

Oct. 22, 1963

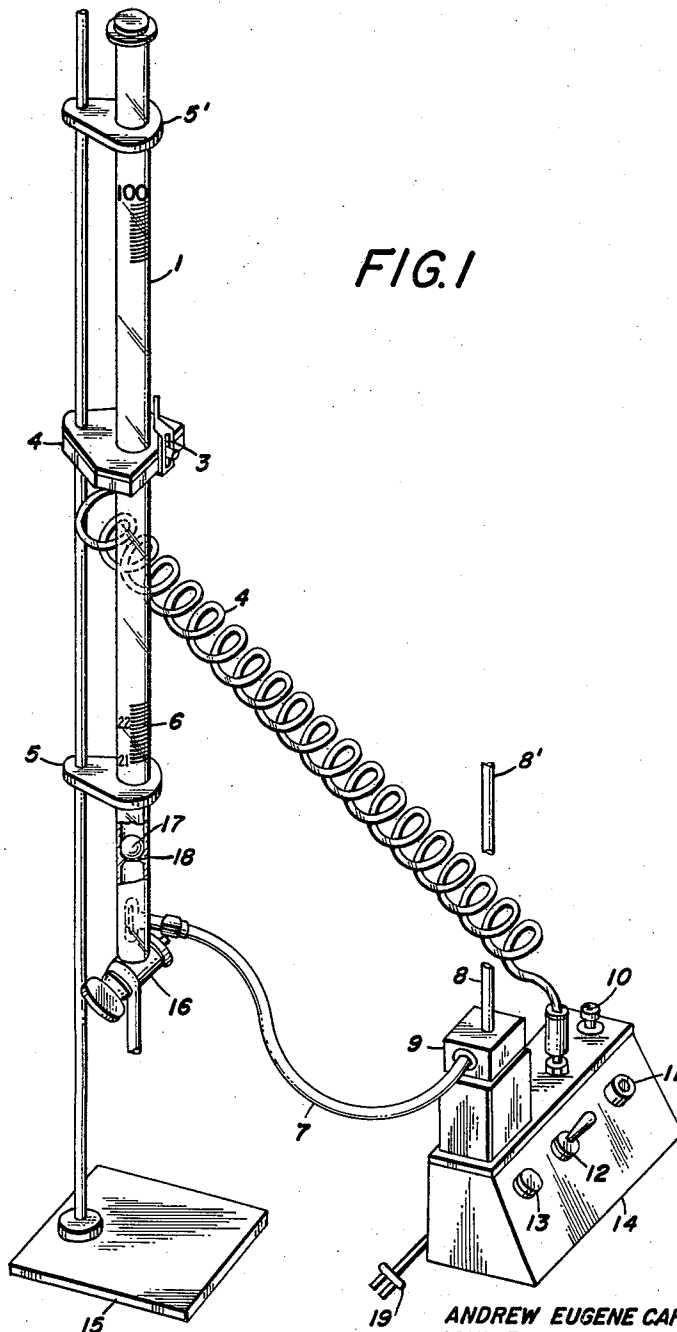
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3,107,818

