecting the flow transmitter **30**.

It will be apparent from the foregoing to those skilled in the art that automatic change return apparatus **10** is constructed to be easily, efficiently and economically incorporated into existing liquid dispensing units, and that the change return apparatus **10** functions to accurately determine the change to be returned to the customer in such a manner that the price per unit of volume of the liquid being dispensed can be quickly and efficiently altered to adjust for price variations, and such that the apparatus can receive monetary inputs of various predetermined denominations, the change in each instance being the difference between the particular monetary input and the total price for the liquid dispensed by the customer.

Changes may be made in the construction and the operation of the various parts or the elements disclosed herein without departing from the spirit and the scope of the invention as defined in the following claims.

What is claimed is:

1. An automatic change return apparatus, comprising: changer means for dispensing predetermined amounts of change in energized positions thereof;

power supply means connected to the changer means, the power supply means energizing portions of the changer means when in electrical continuity therewith;

circuit selector means having a plurality of conductive portions disposed thereon, the circuit selector means interposed between the power supply means and the changer means, each conductive portion connected to one portion of the changer means;

contact means interposed between the circuit selector means and the power supply means, a portion of the contact means movably contacting the circuit selector means;

means connected to the contact means for moving the contact means into contact with predetermined portions of the circuit selector means to establish electrical continuity between the power supply means and the changer means via the contact means and the conductive portions in contact with the contact means in an actuated position thereof, thereby energizing predetermined portions of the changer means to dispense a predetermined amount of change;

verifier means connected to the means for moving the contact means and to the power supply means for receiving a monetary input and actuating the means for moving the contact means upon verifying the genuineness of the monetary input;

a housing supporting the verifier means and the changer means;

air supply means connected to the housing supplying air thereto at a pressure level above atmospheric pressure to prevent air outside the housing from entering therein;

switch means interposed between the verifier means and the power supply means establishing electrical continuity therebetween in one position thereof; and

sensor means having a portion sensing the air being supplied via the air supply means and a portion connected to the switch means positioning the switch means to disconnect the power supply means from the verifier means upon sensing a malfunction of the air supply means.

2. An automatic change return apparatus, comprising:

changer means for dispensing predetermined amounts of change in energized positions thereof;

power supply means connected to the changer means, the power supply means energizing portions of the changer means when in electrical continuity therewith;

liquid dispenser means having a portion connected to the power supply means for dispensing liquid therethrough in one position thereof;

means to sense the flow of liquid through the liquid dispenser and to provide an output flow signal responsive thereto;

circuit selector means having a plurality of conductor portions disposed thereon and spaced thereabout generally near the outer periphery thereof, the circuit selector means interposed between the power supply means and the changer means, each conductive portion connected to one portion of the changer means;

contact means interposed between the circuit selector means and the power supply means, a portion of the contact means movably contacting the circuit selector means; and

means receiving the output flow signal and having a portion connected to the contact means for moving the contact means in response to the received flow signal into contact with predetermined conductive portions of the circuit selector means to establish electrical continuity between the power supply means and the changer means via the contact means and the conductive portions in contact with the contact means in an energized position thereof, thereby energizing predetermined portions of the changer means to dispense a predetermined amount of change, comprising:

drive motor means receiving the output flow signal and having an output rotational speed responsive thereto;

driver means connected to the drive motor means and being rotated thereby;

cam means connected to the driver means and being rotated thereby, a portion of the cam means being connected to a portion of the contact means, a portion of the contact means extending between the cam means and the circuit selector means;

shaft means rotatingly supporting the driver means and the cam means, the circuit selector means being secured in a stationary position about the shaft means and the cam means being interposed generally between the circuit selector means and the driver means;

bushing means constructed of a conductive material connected to a portion of the cam means, the contact means being electrically connected to the bushing means; and

conductive spacer means constructed of an electrically conductive material disposed about a portion of the shaft means generally between the cam means and the circuit selector means, a portion of the conductive spacer means engaging the bushing means to maintain a predetermined spacing between the cam means and the circuit

selector means, the conductive spacer means and the bushing means maintaining an electrical path between the contact means and the power supply means in the stationary position of the circuit selector means and in a stationary position and in a rotating position of the cam means.

