June 1, 1926. 1,586,766

G. H. WILLIAMS ET AL

LIQUID DISPENSING PUMP

Filed July 14, 1924 3 Sheets-Sheet 1

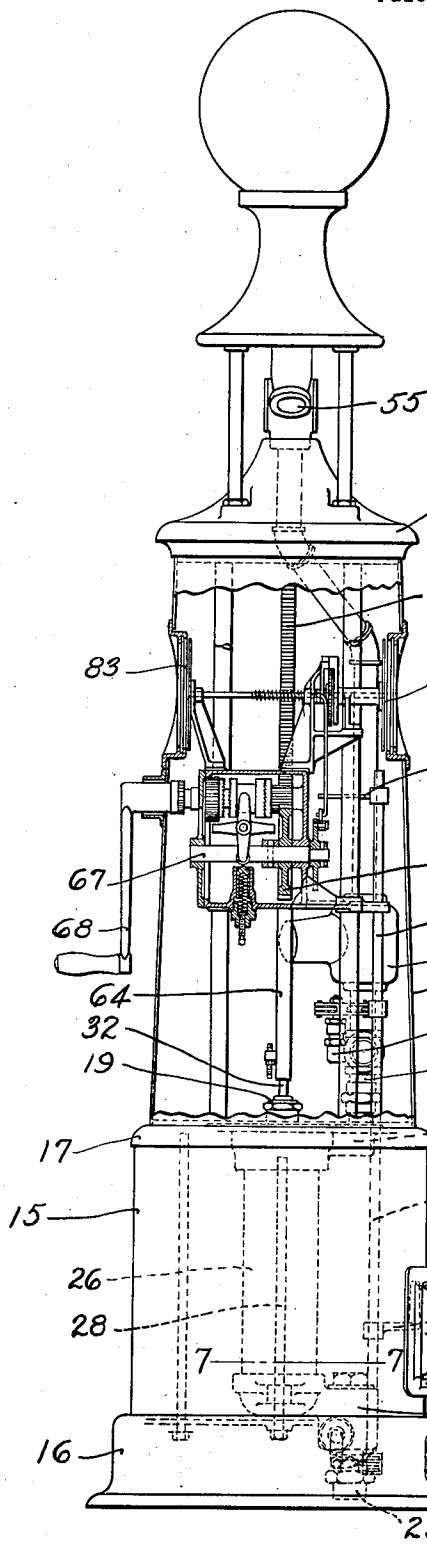


Fig. 1

Fig. 7.

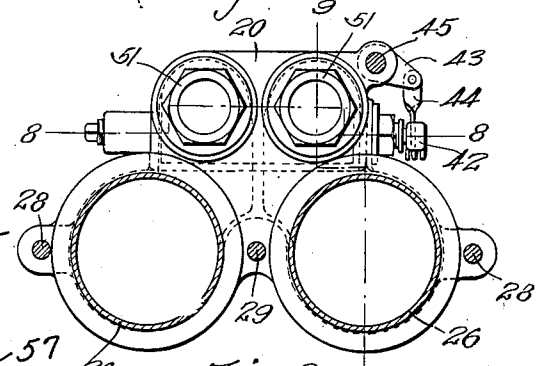
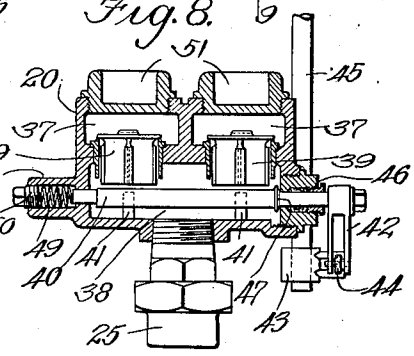


Fig. 8.