FLUID DISPENSING DEVICE HAVING LIGHT SENSITIVE MEANS

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4 Sheets-Sheet 1



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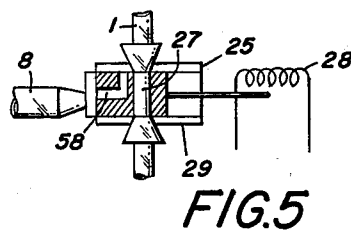
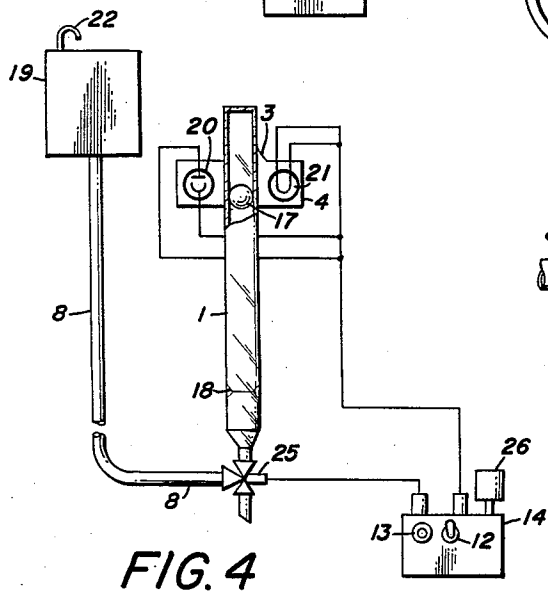
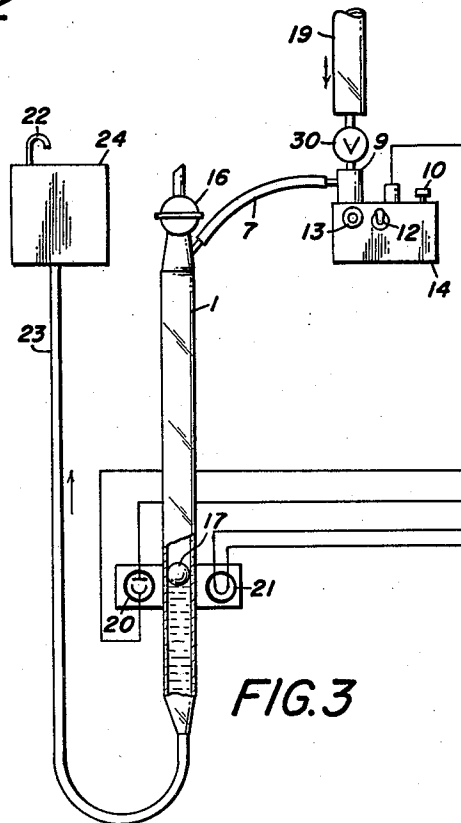
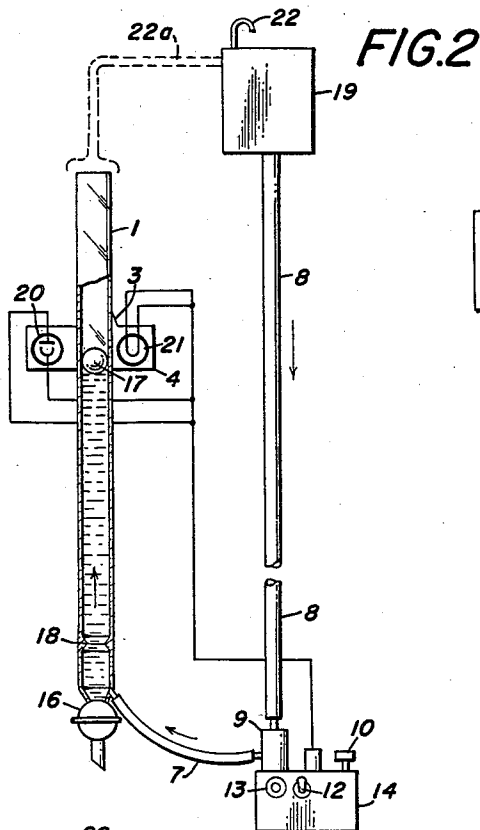
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4 Sheets-Sheet 2