3. An automatic change return apparatus, comprising:

power supply means;

liquid dispenser means having a portion connected to the power supply means for dispensing liquid therethrough in one position thereof;

switch means interposed between the liquid dispenser means and the power supply means providing electrical continuity therebetween in the closed position thereof;

means to sense the flow of liquid through the liquid dispenser means and to provide an output flow signal responsive to the price of the liquid being dispensed;

first change calculator means having a portion receiving the output flow signal and another portion providing a predetermined number of output change signals responsive to the price of the liquid dispensed and a predetermined monetary input in an actuated position thereof, each change signal corresponding to a predetermined amount of change generally greater than one other change signal by a predetermined incremental amount, generally between zero and one predetermined monetary input, one portion of the first change calculator means connected to the switch means, for closing the switch means in an actuated position of the first change calculator means, the first change calculator means including:

a plurality of conductive portions;

contact means movably engaging the conductive portions in one position of the first change calculator means, the output change signal of the first change calculator means provided via the contacting engagement between the contact means and the conductive portions;

means for moving the contact means of the first change calculator means into contacting engagement with one of the conductive portions thereof in response to the liquid dispensed via the liquid dispenser means;

a second change calculator having a portion receiving the output flow signal and another portion providing a predetermined number of output change signals, each change signal responsive to the price of the liquid dispensed and one other predetermined monetary input in an actuated position thereof corresponding to a predetermined amount of change generally greater than one other change signal by a predetermined incremental amount, generally between zero and one other predetermined monetary input, the incremental amount of the second change calculator means being generally equal to the one predetermined monetary input of the first change calculator means, one other portion of the second change calculator means connected to the switch means for closing the switch means in an actuated position of the second change calculator means, the second change calculator means including:

a plurality of conductive portions;

contact means movably engaging the conductive portions in one position of the second change calculator means, the output change signals of the second change calculator means provided via the contacting engagement between the contact means and the conductive portion;

means for moving the contact means in the second change calculator means into contacting engagement with a predetermined number of the conductive portions thereof responsive to the liquid dispensed via the liquid dispenser means;

means connected to the first and to the second change calculator means for receiving monetary inputs and actuating the first and the second calculator means in response thereto, the means for receiving the monetary inputs actuating the first change calculator means and the second change calculator means upon receiving the one other predetermined monetary input, the first change calculator means and the second change calculator means cooperating to provide change signals for dispensing change generally from zero to the one other predetermined monetary input in incremental amounts corresponding to the incremental amount of the first change calculator means, the means receiving the monetary input including:

means for receiving the one predetermined monetary input and actuating the first change calculator means in response thereto; and

means for receiving the one other predetermined monetary input and actuating the second change calculator means in response thereto;

changer means receiving the output change signal and dispensing predetermined amounts of change in response thereto;

circuit breaker means interposed between the means to move the contact means and the first change calculator means and the power supply means and between the power supply means and the portion of the changer means connected to the first change calculator means to interrupt electrical continuity therebetween in an opened position thereof;

means to actuate the circuit breaker means when the changer means has dispensed the change therefrom;

override switch means to connect the first change calculator means to the power supply means after the changer means has dispensed the change, the first change calculator means being thereby returned to a starting position, the contacting engagement between the conductive portions and the contact means remaining disconnected from the changer means and the second change calculator means being thereby returned to a starting position and the contacting engagement between the contact means and a predetermined number of conductive portions providing a predetermined number of change signals therefrom.