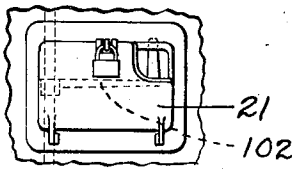


Fig. 11

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G. H. WILLIAMS ET AL

LIQUID DISPENSING PUMP

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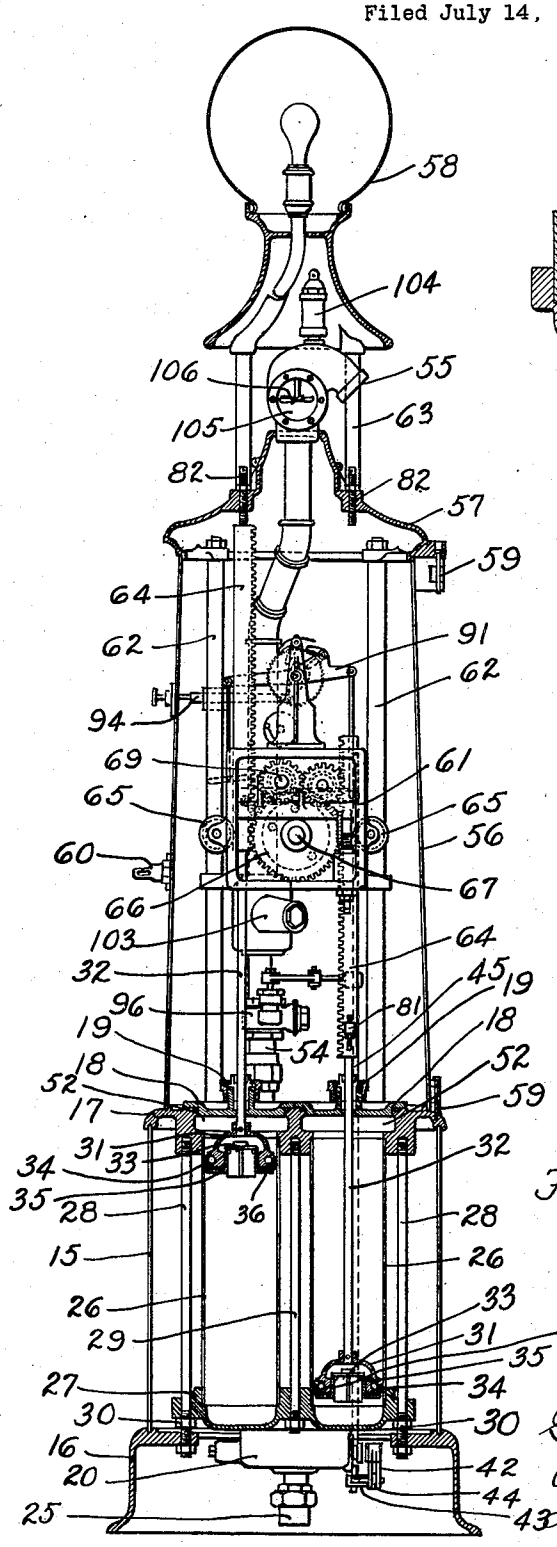


Fig. 2

Fig. 9.

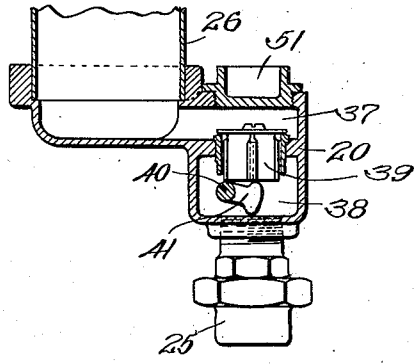
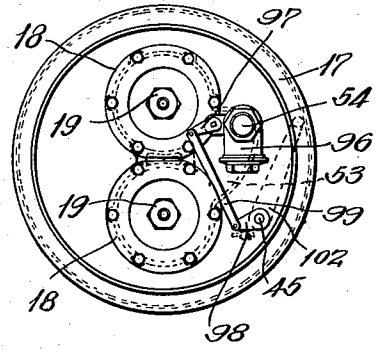


Fig. 10.



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LIQUID DISPENSING PUMP

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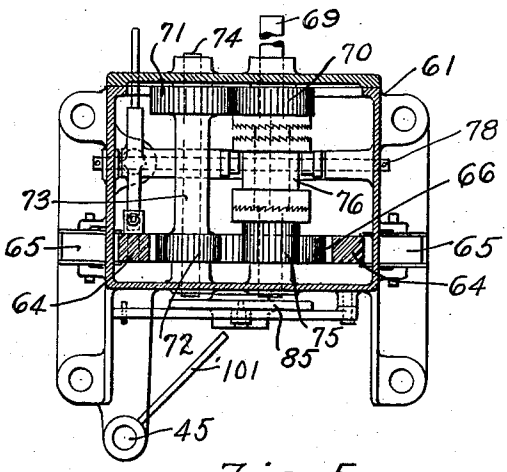