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4 Sheets-Sheet 3

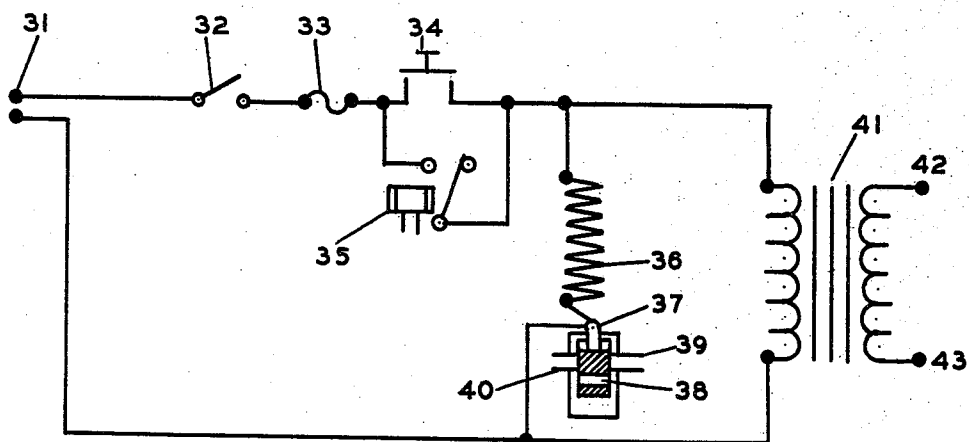


FIG. 6

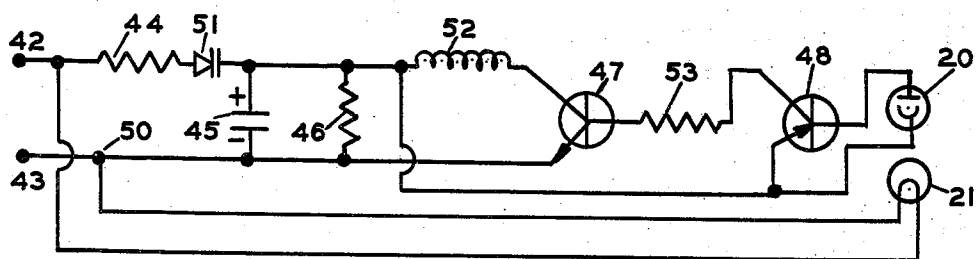


FIG. 7

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4 Sheets-Sheet 4

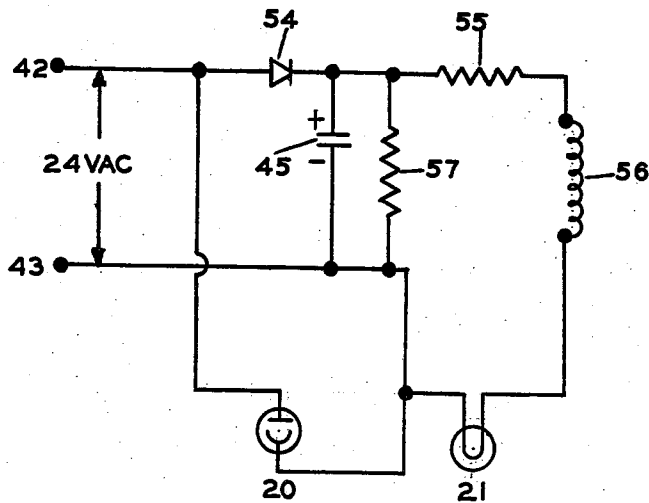


FIG. 8

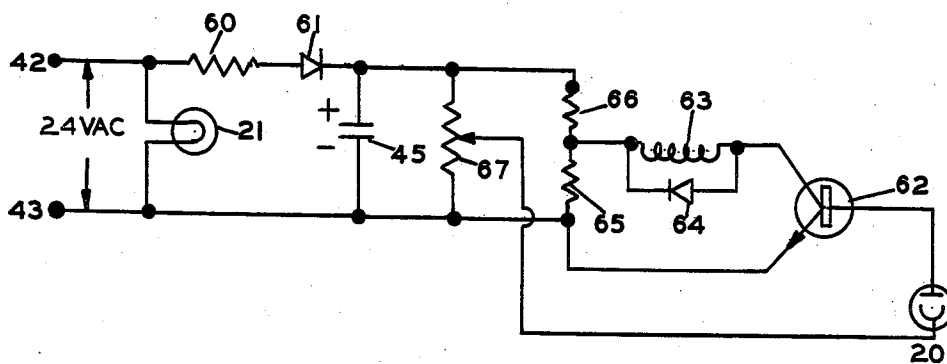


FIG. 9

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FLUID DISPENSING DEVICE HAVING LIGHT SENSITIVE MEANS

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This invention relates to devices for delivering predetermined measured quantities of fluids including liquids, gases and vapors. It has particular reference to devices of the kind wherein a series of equal quantities of liquids or gases or vapors are dispensed.

In batch processes it is often required to contact predetermined volumes of solutions or other liquid materials in such batch which may also partly be composed of solid materials. It may also be necessary to add predetermined volumes of fluid materials at the start, during or at the end of the reaction process. In pilot plants many samples of predetermined volumes may be essential to follow the course of the reaction or production process in order to arrive at the optimal conditions for designing a technical production unit. Sometimes in chemical processes, such as, for instance, the production of certain plastic compositions, batch operations at a small scale, involving the bringing together of relatively modest but accurately measured predetermined volumes of liquids are required to determine the behavior of the relevant base materials in the larger scale batch or continuous process. Many pharmaceutical and similar compositions are produced in small batches, ranging from some grams to a few hundred pounds, by adding or mixing measured volumes of the base materials in liquid form as such or dissolved in a solvent. Solid materials may also be present or may be added to such batches.

In continuous processes liquid samples of predetermined volume have to be taken at certain points of the production line for controlling and other purposes. Often, such samples are taken at regular time intervals. In such cases there is a need for a dispensing device delivering at regular intervals a predetermined volume of liquid into a container. Many samples taken over regular intervals of time may have to be added into one container in order to obtain a representative sample over a period of time equal to the sum of the intervals. Such container may hold 2 to 24 or more samples which as a whole are representative for 2 to 24 or more intervals of time, each interval being the period of time between the drawings of two consecutive samples.

In laboratory work also, series of analysis or other determinations often involve measuring and dispensing of a large number of equal volumes of liquids, gases or vapors.

Preferably a device for delivering measured quantities of liquid should be independent of the characteristics of the liquids to be dispensed such as specific gravity, color, turbidity, heat or electric conductivity, polarity, breaking index and other properties.

The device according to the invention can be used for dispensing predetermined measured volumes of clear solvents or solutions, of liquids containing finely divided or dispersed materials such as suspensions, emulsions, colloidal solutions. The liquids may be turbid, opaque or colored. The solutions or dissolved or dispersed substances may be ionized or non-ionized, acid, alkaline or neutral and pure chemical compounds as well as mixtures may be present.