4. An automatic change return apparatus, comprising:

changer means for dispensing predetermined amounts of change in energized positions thereof;

power supply means connected to the changer means, the power supply means energizing portions

of the changer means when in electrical continuity therewith;

circuit selector means having a plurality of conductive portions disposed thereon and spaced thereabout generally near the outer periphery thereof, the circuit selector means interposed between the power supply means and the changer means, each conductive portion connected to one portion of the changer means;

contact means interposed between the circuit selector means and the power supply means, a portion of the contact means movably contacting the circuit selector means;

liquid dispenser means having a portion connected to the power supply means for dispensing liquid therethrough in one position thereof;

means to sense the flow of liquid through the liquid dispenser means and to provide an output flow signal responsive thereto;

means receiving the output flow signal and having a portion connected to the contact means for moving the contact means in response to the received flow signal into contact with predetermined conductive portions of the circuit selector means to establish electrical continuity between the power supply means and the changer means via the contact means and the conductive portions in contact with the contact means in an actuated position thereof, thereby energizing portions of the changer means to dispense a predetermined amount of change, comprising:

drive motor means receiving the output flow signal and having an output rotational speed responsive thereto;

driver means connected to the drive motor means and being rotated thereby;

circuit breaker means interposed between the changer means and the power supply means and between the liquid dispenser means and the power supply means to interrupt the electrical continuity therebetween in an opened position thereof;

means to actuate the circuit breaker means to the opened position when the changer means has dispensed the change therefrom;

override switch means to connect the drive motor means to the power supply means in one position thereof;

switch support means supporting the override switch means;

switch means supported on the switch support means interposed between the liquid dispenser means and the power supply means providing electrical continuity therebetween in the closed position thereof;

cam means connected to the driver means and being rotated thereby, the cam means having a cam surface engaging and closing the override switch means and the switch means supported on the switch support means after the cam means has been rotated from a starting position a predetermined angular distance, and a cam slot means formed in a portion of the cam surface for disengaging and opening the override switch means and the switch means in the starting position of the cam means and during the rotation of the cam means from the starting position through a predetermined angular distance, the first-mentioned and the last-mentioned angular distance corresponding substantially to the angular width of the cam slot means;

means connected to the cam means for rotating the cam means a predetermined angular distance corresponding substantially to the angular width of the cam slot means in an energized position thereof; and

verifier means connected to the means for rotating the cam means a predetermined angular distance for receiving a monetary input and energizing said means upon verifying the genuineness of the monetary input, the liquid dispenser means being thereby disconnected from the power supply means until the verification of the monetary input and the drive motor means being thereby connected to the power supply means after the changer means has dispensed the change.

5. The apparatus of claim **4** wherein an extension arm is connected to a portion of the cam means; and wherein an extension arm is connected to a portion of the driver means, the driver extension arm engaging the cam extension arm after the driver means has been rotated through an angular distance substantially corresponding to the angular width of the cam slot means to provide the connection between the cam means and the driver means, the driver means thereby being rotated **360** degrees while rotating the cam means through 360 degrees less an angular distance substantially corresponding to the angular width of the cam slot means.

6. An automatic change return apparatus, comprising:

power supply means;

liquid dispenser means having a portion connected to the power supply means dispensing liquid therethrough in one position thereof;

switch means interposed between the liquid dispenser means and the power supply means providing electrical continuity therebetween in a closed position thereof;

means sensing the flow of liquid through the liquid dispenser means and providing an output flow signal responsive to the price of the liquid being dispensed;

first change calculator means having a portion receiving the output flow signal and another portion providing an output change signal responsive to the price of the liquid dispensed and a predetermined monetary input in an actuated position thereof, one other portion of the first change calculator means connected to the switch means closing the switch means in an actuated position of the first change calculator means, comprising:

circuit selector means having a plurality of conductive portions disposed thereon, the circuit selector means interposed between the power supply means and the changer means, each conductive portion connected to one portion of the changer means;

contact means interposed between the circuit selector means and the power supply means, a portion of the contact means movably contacting the circuit selector means;

drive motor means receiving the output flow signal and having an output rotational speed responsive thereto;

driver means connected to the drive motor means and being rotated thereby;