Fig. 5

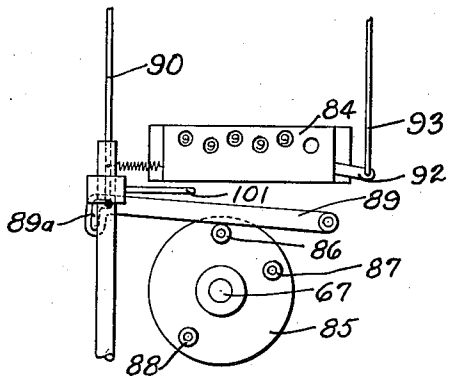


Fig. 6

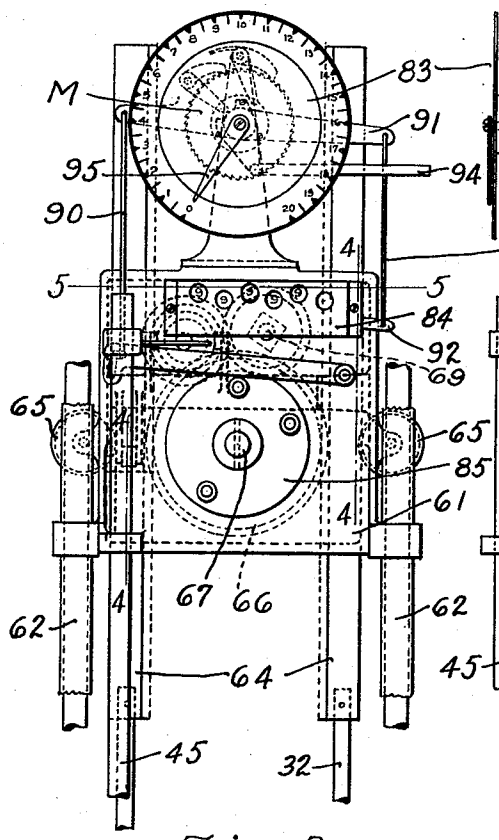


Fig. 3

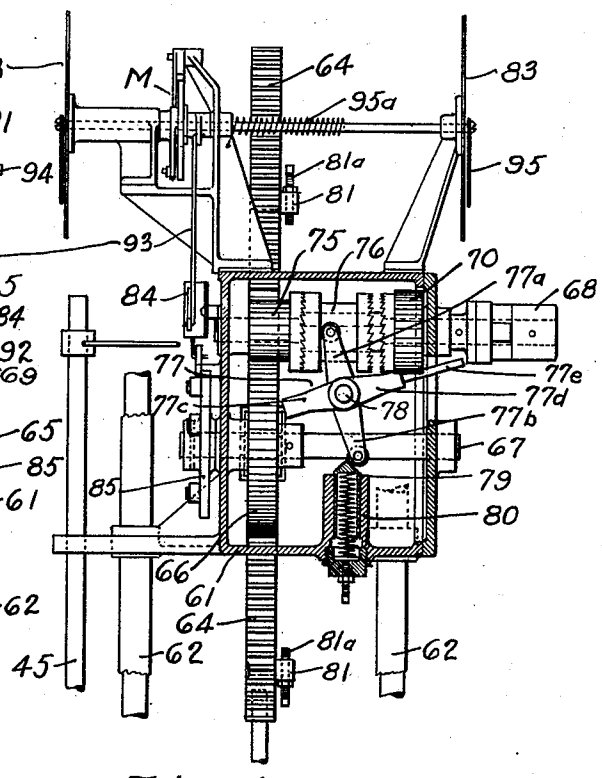


Fig. 4

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Patented June 1, 1926. 1,586,766

UNITED STATES PATENT OFFICE.

GILBERT H. WILLIAMS AND OLIVER C. HUFNAGLE, OF DAYTON, OHIO.

LIQUID-DISPENSING PUMP.

Application filed July 14, 1924. Serial No. 725,964.

This invention relates to liquid dispensing pumps, having particular reference to pumps of the character used at gasoline filling stations for automobile traffic.

The main object of the invention is to provide a pump of this character which will insure dependable measurement of liquid dispensed therethrough.

A further object of improvements embodied in the construction herein set forth is to provide a visual indication to the customer that the full measurement of liquid ordered is delivered.

An object of the invention is to provide means for making a compensating disposition of the surplus liquid remaining in the pump cylinder on orders requiring delivery of a fractional gallon of liquid,—thus to permit of restoring the dispensing mechanism to normal for the next customer.

A further object of the invention is to simplify and at the same time to make more effective the construction and operation of the pump mechanism, and to provide in the general organization of the pump for the minimum of time and effort required in its operation.

An important feature of the improved construction consists in an arrangement between the discharge and intake ends of the pump cylinders in which provision is made to insure an exact compensating adjustment of liquid in quantities less than even gallons.

A detail feature of improvement in the construction of the pump relates to a novel manner of closing the discharge ends of the cylinders, the object of the improvement being to provide for convenient accessibility through the end of the cylinders to the interior mechanism.

More general improvements of the pump relate to the design of the pump structure as a whole in which right proportions between the different units and structural lines of the main assembly have been achieved; also in the design and arrangement of the mechanism throughout in which simplicity of construction, durability of parts and dependability of operation of the various groups of coordinated mechanisms have been carefully considered from the view point of quantity production and the commercial use of the pump.

These and other features of novel construction are described in the detail specification which follows, and are shown in suitable illustrations in the accompanying drawings, in which;—

Fig. 1 is a side elevation of the improved pump with portions of the mechanism shown in section;

Fig. 2 is a side elevation of the pump, taken at right angles to Fig. 1, with other portions of the mechanism shown in section;

Fig. 3 is a side elevation of the pump actuating mechanism and registering mechanism in complete assembly, the actuating mechanism being shown in dotted outline;

Fig. 4 is an elevation of the mechanism shown in Fig. 3 taken at right angles on lines 4—4—4—4 of Fig. 3;

Fig. 5 is cross sectional view taken on lines 5—5 of Fig. 3;

Fig. 6 is a detail view of the register mechanism;

Fig. 7 is a cross sectional view taken on lines 7—7 of Fig. 1;

Fig. 8 is a cross sectional view taken on lines 8—8 of Fig. 7;

Fig. 9 is a sectional view taken on lines 9—9 of Fig. 7;

Fig. 10 is a sectional view taken on lines 10—10 of Fig. 1;

Fig. 11 is a detail view of a lock controlled housing for the pump regulating mechanism.

The structure illustrated in the drawings is a double cylinder, continuous action pump, comprising a suction line 25 adapted to be connected to a supply tank, or any suitable source for supplying liquid to the pump; the twin cylinders 26 which, as here shown, are arranged one opposite the other in the base housing of the pump, the housing comprising the cylindrical casing 15, a base 16, a cover or head 17 and individual cover plates 18 for the cylinders, as best illustrated in Fig. 2. The cylinders comprise the cylindrical member 26, an integral lower head 27 which, as here shown, serves for both cylinders, the upper ends of the cylinders being supported in the head member 17 which is tied to base member 16 by rods 28 which also serve together with a central tie rod 29 and nuts 30 to hold the cylinder casings 26 and heads 17—27 in assembled relation. The cover plates 18 are each provided with piston bearings, or journal packing boxes 19; the lower cylinder head with a suction chamber housing 20, and the housing casing 15 with a

door 21 to afford convenient access to pump regulating mechanism contained therein, the base housing member 16 also being provided with a hand aperture and a cover plate 22 therefor to afford access to the suction line connections.

The cylinder operating parts comprise the pistons 31 which, as here shown, are rigidly connected to piston rods 32, the pistons being each provided with valves 33 which are adapted to open on the down stroke and to close on the up stroke of the piston under pressure thereon of the liquid in the cylinder. Any suitable means may be employed to make the pistons tight fitting in the cylinders. The means here shown comprise a flexible ring 34 which is supported on the piston by an annular, well-shaped member 35 which also serves as a seat for the valve head 33, part 34 being pressed outwardly yieldingly into engagement with the cylinder wall by an annular tension member 36 arranged circumferentially of the piston head.

The suction, or intake mechanism of the cylinders comprises the suction housing 20 which, as best shown in detail Figs. 7, 8, 9, and 10, is direct connected to the supply line 25. The housing is provided with opposite chambers 37, one for each cylinder, and a chamber 38 common to both cylinders, the connection of the supply line being with chamber 38. Each of the chambers 37 is connected with chamber 38 by means of a valve 39 which, as here shown, is similar in construction to the piston valves, the valves being adapted to open and close in the normal operation of the pump under liquid pressure thereon. Mechanical means for operating the valves are also provided, the same comprising a rocker cam shaft 40 extended horizontally through chamber 38 at right angles to valves 39, the shaft being operably supported in housing 20 and having cam elements 41 thereon aligned with and adapted to actuate valves 39 to open the valves simultaneously for a purpose which will presently be described. One end of the cam shaft projects outwardly of the housing and is connected by means of arms 42—43 and a link 44 to a vertically extended shaft 45 by means of which the cam shaft is adapted to be actuated. To prevent leakage at the bearing apertures of cam shaft 40 one end of the shaft is provided with a pack bearing 46 and the shaft is provided with an annular, tapered shoulder 47 in bearing relation with the inner face of the bearing. The opposite bearing 48 is elongated and apertured to receive a spring 49 butted against the end of shaft 40 and adapted upon adjustment of a plug 50, threaded into the end of the bearing, to exert sufficient endwise pressure on the shaft to prevent leakage at the opposite bearing, the plug 50 being effective to prevent leakage at bearing 48. To make valves 39 accessible the valve housing 20 is apertured upwardly adjacent each valve and provided with threaded plugs 51.

At their upper ends the pump cylinders are each provided with a discharge chamber 52, as shown in Fig. 2, the chambers being connected one with the other by an open port 53 as indicated in dotted lines in Fig. 10,—thus the liquid is free to flow from one cylinder to the other under certain conditions entering into operation of the pump which will presently be described.

A discharge line 54 is connected to chamber 52 of the left cylinder as viewed in Fig. 2, the discharge end 55 of the line being adapted for a hose connection.

The pump actuating mechanism is enclosed in a casing 56 extended upwardly from the cylinder housing, tapered toward its upper end and provided with an ornamental top cover 57 and lighting fixture 58 to effect a harmonious design of the pump, the light also serving as a means for locating the pump at night. The casing 56 is in two sections, hinged one to the other as shown at 59 in Fig. 2, the swinging section being removed. A padlock hasp 60 is provided for safeguarding the pump mechanism against tampering.

The actuating mechanism is supported in a frame housing 61 which in turn is supported on four vertically extended rods 62 which serve to tie the actuating mechanism casing and the cylinder casing firmly together, the lighting fixture being tied to the cover member 57 by rods 63.

The actuating mechanism comprises racks 64 one of which is connected to and extended upwardly from each of the piston rods 32, the racks operating in wheel guides 65 arranged on opposite sides of housing 61 which serve to hold the racks in vertical alignment.

Both racks 64 are in constant mesh with the main actuating gear 66 of the pump which is mounted on a shaft 67 in the housing 61. Gear 66 is adapted to be actuated in clockwise direction on one stroke of the pump and in counter-clockwise direction on the other stroke of the pump by a crank 68 which has continuous operation in clockwise direction. The crank is connected to the outwardly extended end of a squared shaft 69 supported in the housing 61 and is adapted to be operatively connected to gear 66 on one stroke of the pump by a gear train comprising a gear 70 mounted on the crank shaft 69, gears 71—72 formed integrally and spaced one from the other by a sleeve 73 and mounted on a shaft 74 supported in housing 61, gear 71 being in mesh with gear 70 and gear 72 with gear 66. On the other stroke of the pump, operative relation between the crank shaft and gear 66 is effected by means

of a gear 75 which, as gear 70, is mounted on the crank shaft.

Change from one to the other of the gear connections for operating gear 66 and, therefore, the direction of operation of the gear, is controlled by a clutch 76 mounted on the squared portion of crank shaft 69 and adapted to be shifted axially thereon into driving relation with gears 70 and 75 respectively on alternate strokes of the pump—that is to say the clutch is shifted upon completion of each up stroke and each down stroke of the pistons 31. Gears 70 and 75 are not engaged by the squared portion of the crank shaft but are mounted free on the shaft and operate as idle gears except when the same are brought into operative relation with clutch 76. When the clutch is in operative relation with gear 75, gear 66 will be actuated in counter-clockwise direction, and in clockwise direction when the clutch is in operative relation with gear 70.

Clutch 76 is controlled as to operative relation with gears 70 and 75 by means of a multiple-armed lever 77 pivoted on a shaft 78 supported in the gear housing 61, one of the arms 77^a being in the form of a yoke and thus adapted to span the clutch sleeve. The opposite end 77^b of the yoke arm is adapted to be engaged by a spring plunger 79 supported in a sleeve housing 80, extended upwardly from the lower wall of housing 61, and serving a purpose which will presently be described. An arm 77^c of the clutch shifter is extended into the plane of clutch actuating devices 81 secured to one of the racks 64 and comprising set screws 81^a whereby the operating relation between the rack and the clutch can be accurately adjusted. The remaining arm 77^d of the clutch shifter is provided with an extension lever 77^e projecting through the housing 61,—means being thus provided for shifting the clutch manually.

From the foregoing detailed description the action of the pump in discharging liquid through pipe 54 will be readily understood. It will be seen that the working stroke of one piston is accurately timed with the idle stroke of the other piston and, therefore that the discharge of liquid through pipe 54 will be uniform and continuous as long as crank 68 is operated. The capacity of each of the pump cylinders in the organization of the mechanism as herein set forth is an even gallon on each full work stroke of the piston, the stroke of the pistons in both directions being effective to shift the clutch by means of the devices 81—81^a which are located on the right rack 64 as viewed in Fig. 2. On the down stroke of the rack the upper device 81—81^a will engage arm 77^c of the clutch shifter and move the same downward the required extent to cause the roller on the end of arm 77^b to pass the center line of spring plunger 79 which will then act to move the clutch shifter and the clutch to the position shown in Fig. 4 with the clutch in engagement with gear 75. On this movement the right piston of the pump, as viewed in Fig. 2, will be on the idle stroke and the left piston on the work stroke. On the upward movement of the rack the lower devices 81—81^a will actuate the clutch mechanism in the opposite direction, the clutch being moved into engagement with gear 70, in which relation the right piston will be on the work stroke and the left piston on the idle stroke of the pump. The rack 64, as shown in Fig. 4, is at an intermediate point on the up stroke.

The relation between the clutch shifter 77, the spring plunger 79 and the actuating devices 81—81^a is such that the latter act only to move the shifter arm 77^b slightly beyond the center line of plunger 79, in which relation one of the racks 64 will have been moved into engagement at its upper end with one of the adjustable stop gauges 82, best shown in Fig. 2, which serve to establish the upper limits of movement of the racks, and clutch 76 will be in engagement with one or the other of gears 70—75, as the case may be. The pumping action having been brought to a stop, when the parts are in the described relation, the clutch will be shifted under the action of plunger 79 upon momentarily relieving the operating crank 68 of forward pressure thereon, whereupon forward operation of the crank can be continued until the mechanism is again brought into a similar relation with respect to the opposite rack,—the described sequence of operation occurring upon delivery of each gallon of liquid through the discharge line 54.

Two customer's measure indicators 83 and a cumulative total meter or register 84 are operatively associated with gear 66 by means of a disc 85 secured to shaft 67 outside gear housing 61, the disc being provided with three roller sleeves 86—87—88 adapted, upon operation of gear 66, to actuate a lever 89 connected to the ratchet actuating mechanism—M of the customer's visual indicators 83 by a rod 90, the indicator and ratchet mechanism for operating the same being of well known construction in registering devices of this character. The ratchet mechanism M, as here shown, is provided with an extension arm 91 which is connected to the actuating lever 92 of meter 84 by a rod 93,—the registers 83—84 being thus operated in unison one with the other form disc 85. As in the usual construction of customer's indicators on liquid dispensing pumps, the indicators 83 are provided with a push rod 94 for releasing the ratchet mechanism M to permit the dial pointer 95 to be returned to zero position under tension of a spring

95[a] after each dispensing operation. Meter 84 is a total register—that is to say, a non-zero register—adapted to register the total measurement of liquid dispensed during any given period, as a month, or year.

As will be understood from the described operation of gear 66, the gear has both clockwise and counter-clockwise movement, the extent of rotation of the gear in both directions being the longest distance, taken circumferentially of disc 85, between the roller sleeved actuators 86 and 87, thus in the clockwise direction of operation, lever 89 will be twice actuated—by parts 87 and 88—and in the opposite direction by parts 86 and 88, a half unit, representing measurement of a half gallon of liquid, being registered on meters 83 and 84 on each actuation of lever 89.

In the normal use of the pump, it is assumed that even gallons will be dispensed to customers. Provision is made, however, to deliver and measure half gallons as well, the intermediate actuating member 88 on disc 85, and the half unit of registration on meters 83—84 being provided for that purpose.

When a fractional gallon of liquid is delivered by the pump to complete an order, it is obvious that the mechanism will be left in abnormal relation for the next customer, the pistons being stopped on a half stroke. To restore the pump to normal relation, a compensating arrangement is provided which comprises means for neutralizing the acting cylinder with the idle cylinder and, at the same time rendering the meter mechanism inoperative in order that the half operation can be completed without discharging liquid through line 54 and without effecting further registration on meters 83—84.

To this end the valve mechanism 39—40—41 in the suction chamber 20, and the valve actuating connections 42 to 45 are provided. The complete mechanism for effecting the compensating adjustment of liquid between the cylinders and for neutralizing the meters, also includes a valve 96 in discharge line 54 near the connection of the line with the cylinders, the valve mechanism including a connection 97—98—99 with the vertically extended rod 45 for opening and closing the valve, the rod being provided at its upper end with an operating handle 101. Rod 45 also extends into the cylinder housing and has a lever 102 connected thereto adjacent the door 21, the location of the lever relative to the door opening being such as to require operation of the lever to close valve 96 in order to permit of placing the hose connection for the discharge line in the cylinder housing thus rendering the pump inoperative during the hours of the night when no sales are made.

When it is desired to make a compensating adjustment of liquid between the cylinders, following delivery of a fractional gallon by the pump, hand lever 102 is actuated to close valve 96, which is normally open, and simultaneously with closing of valve 96, to open both valves 39 which permits the liquid in the cylinders to move from one cylinder to the other at both the intake and discharge ends of the cylinder as the mechanism of the pump is actuated from half to full stroke,—lever 102 being then operated in the opposite direction to again open valve 96 to restore the mechanism to normal. Locating lever 102 in the cylinder housing and its enforced operation is provided to insure restoration of the liquid measuring mechanism to normal at the beginning of each day's work to compensate for any leakage at the pistons during the night period when the pump is not in use.

Operation of lever 102 to close valve 96, also causes the lever 101 to engage the meter actuating rod 90 and to move the lower end of the rod out of operative relation with lever 89 into an elongated slot 89[a], as best shown in Fig. 6, in which relation operation of meters 83 and 84 will be neutralized, or rendered inoperative, for completion of the stroke to restore the pump to normal.

The device 103, shown in Figs. 1 and 2 is a filter, and the device 104, shown in Fig. 2, a vacuum breaker, which are of well known construction in this art, and do not require detailed description.

A feature of the pump consists of a flow indicator device comprising a glass covered aperture 105 and a spinner 106 in the discharge line which serve the purpose of providing a visual indication for both the attendant of the pump and the customer that the liquid is full-up in the discharge line when the pump is started to fill an order. Devices of this character being more or less common in liquid dispensing pumps of this character, no novelty is claimed with respect to the flow indicator feature of the pump, except as to its relation with the compensating means for restoring the mechanism to normal after incomplete operations thereof.

Having described our invention, we claim:—

1. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with the other at their discharge ends, means adapted to effect communication be-

tween the cylinders at their intake ends, whereby to cause a compensating distribution of liquid between the cylinders upon completing said operation.

2. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with the other at their discharge ends, means including normally closed passages adapted to be actuated to effect communication between the cylinders at their intake ends, whereby to cause a compensating distribution of liquid between the cylinders upon completing said operation.

3. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with the other at their discharge ends, means including normally closed passages and means to open the same manually to effect communication between the cylinders at their intake ends, whereby to cause a compensating distribution of liquid between the cylinders upon completing said operation.

4. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with the other at their discharge ends, means including a suction chamber for each cylinder and normally closed passages between said chambers adapted to be opened to effect communication between its cylinders at their intake ends, whereby to cause a compensating distribution of liquid between the cylinders upon completing said operation.

5. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with the other at their discharge ends, means including a suction chamber for each cylinder, a liquid supply chamber common to the suction chambers and normally closed passages between said chambers adapted to be opened to effect communication between the cylinders at their intake ends.

6. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with the other at their discharge ends, means including a suction chamber for each cylinder, a supply line connection common to the suction chambers and normally closed passages between said chamber and said line connections adapted to be opened to effect communication between the cylinder at their intake ends, whereby to cause a compensating distribution of liquid between the cylinders upon completing said operation.

7. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with the other at their discharge ends, means including a suction chamber for each cylinder, normally closed passages between said chambers, manual means for opening said passages simultaneously to effect communication between its cylinders at their intake ends, whereby to cause a compensating distribution of liquid between the cylinders upon completing said operation.

8. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders normally open one to the other at their discharge ends and closed one to the other at their intake ends, means adapted to effect communication between the cylinders at their intake ends, whereby to cause a compensating distribution of liquid between the cylinders upon completing said operation.

9. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid

than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders normally open one to the other at their discharge ends and closed one to the other at their intake ends, manually operable means adapted to effect communication between the cylinders at their intake ends, and valves in the cylinder pistons adapted to be actuated by pressure of the liquid thereon, whereby to cause a compensating distribution of liquid between the cylinders upon completing said operation.

10. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with another and with a discharge line at their discharge ends, means adapted to close the discharge line and to effect communication between the cylinders at their intake ends, whereby to cause a compensating distribution of liquid between the cylinders upon completing said operation.

11. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with another and with a discharge line at their discharge ends, means adapted to be actuated manually to simultaneously close the discharge line and effect communication between the cylinders at their intake ends, whereby to cause a compensating distribution of liquid between the cylinders upon completing said operation.

12. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for registering said quantity, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with the other at their discharge ends, means to render said register inoperative and means adapted to effect communication between the cylinders at their intake ends, whereby to effect registration only of the amount of liquid discharged, and to cause a compensating distribution of liquid between the cylinders upon completing said operation.

13. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for registering said quantity, means for limiting said operation and discharging less liquid than said quantity, and means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with the other at their discharge ends, means to render said register inoperative and adapted simultaneously to effect communication between the cylinders at their intake ends, whereby to effect registration only of the amount of liquid discharged, and to cause a compensating distribution of liquid between the cylinders upon completing said operation.

14. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with another and with a discharge line at their discharge ends, a hose connection for the discharge line, a housing for said cylinders adapted to have said hose placed therein, means within the housing arranged for enforced actuation thereof by placing of the hose in said housing and acting to effect communication between the cylinders at their intake ends and to shut-off the discharge line, whereby to cause a compensating distribution of liquid between the cylinders upon completing said operation.

15. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with another and with a discharge line, means to indicate the presence of liquid at the discharge level in said line, means adapted to effect communication between the cylinders at their intake ends, whereby to cause a compensating distribution of liquid between the cylinders and to maintain the liquid in the discharge line at said level upon completing said stroke.

16. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump means for limiting said operation and discharging less liquid than said quantity, and means

for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with the other at their discharge ends, one-way automatic valves for the passage of liquid through the pistons of the cylinders, one-way valves acting automatically normally to prevent discharge from one cylinder to the other at their intake ends, and means to open the last named valves, whereby to permit discharge from each cylinder to another at the discharge ends of the cylinders and inversely from one cylinder to the other at their intake ends to effect a compensating distribution of liquid between the cylinders upon completing said operation.

17. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with another at their discharge ends, the work stroke of the piston of one cylinder being timed in unison with the idle stroke of the piston of another cylinder, one-way automatic valves for the passage of liquid through the piston of the cylinders, one-way valves acting automatically normally to prevent discharge from one cylinder to the other at their intake ends, and means to open the last named valves, whereby to permit discharge from each cylinder to another at the discharge ends of the cylinders and inversely from one cylinder to the other at their intake ends to effect a compensating distribution of liquid between the cylinders upon completing said operation.

18. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with another at their discharge ends, a discharge line connected to one of said cylinders and adapted to receive the discharge of liquid from all cylinders, means adapted to shut-off the discharge line and to effect communication between the cylinders at their intake ends, whereby to cause a compensating distribution of liquid between the cylinders upon completing said operation.

19. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and, means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with another at their discharge ends, a discharge line connected to one of said cylinders and adapted to receive the discharge of liquid from all cylinders, means adapted to shut-off the discharge line and to effect communication between the cylinders at their intake ends, in a manner to permit free movement of liquid from each of the cylinders to another at both their discharge and intake ends whereby to cause a compensating distribution of liquid in the cylinders upon completing said operation.

20. A liquid dispensing pump including in combination with means for operating the pump, means for predetermining the quantity of liquid discharged upon each full operation of the pump, means for limiting said operation and discharging less liquid than said quantity, and means for restoring the pump to normal thereafter, comprising a plurality of cylinders communicating one with another and with a discharge line, means to indicate the presence of liquid at the discharge level in said line, means to shut-off the discharge line and to effect communication from the passage of liquid between the cylinders at their intake ends, means to open the discharge line during a partial operation of the pump and to again close the same whereby to cause a compensating distribution of liquid in the cylinders upon completing said stroke and to restore the liquid in the discharge line to said level to compensate for leakage of the pump.

21. In a liquid dispensing pump, the combination of a cylinder housing, a cylinder within the housing, a piston operable in the cylinder, a head for the housing serving also as a head for the cylinder, and a removable cover plate for the cylinder supported in said head whereby to afford access to the piston connections in said cylinder.

In testimony whereof, we affix our signatures.

GILBERT H. WILLIAMS.
OLIVER C. HUFNAGLE.