In many cases a high degree of accuracy is essential. Dispensing or metering series of accurate quantities of

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liquids and gases or vapors by purely manual operation usually involves filling a calibrated device such as a buret or pipet to a certain level, reading the level of the liquid in the calibrated device, opening the outlet of the device and keeping such outlet, such as a valve, open until a predetermined volume of liquid has flown out thereby closing such outlet just at the right moment and refilling the calibrated device with the liquid to be dispensed till a certain level. Such series of manual operations are not only time consuming but it is also nearly impossible to refill the device each time exactly to a predetermined level and to shut the outlet valve exactly at the right moment. The operator gets tired and experience has shown that results become less accurate as longer series of dispensings have to be made. By using a pipet of predetermined volume the effort to obtain series of dispensings of such predetermined volume is somewhat less, but here too, longer series of measurements give rise to increasing inaccuracy. Moreover for each different volume of liquid to be drawn off in series a different pipet is needed which, from a laboratory point of view, is impractical and expensive. Pipets and burets need special and often difficult to meet precautions when noxious, flammable, radio-active, or other harmful liquids have to be dispensed or involve liquids with a high vapor pressure which tend to evaporate during handling.

It is an object of the invention to meet the above described needs and to overcome the difficulties and disadvantages connected therewith by providing an apparatus which can be used to measure and dispense or meter series of predetermined volumes of fluids, including gases and vapors, of any kind even if such fluids are noxious, flammable or radio-active, in an automatic or semi-automatic way.

A further object of the invention is to provide a device which can easily be adjusted so as to deliver series of predetermined measured volumes of liquid wherein the volumes of liquids to be dispensed are the same for each series but may be varied for different series of dispensings.

According to a special embodiment of the invention, simple and improved means are provided to take measured volumes of liquids, such as samples, by remote control from large containers or production lines.

According to a preferred form of the invention a device for delivering predetermined measured quantities of liquids in series is provided comprising in combination feeding means for supplying a liquid into a calibrated tube, which at least partly consists of the light-permeable material and is provided with: closing means to prevent the flow of liquid out of said calibrated tube during the feeding and measuring period; a valve for controlling the flow of liquid through the feeding means; electromagnetic means for opening and closing this valve; a normally open electric circuit provided with a switch for energizing the electromagnetic means and in the circuit of the switch a relay for controlling the electric circuit; light sensitive means movably located alongside of the calibrated tube; a source of light in such position that a beam of light is directed through the calibrated tube onto the light sensitive means; opaque means responsive to the level of the liquid in the calibrated tube for interrupting the light beam to successively open the relay, shut off the light, and thus de-energize the electromagnetic means and close the valve in the feeding means as the liquid level in the calibrated tube ascends to a predetermined level; and means provided in the calibrated tube to enable liquid contained in the calibrated tube to flow into a recipient.

Reference will now be made to the accompanying drawings which illustrate constructional embodiments of the invention and in which:

FIGURE 1 is an elevation of a liquid dispensing device. FIGURE 2 is a diagrammatic view of a liquid dis-

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dispensing device, showing the outlet valve of the buret in closed position and the buret just filled to the desired calibration mark.

FIGURE 3 is a diagrammatic view of a liquid dispensing device to be used for dispensing gases or vapors.

FIGURE 4 is a diagrammatic view of a liquid dispensing device provided with an automatically controlled outlet valve.

FIGURE 5 is a detailed diagrammatic view of part 25 of FIGURE 4 in de-energized position.

FIGURE 6 is a wiring diagram of the basic electric circuit.

FIGURE 7 is a wiring diagram showing the signaling part of the photocell-light source combination.

FIGURE 8 is an alternative and simpler wiring diagram of FIGURE 6.

FIGURE 9 shows the wiring of an improved signaling system.

While we have illustrated the arrangement of our invention as utilized for dispensing predetermined, measured quantities of liquids with the use of a conventional buret and certain specific wiring diagrams, it is to be understood that we contemplate the utilization of the device of the instant invention in any place where the same may be found to have utility and with the kind and shape of calibrated liquid containers and by the use of wiring diagrams that may best suit the particular application for which the device is to be used.

Referring to the drawings in detail the device, according to the invention as shown in FIGURE 1, is composed of a buret 1 provided with a calibration as partly shown in 6. The buret is attached to a standard 15 with clamps 5 and 5'. The buret has an outlet valve 16. The feeding line to the buret is indicated by 7 whereas a float 17 of spherical shape is provided resting on indentures 18. Float 17 may also be shaped as a teardrop, cone, cylinder, prism, or otherwise.