cam means connected to the driver means and being rotated thereby; and

contact means connected to the cam means and interposed between the circuit selector means and the power supply means, a portion of the contact means movably contacting predetermined conductive portions of the circuit selector means and moved into contacting engagement with predetermined conductive portions in response to the rotation of the cam means establishing electrical continuity between the power supply means and the changer means via the contact means and the conductive portions in contact with the contact means in an actuated position thereof, thereby energizing predetermined portions of the changer means to dispense a predetermined amount of change;

means connected to the first change calculator means receiving the monetary input and actuating the first change calculator in response thereto; and

changer means receiving the output change signal and dispensing predetermined amounts of change in response thereto.

7. The apparatus of claim **6** wherein the first change calculator means provides a predetermined number of output change signals, each change signal corresponding to a predetermined amount of change generally greater than one other change signal by a predetermined incremental amount, generally between zero and one predetermined monetary input; and wherein the apparatus is defined further to include:

a second change calculator having a portion receiving the output flow signal and another portion providing a predetermined number of output change signals, each change signal responsive to the price of the liquid dispensed and one other predetermined monetary input in an actuated position thereof and corresponding to a predetermined amount of change generally greater than one other change signal by a predetermined incremental amount, generally between zero and the one other predetermined monetary input, the incremental amount of the second change calculator means being generally equal to the one predetermined monetary input of the first change calculator means, one other portion of the second change calculator means connected to the switch means for closing the switch means in an actuated position of the second change calculator means, comprising:

circuit selector means having a plurality of conductive portions disposed thereon, the circuit selector means interposed between the power supply means and the changer means, each conductive portion connected to one portion of the changer means;

contact means interposed between the circuit selector means and the power supply means, a portion of the contact means movably contacting the circuit selector means;

drive motor means receiving the output flow signal and having an output rotational speed responsive thereto;

driver means connected to the drive motor means and being rotated thereby;

cam means connected to the driver means and being rotated thereby; and

contact means connected to the cam means and interposed between the circuit selector means and the power supply means, a portion of the contact means movably contacting predetermined conductive portions of the circuit selector means and moved into contacting engagement with predetermined conductive portions in response to the rotation of the cam means establishing electrical continuity between the power supply means and the changer means via the contact means and the conductive portions in contact with the contact means in an actuated position thereof, thereby energizing predetermined portions of the changer means to dispense a predetermined amount of change; and

wherein the means for receiving the monetary input includes means for receiving the one predetermined monetary input and actuating the first change calculator means in response thereto, and means for receiving the one other predetermined monetary input and actuating the second change calculator means in response thereto.

8. The apparatus of claim **7** wherein the means for receiving the monetary input actuates the first change calculator means and the second change calculator means upon receiving the one other predetermined monetary input, the first change calculator means and the second change calculator means cooperating to provide change signals for dispensing change generally from zero to the one other predetermined monetary input in incremental amounts corresponding to the incremental amount of the first change calculator means.

9. An automatic change return apparatus, comprising:

changer means dispensing predetermined amounts of change in energized positions thereof;

power supply means connected to the changer means, the power supply means energizing portions of the changer means when in electrical continuity therewith;

liquid dispenser means having a portion connected to the power supply means dispensing liquid or the like therethrough in one position thereof;

means sensing the flow of liquid through the liquid dispenser means and providing an output flow signal responsive thereto;

circuit selector means having a plurality of conductive portions disposed thereon, the circuit selector means interposed between the power supply means and the changer means, each conductive portion connected to one portion of the changer means;

contact means interposed between the circuit selector means and the power supply means, a portion of the contact means movably contacting the circuit selector means; and

means receiving the output flow signal and having a portion connected to the contact means continuously moving the contact means at a rate of speed proportional to the received flow signal into contact with predetermined conductive portions of the circuit selector means to establish electrical continuity between the power supply means and the changer means via the contact means and the con-

ductive portions in contact with the contact means in an actuated position thereof, thereby energizing predetermined portions of the changer means to dispense a predetermined amount of change.