The controlling part of the apparatus 14 carries a light 13, an on-off switch 12, a fuse 11, a push button for momentary contact 10, a photocell-light source combination 4, a feed line 8, 8' from a feed container (not shown) to the electronic device 14 containing a normally closed solenoid valve in part 9 of device 14 and continuing through tube 7 to the buret. Operation sequence with this variable liquid dispensing device is as follows:

Current supply is connected with plug 19, calibrator index 3 is set on the desired volume, switch 12 is turned on and push button 10 is pushed down, thereby lighting the light in the photocell-light source combination, energizing the solenoid in the electronic equipment 14 to the open valve position and holding such position open by the photocell, allowing fluid to flow through 8, 8', the open solenoid valve 9, and 7 into the graduated tube 1 and entraining float 17 on the surface of the inflowing fluid. The float 17 intercepts the light beam as soon as the liquid surface has reached the predetermined level defined by the setting of indicator 3, causing the open solenoid valve 9 to be closed and so stopping further flow of liquid into tube 1. At the same time the light source in the photocell combination 4 is shut off. Instead of extinguishing the light source in 4 one may also use an electrically controlled diaphragm or similar device that prevents light from falling on the photocell in the closed position. By opening valve 16 the contents of tube 1 are drained and by closing valve 16 after drainage and pushing down button 10 the cycle of operations can begin again.

The device according to FIGURE 2 shows more diagrammatically the apparatus of FIGURE 1. Numbers have the same meaning as in FIGURE 1 and the photocell-light source combination is shown in more detail. The photocell is indicated by 20, the light source by 21. Float 17 is just in the position that it intercepts the light beam directed towards photocell 20 and so stops the flow of liquid into tube 1 as explained in connection

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with FIGURE 1. The stopcock is still in closed position. FIGURE 2 shows the head tank 19 containing the liquid to be dispensed and a vent 22 in connection with the open air. When handling oxidizable, flammable or noxious fluids the top tube 1 and vent 22 may be connected in a closed system (shown by dotted lines 22a) with a buffer of inert or atmospheric gas. A check valve (not shown) may be used in the outlet part of vent 22 to prevent the escape of vapors or gases from the dispensing system and admit air or another gas during the withdrawal of liquid from the dispensing system. Float 17 should be of such shape that it clearly defines the position of the liquid within tube 1. Instead of using a float in some cases the liquid to be dispensed can be used to activate the photocell-light source combination. Though, in general, results tend to be less accurate, this system, in appropriate cases, can be used when dispensing or metering liquids of such opacity, turbidity or color which intercepts to a sufficient extent at the location of the photocell-light source combination those parts of the light beam which act on the photocell thereby causing the cycle of electrically controlled operations, described above, to take place. Preferably tube 1 has an elongated form and it may have a volume of 5 ml. or less, or up to 25 ml. or 100 ml. or even 1000 ml. or more. With larger volumes of for instance hundreds of gallons but sometimes even in the one gallon range, the shape of container 1 may profitably be so that it is relatively much wider and made from steel or another non-light permeable material and is connected with a much narrower upper portion which at least at the position of the photocell-light source combination consists of light permeable, preferably clear, material such as glass or a clear type of plastic such as polymethacrylate or polystyrene.

Construction material of the liquid containing or liquid transferring portions of the device may be of any kind of material either ferrous or non-ferrous metal or non-metal, such as plastic, glass, silica, dependent upon the liquids to be dispensed. Push button 10 may be located in the vicinity of the solenoid valve portion as shown in FIGURES 1, 2, and 3, but it may also be located at considerable distance from the rest of the electronic equipment, for instance in the instrument room of a plant so as to enable the operators to draw samples or dispense predetermined volumes of liquids for other purposes without being next to the unit where the dispensing has to take place. Such remote control is also important when dispensing noxious, flammable or radio-active liquids. By combining the switching part of several dispensers it is possible to draw samples at different spots of a plant at the same time or predetermined time intervals. This can be of special importance in continuous plants.

FIGURE 3 shows the variable dispensing device according to the invention as used for dispensing a series of equal volumes of gas or vapor. Gas under pressure leaves the container 19 through a pressure reducing valve 30 to enter the solenoid valve in part 9 of apparatus 14 and if this valve is open the gas or vapor flows through conduit 7 into the upper portion of tube 1 which is turned upside down as compared with its position in the liquid dispensing device. Float 17 defines the level of the liquid in tube 1 which is in open communication with container 24 through conduit 23. By choosing an appropriate liquid of opaque turbid or colored nature, as described before, one may advantageously omit the float and use the liquid surface instead. At the start tube 1 is completely filled with liquid. When pushing push button 10 the solenoid valve 9 is opened and gas flows into tube 1 thereby gradually pushing the liquid from tube 1 into container 24. The descending float or liquid intercepts the light beam onto the photocell when the liquid level has reached a predetermined position. If in this case a liquid is used for intercepting the light beam, such liquid is used as an opaque layer floating on the clear liquid which fills the rest of the liquid portion of the dispensing

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device. At that moment the solenoid valve 9 is closed and tube 1 contains a measured volume of gas which can be removed by turning stopcock 16 into the open position. After the gas has been removed stopcock 16 is closed and the cycle of operations can begin again. For the sake of accuracy tube 1 may be surrounded by a mantle of constant temperature (not shown).

FIGURE 4 represents a further embodiment of the invention in which the fluid dispensing device is used as a metering pump. The arrangement is the same as in FIGURE 2 except that stopcock 16 and the solenoid valve in part 9 of FIGURE 2 are combined into one three-way solenoid valve and that push button 10 is automatically activated by a cycletimer. The operation is as follows:

Index 3 is set at the proper volume and the cycletimer is set at the desired period of time. This period of time should be longer than or at least as long as the time needed for the dispensing device to complete a full cycle of operation. For each fluid to be dispensed this minimum time period can easily be determined before setting the cycletimer. The cycletimer may be of any of the known types. The main switch is turned on thereby energizing the three-way solenoid 25 and the cycletimer 26. This brings the valve in such position that a connection is formed between conduit 8 and container 1 thus allowing liquid to flow from head tank 19 through conduits 8, 8' into container 1. The liquid in container 1 carries at its surface float 17 which in the position shown just intercepts the light beam from 21 through tube 1 onto photocell 20. This interception de-energizes the solenoid valve which causes channel 58 of FIGURE 5 to move to the left thereby bringing port hole 27 just under the outlet of container 1. The contents of container 1 are drained through 27 into a receptient (not shown). After a predetermined period the cycletimer 26 causes the three-way solenoid valve to move to the right thereby initiating a new cycle of operations. If desired, samples taken at regular intervals during a certain period of time may be assembled into one recipient which so contains a representative sample for the chosen period of time.

FIGURE 6 represents the basic electric circuit as follows: Current input is at 31, a switch 32 is provided corresponding with switch 12 in FIGURES 1-4; push button 34 of FIGURE 6 corresponds with push button 10 of FIGURES 1-4. A relay is indicated by 35, whereas 36, 37, 38, 39 and 40 give details of the solenoid valve in part 9 of FIGURES 1-4. In de-energized condition the position of the port hole 38 in the solenoid valve is such that no liquid can flow from 39 to 40 or vice versa. When energized 37 moves upward and port hole 38 connects 39 with 40 so that liquid can pass the solenoid valve. As soon as the solenoid valve is de-energized such as by the action of a signal produced by the interruption of the light beam on the photocell and amplified in an appropriate way, the connection between 39 and 40 is interrupted again and stays so till the solenoid valve is re-energized. 41 is a transformer which supplies the light source-photocell combination of the dispensing device. A fuse is indicated by 33. In many cases a 110 v. A.C. light source and a 110 v. A.C. solenoid are very satisfactory.

FIGURE 7 gives a wiring diagram that may be used to feed the photocell-light source combination and to de-energize the solenoid by the interruption of the light beam directed onto the photocell 42 and 43 serve to provide the system with electric energy and have the same meaning as 42 and 43 in FIGURE 6. Potential difference between 42 and 43 may have any desired value and was used with excellent results at a value of 6.3 v. A.C.; 44 is a resistance, 51 a rectifier, 45 a condenser, 46 a resistance, 52 a relay, 47 and 48 are transistors, 53 is a resistor, 20 a photocell and 21 a light source. In a special embodiment of the invention the following parts were used: Transistor 47 a 2 N 170 NPN transistor of General Elec-

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tric; 48 a CK 722 PNP transistor of Raytheon; 26 an International Rectifier Photocell B2M; 52 a relay BK-7B of 4000 ohms of Kurman; a 6.3 v. A.C. light source 21; a CR-1 rectifier 51 type IN 34; 44 a resistance of 15 ohms acting as a surge limit; 46 a resistance of 10,000 ohms acting as a bleeder; 53 a resistance of 430 ohms acting as a current limiting device and 45 a condenser of 10 micro-f.

FIGURE 8 gives a somewhat simpler wiring diagram which was used with an input of 24 v. A.C. The numbers 42, 43, 21, 20 and 45 have the same meaning as in FIGURE 7. 54 is a rectifier, 55 and 57 are resistances and 56 is a relay. The rectifier was the same as in FIGURE 7, type IN 34; 57 and 55 were respectively 10,000 and 500 ohms; 45 was 20 micro-f., 21 a 24 v. A.C. light source; 56 a 10,000 ohm Kurman relay and 20 a CL-3 photocell of Clairex.

An improved and more sensitive system is represented in FIGURE 9. The following parts were used with outstanding results:

Resistance 60 of 15 ohms; potentiometer 67 of 10,000 ohms; resistances 66 and 65 of 4,700 and 12,000 ohms respectively; rectifiers 61 and 64 both IN 34; condenser 45 of 10 micro-f./50 v.; relay 63 with 4,000 ohms resistance; photocell 20 as in FIGURE 8; transistor 62 type 2N 167 NPN of General Electric.

The above wiring diagrams are given by way of example only and many other systems, known in the art, may be used to energize a solenoid by amplifying a signal produced by a light beam falling onto a photocell.

The accuracy obtained by using a device according to the invention is shown in the following examples. The invention, however, is not limited in any way by the figures, liquids, and other data given in the examples.

Example 1

Dispensing of water with the variable fluid dispensing device of FIGURE 1 and the wiring diagram described in FIGURES 6, 7.

The calibrator index was given an arbitrary setting and a series of 10 dispensings was made. Each dispensing was weighed separately with the following results:

Test No.	Tare, g.	Gross, g.	Net, g.
1	25.24	94.31	69.07
2	25.21	94.32	69.11
3	25.22	94.23	69.01
4	25.26	94.35	69.09
5	25.25	94.13	68.88
6	25.25	94.25	68.99
7	25.25	94.25	68.99
8	25.21	94.32	69.11
9	25.22	94.23	69.01
10	25.22	94.25	68.99

As can be calculated from the above figures the deviation amounts to $\pm 0.17\%$ which is acceptable for most analytical work. A still higher degree of accuracy was obtained with the device according to FIGURE 4.

Example 2

Dispensing of isopropylalcohol with the same device and in the same way as in Example 1.

Ten consecutive dispensings gave the following net weights in g. of isopropylalcohol:

76.8, 77.0, 76.7, 76.1, 76.8, 76.2, 76.2, 76.0, 76.0

Maximum deviation amounts to about $\pm 0.37\%$.

Example 3

Dispensing of milk using the device of FIGURES 1 and 2 with wiring diagrams 6 and 8; same procedure as in Example 1.

11 consecutive dispensings gave the following net weights in grams of milk:

54.2, 53.8, 53.7, 53.7, 53.7, 53.6,

53.5, 53.5, 53.5, 53.4, 53.6

Maximum deviation: $\pm 0.4\%$.

Example 4

Dispensing of water with the same device as used in Example 3.

10 dispensings gave the following net weights in grams of water:

199.7, 199.2, 199.5, 199.4, 199.6, 199.2,
199.3, 199.4, 199.2, 199.4

Maximum deviation amounts to about $\pm 0.125\%$.

With the use of a cycletimer and with the same setting, dispensing the water every 10 minutes maximum deviation amounted to $\pm 0.13\%$.

Example 5

Dispensing of benzene with the same device as used in Example 3.

Ten dispensings gave the following net weights in grams of benzene:

85.3, 85.3, 85.3, 85.3, 85.3, 85.2, 85.3, 85.3, 85.3

Example 6

Dispensing of nitrous oxide with the device as shown in FIGURE 3 and with the wiring diagram described in FIGURES 6 and 7.

Ten dispensings gave the following volumes in cubic centimeters:

51.5, 51.5, 51.4, 51.4, 51.5, 51.4, 51.5, 51.5, 51.4

We claim:

1. A fluid dispensing device for delivering a series of predetermined measured quantities of fluid comprising, in combination, a container, feeding means for supplying a fluid into said container, said container at least partly consisting of light permeable materials; said container being provided with a valve for controlling the flow of fluid into said container; electromagnetic means for opening and closing said valve; a normally open electric circuit, including an electrical source, provided with a switch for energizing said electromagnetic means and parallel with said switch a relay for controlling the electric circuit; light sensitive means connected in said circuit and movably mounted adjacent a predetermined light permeable portion of said container and a source of light movably mounted in such position that a beam of light is directed through said predetermined light permeable portion onto said light sensitive means; opaque means responsive to the level of the fluid in said container at least as such level approaches the predetermined light permeable portion of said container for preventing the light beam from acting on said light sensitive means so as to successively open said relay and thus to de-energize said electromagnetic means and close the valve in said feeding means as the fluid level in the predetermined light permeable portion of said container ascends to a predetermined level; and means provided on the container to enable fluid contained in the container to flow out and to prevent such flow out during the supply of fluid into said container.

2. A fluid dispensing device as claimed in claim 1 in which the opaque means responsive to the level of the fluid in the container consist of an appropriately shaped device floating on the surface of the liquid in said container.

3. A fluid dispensing device as claimed in claim 2 in which the device floating on the surface of the liquid in the container has a spherical shape.

4. A fluid dispensing device as claimed in claim 1 in which the opaque means responsive to the level of the fluid in the container comprises liquid in the container which, at least in the portion adjacent to the surface in the container is opaque so as to prevent the light beam from acting on the light sensitive means when said light beam is intercepted by said liquid.

5. A variable liquid dispensing device for delivering a series of predetermined, equal, measured quantities of liquid, comprising, in combination, a calibrated container, feeding means for supplying a liquid into said calibrated container, said container at least partly consisting of light

permeable material; said container being provided with manually operated closing means to prevent the flow of liquid out of said calibrated container during at least the feeding and measuring period; a valve for controlling the flow of liquid through the feeding means; electromagnetic means for opening and closing said valve; a normally open electric circuit, including an electrical source, provided with a switch for energizing said electromagnetic means and parallel with said switch a relay for controlling the electric circuit; light sensitive means connected in said circuit and movably located on one side of a calibrated portion of said container and a source of light movably mounted in such position that a beam of light is directed through said calibrated portion onto said light sensitive means; opaque means defining the level of the liquid in said container at least as such level approaches the calibrated portion of said container for interrupting the light beam before it reaches said light sensitive means to successively open said relay and thus to de-energize said electromagnetic means and close the valve in said feeding means as the liquid level in the calibrated portion of said container ascends to a predetermined level.

6. A fluid dispensing device for metering a series of predetermined quantities of fluids comprising, in combination, a container, feeding means for supplying a fluid into said container, said container at least partly consisting of light permeable material; said container being provided with closing means to prevent the flow of liquid out of said container during at least the feeding period and to prevent the flow of liquid into said container after the feeding period; electromagnetic means for controlling said closing means; a normally open electric circuit, including an electrical source, provided with a switch for energizing said electromagnetic means and parallel with said switch a relay for controlling the electric circuit; light sensitive means connected in said circuit and movably located alongside a predetermined light permeable portion on said container and a source of light movably mounted in such position that a beam of light is directed through said predetermined light permeable portion onto said light sensitive means; opaque means defining the level of the fluid in said container at least as such level approaches the predetermined light permeable portion of said container for preventing the light beam from acting on said light sensitive means so as to successively open said relay and thus to de-energize said electromagnetic means and consecutively close the inlet of said feeding means into said container and open the outlet of said container to enable the flowing out into a recipient of the liquid contained in said container.

7. A fluid dispensing device as claimed in claim 6 provided, in addition, with a cycletimer to re-energize the electromagnetic means at pre-set intervals, said intervals being at least equal to the time period needed for a complete cycle of feeding and dispensing operations.

8. A fluid dispensing device as claimed in claim 6 in which the closing means to prevent the flow of liquid from out said container during at least the feeding period and to prevent the flow of liquid into said container after the feeding period consist of a three-way valve movable in such position that it connects the feeding means with the container and in such other position that it connects the container with the recipient.

9. A liquid dispenser for delivering predetermined, equal, measured quantities of liquid, comprising, in combination, a buret provided with manually operated closing means to prevent the flow of liquid from said buret during at least the feeding and measuring period; a feed line for feeding to the buret the liquid to be measured, a valve for controlling the flow of liquid through the feeding line; electromagnetic means for opening and closing said valve; a normally open electric circuit, including an electrical source, provided with a switch for energizing said electromagnetic means and parallel with said switch a relay for controlling the electric circuit; light sensitive means connected in said circuit and movably located on one side

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of a calibrated portion of said buret and a source of light movably mounted in such position that a beam of light is directed through said buret onto said light sensitive means; a float buoyed by the liquid in said container for interrupting the light beam to successively open said relay, de-energize said electromagnetic means and close the valve in said feeding means as the liquid level in the buret ascends to a predetermined level.

10. A liquid dispensing device for metering a series of predetermined quantities of liquids comprising, in combination a buret provided with closing means to prevent the flow therefrom of liquid during at least the feeding period and with means to prevent the flow of liquid into said buret after the feeding period; electromagnetic means for controlling said closing means so that after a predetermined quantity of liquid is fed into said buret, the means preventing flow into said buret is automatically activated, a normally open electric circuit, including an electrical source, provided with a switch for energizing said electromagnetic means and parallel with said switch a relay for controlling the electric circuit; a photo-cell connected in

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said circuit and mounted for attached movable positioning longitudinally on said buret and a source of light movably mounted in such position that a beam of light is directed through said buret onto said photo-cell; a float defining the level of the fluid in said container, for preventing the light beam from acting on said photo-cell when the predetermined quantity of liquid has entered the buret and thereby to successively open said relay, to de-energize said electromagnetic means, to close the inlet of said feeding means into said buret and to open the outlet of said buret to enable the flowing out into a recipient of the liquid contained in said buret.

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