10. The apparatus of claim **9** defined further to include:

verifier means connected to the means for moving the contact means and to the power supply means for receiving a monetary input and actuating the means for moving the contact means upon verifying the genuineness of the monetary input.

11. The apparatus of claim **9** wherein the means for moving the contact means includes:

drive motor means receiving the output flow signal and having an output rotational speed responsive thereto;

driver means connected to the drive motor means and being rotated thereby; and

cam means connected to the driver means and being rotated thereby; and

wherein the contact means is defined further as being connected to a portion of the cam means; and wherein the conductive portions of the circuit selector means are spaced thereabout generally near the outer periphery thereof.

12. The apparatus of claim **11** defined further to include:

switch means connected to a portion of the liquid dispenser means having a pump position and a change position and connecting the drive motor means to the power supply means in a change position and connecting the drive motor means to the power supply via the means to sense the flow of liquid in a pump position; and

wherein the liquid dispenser means includes: means to actuate the switch means to a pump position in one position of the liquid dispenser means and to a change position in one other position of the liquid dispenser means.

13. The apparatus of claim **11** defined further to include:

liquid price change means interposed between the drive motor means and the means to sense the flow of liquid to control the flow signal to the driver motor means, the flow signal being responsive to rate of the flow through the liquid dispenser means and the price of the liquid per unit volume, the liquid price change having a portion thereof adjustable for controllingly setting the flow signal to be responsive to a plurality of predetermined prices of the liquid per unit volume.

14. The apparatus of claim **11** defined further to include: shaft means; and wherein the driver means and the cam means are each rotatingly supported on the shaft means; and the circuit selector means is secured in a stationary position about the shaft means, the cam means being interposed generally between the circuit selector means and the driver means.

15. The apparatus of claim **14** wherein each of the conductive portions of the circuit selector means is connected to a predetermined portion of the changer means for energizing the changer means to dispense change in amounts from zero to one dollar in 5-cent increments; and wherein the drive motor means drivingly rotates the cam means via the driver means to move the contact means generally from contacting engagement with one conductive portion to contacting engagement with one other conductive portion as each 5-cent portion of liquid is dispensed via the liquid dispenser means.

16. The apparatus of claim **11** defined further to include:

circuit breaker means interposed between the changer means and the power supply means and between the liquid dispenser means and the power supply means to interrupt the electrical continuity therebetween in an opened position thereof;

means to actuate the circuit breaker means to the opened position when the changer means has dispensed the change therefrom; and

override switch means to connect the drive motor means to the power supply means to return the driver means and the cam means to the starting positions thereof after the changer means has dispensed the change.

17. The apparatus of claim **16** wherein each of the conductive portions of the circuit selector means is connected to a predetermined portion of the changer means for energizing the changer means to dispense one predetermined amount of change; and wherein the drive motor means drivingly rotates the cam means via the driver means to move the contact means to a position wherein the contact means contactingly engages a predetermined number of the conductive portions as the cam means returns to the starting position thereof.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,747,732 Dated July 24, 1973

Inventor(s) Sammy C. Mitchell

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

Column 14, line 9, the numeral "400" should be the numeral --406--.

Column 16, the first-occurring table (lines 12-27) should be corrected as follows:

At "1. Starting position 356" under the column "236", the word "opened" should be --closed--; and under the column "182", the word "opened" should be --closed--.

At "2. After rotation through angular distance 418" under column "238", the word "closed" should be --opened--; and under the column "214", the word "closed" should be --opened--.

At "4. Angular distance 432 from starting position 356" under the column "236", the word "closed" should be --opened--; and under the column "182", the word "closed" should be --opened--.

At "1. Starting position 348" under the column "210" the word "opened" should be --closed--; and under the column "180", the word "opened" should be --closed--.

Column 19, line 28, "(360L)" should be --(360°)--.

Signed and sealed this 22nd day of January 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents.