Nov. 14, 1950 J. B. HALE 2,529,937

LIQUID METERING DEVICE

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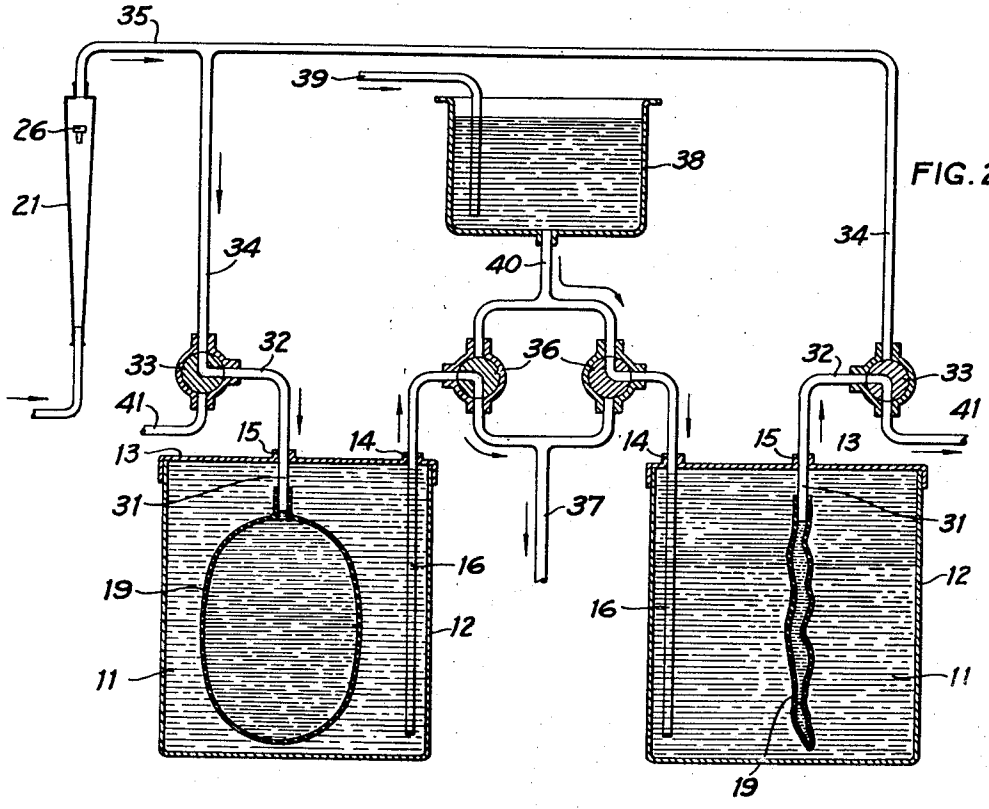

FIG. 2.

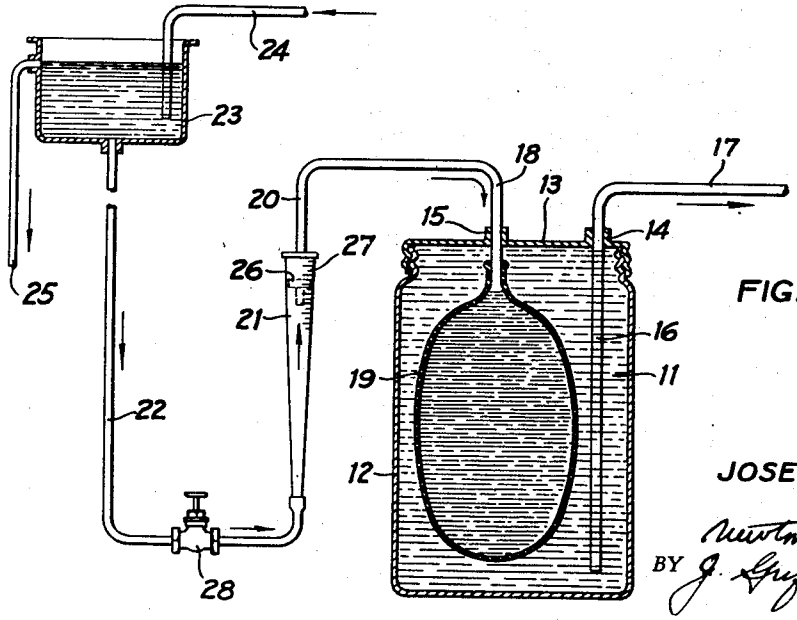

FIG. 1.

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LIQUID METERING DEVICE

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3 Claims. (Cl. 222—263)

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The present invention relates to metering devices, and more particularly to a metering device for supplying a liquid, such as a photographic emulsion, at a constant uniform rate and free from pulsations and surges.

One of the problems faced in coating emulsions is that of supplying the emulsion at a non-pulsating, known rate, to the coating mechanism or hopper. Various methods have been used to attain these ends in the past, of which the most common was supplying the emulsion from a constant-head hopper. Other methods comprise the use of a constant level device and a coating pan, or orifices operating under high enough head so that small changes in the total head would not be important. Various pumps, usually of the gear type, were also utilized. Any equipment, however, used for supplying emulsion must satisfy rigid requirements which include indication, control and uniformity of flow. Also such equipment must, of necessity, be very simple to permit easy cleaning. None of the prior known devices, however, provide a flow which is constant and free from pulsations or surges, and which affords a visual indication of the amount of emulsion being delivered to the coating apparatus.

In the present invention, these disadvantages are eliminated by making an emulsion supply pump sufficiently large so that only one cycle is involved. In its simplest form, shown in Fig. 1, and later more fully described, the emulsion to be coated is placed in a receptacle or container sealed with a cover having two openings. One of the openings has positioned therein a discharge tube which dips down into the emulsion contained in the jar, while the other opening has a tube extending therethrough. One end of the second tube is connected to a flexible bag positioned inside the container and the other end is connected to a constant-head liquid supply source which supplies a liquid, such as water, to the bag at a constant-head and at a definite, constant and uniform rate. The liquid inflates the bag to thus displace the emulsion which is gradually forced out of the container through the discharged tube in a non-pulsating stream and at a rate equal to that at which the water is supplied to the bag. The rate the water is supplied to the bag can be accurately controlled to thus control the desired rate of the emulsion flow, all as will be later more fully described.

The present invention has, therefore, as its principal object the provision of a liquid metering device which will provide a uniform, non-pulsating flow of emulsion at a known and controlled rate.

A further object of the invention is the provision of a metering device which is simple in construction, inexpensive to manufacture, accurate and easy to control, and easy to clean.

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To these and other ends, the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a diagrammatic arrangement of a liquid metering device constructed in accordance with the present invention and embodying the most simple form thereof; and

Fig. 2 shows an arrangement in which the invention is applied to a plurality of containers and by which a uniform flow is secured irrespective of the number of containers in operation.

Similar reference numerals throughout the various views indicate the same parts.

The invention is embodied in its simplest form in the metering device illustrated in Fig. 1 in which the emulsion 11 to be coated is positioned in a suitable container or receptacle 12 the top of which is closed or sealed by a cover 13 formed with a pair of spaced openings 14 and 15. An L-shaped tube extends through the opening 14 and has a vertical leg 16 which is positioned within the container 12 and extending substantially to the bottom thereof, as clearly illustrated in Fig. 1. The other or horizontal leg 17 is connected to a suitable coating apparatus, not shown. This tube thus provides a discharge outlet through which the emulsion 11 in the jar 12 is discharged or fed to the coating apparatus. The other opening 15 has positioned therein a leg 18 of a U-shaped tube which projects into the container 12 and has secured thereto a flexible bag or diaphragm 19, as clearly illustrated in Fig. 1.

It will be now apparent that if a liquid, such as water, is supplied to the bag 19, the latter will be inflated, and such inflation will displace the emulsion in the container 12. It is also apparent that the volume of emulsion discharged from the container 12 will be equal to the volume of water supplied to the bag 19. Therefore, if water can be supplied to the bag 19 at a constant and uniform rate, the emulsion will be discharged from the container at the same rate. To secure this result, the present invention provides an arrangement for supplying water to the bag 19 at a definite, uniform and non-pulsating rate.

To this end, the other leg 20 of the U-shaped tube is connected to one end of a "Rota-meter" 21, the other end of which is connected by a pipe 22 to a tank 23 supplied with water by a pipe 24. An overflow pipe 25 maintains a constant level in the tank 23. It is thus apparent that the water supplied to the bag 19 is under a constant and unvarying head. The rate of flow of water to the bag 19 is indicated by a float 26 suspended in the water in the "Rota-meter" and cooperating with a scale 27 calibrated in terms of pounds

of emulsion per minute discharged from the container 12. As the rate of water flow increases, the flow of emulsion correspondingly increases and the float 26 will rise to thus visually indicate the rate of flow of the emulsion and/or water, both being equal. The rate of flow may, however, be varied as desired by means of a needle-valve 28 positioned in the line 22 between the meter 21 and the supply tank 23. Thus, by adjusting the needle-valve, the rate of water and emulsion flow may be accurately controlled.

It is apparent that the water is supplied to the bag 19 at a constant-head and in a known predetermined rate. Furthermore, the flow of water into the bag 19 will correspondingly displace an equal volume of emulsion which is forced out through the L-shaped tube to the coating mechanism. The rate of flow or discharge of the emulsion will be equal to the rate of flow of the water to the bag 19. However, as the water is supplied at a uniform rate, the emulsion will be similarly discharged in a constant, even, non-pulsating stream, the advantages of which will be readily apparent to those in the emulsion coating art.

The construction illustrated in Fig. 1 shows an arrangement for discharging the emulsion uniformly from a single container. In the embodiment shown in Fig. 2, on the other hand, an arrangement is provided for changing from one container to another without in any way altering or varying the uniformity of the flow. The arrangement shown in Fig. 2 also permits the discharging from either one or both containers without in any way changing the rate of flow so long as the rate of the water supply has not changed. Parts corresponding to those in Fig. 1 will be designated by the same numerals. Upon an inspection of Fig. 2, it will be apparent, however, that this embodiment is merely a parallel arrangement of two units, such as illustrated in Fig. 1 and above described.

In Fig. 2, each bag 19 is connected to the lower end 31 of an L-shaped tube, the other end 32 of which is connected through a 2-way valve 33 and pipe 34 to a main feed-water line 35 connected to the top of the meter 21. With the parts in the position shown in Fig. 2, water will be supplied to the meter 21, feed line 35, left pipe 34 and left valve 33, and finally to the left bag 19 to inflate the latter in the same manner as described in connection with Fig. 1. The discharged emulsion flows upwardly through the L-shaped tube, the horizontal leg 17 of which is connected through a 2-way valve 36 to an emulsion discharge line 37 connected to a coating apparatus, not shown. Thus the emulsion 11 in the left-hand container 12 will be discharged in the same manner as that described in connection with the arrangement shown in Fig. 1.

While the left-hand container 12, Fig. 2, is being emptied, the right-hand container may be filled from the emulsion supply tank 38 to which emulsion is supplied through a pipe 39. In order to fill the right-hand container 12, the right-hand 2-way valve 36 is turned, as shown, to connect the discharge line 40 of the emulsion tank with the horizontal leg 17 of the L-shaped tube which extends down into the emulsion. By means of this arrangement, the right-hand container 12 is in direct liquid communication with the emulsion tank 38 and the emulsion will flow into said container. During the filling operation, the right-hand 2-way valve 33 is turned to the position shown to connect the right-hand bag 19 to a pipe 41 which carries the water from the bag to a suitable point of disposal.

As the emulsion flows into the right-hand container, the water present in the bag 19 is forced out through the line 41, and the bag 19 gradually collapses. When, however, the right-hand container is filled, the right-hand valves 33 and 36 may be turned to disconnect the right container from the emulsion supply tank 38 and to disconnect the right-hand bag from the discharge line 41. The right-hand container is now filled with emulsion and ready for use. When the left-hand container nears exhaustion, the right-hand 2-way valve 33 is now turned to connect the right-hand bag 19 to the right-hand line 34 to supply water to the right-hand bag, as is apparent. It is to be noted, however, that water is supplied to the main feed line 35 by the meter 21, at a constant rate and at a constant-head. However, with the two valves 33 in the position of that of the left-hand valve, both bags 19 will be directly connected to the feed line 35, but the quantity of water supplied will be exactly the same as when only one bag was connected, as shown in Fig. 2. Thus, whether one or both bags are connected, the amount of displacing water supplied is the same. Therefore, the amount of emulsion discharged will also be the same. Obviously, however, the amount of emulsion discharged from each container when two are connected in will be less than when only one is connected, the total amount of discharge being, of course, the same.

After the right-hand container has been thus connected in, the left-hand container may be disconnected by moving the 2-way valve 33 to disconnect the left bag 19 from the line 34 and connecting it to the discharge line 41. During this change-over, however, the amount of water being supplied remains constant so that the amount of emulsion discharge accordingly remains constant. Therefore, there is no pulsation or surge encountered during the change-over, the advantages of which will be readily apparent. Now only the right-hand container is in position to discharge the emulsion. The left-hand container may now be filled with the emulsion supply tank 38 by turning the left-hand 2-way valve 36 to connect the line 40 to the left-hand container and to disconnect the latter from the discharge line 37. During this filling operation, the flow of the emulsion into the left-hand container forces the water from the left-hand bag 19 through the line 41 to collapse the bag, as will be apparent.

By means of this arrangement, either one or both containers may be selectively used and the rate of emulsion discharged will be exactly the same. This is due to the fact that the amount of emulsion discharged is equal to the amount of water supplied, and the latter flows at a uniform rate and under a constant-head. Also a change from one container to the other may be made without causing any pulsations or variations in the rate of flow of the emulsion discharged. While only two containers have been shown in Fig. 2, one discharging and one filling, this is by way of illustration only, as it is obvious that any number of such containers may be used. However, irrespective of the number of containers discharging or the number put on or taken off the line, the emulsion flow will be equal to the water flow thus providing a constant, uniform and non-pulsating supply of emulsion, the

advantages of which will be readily apparent to those in the art.

While certain embodiments of the invention have been disclosed, it is to be understood that the inventive idea may be carried out in a number of ways. This application is, therefore, not to be limited to the precise details described, but is intended to cover all variations and modifications thereof falling within the scope of the appended claims.

I claim:

1. A liquid metering device comprising, in combination, a sealed receptacle containing a liquid to be discharged at a uniform rate, a discharge outlet for said receptacle, a flexible bag positioned within said liquid and adapted to be inflated to displace said liquid and to force the latter from said receptacle through said outlet, a tank, a water supply line connected to said tank, an overflow for said tank to maintain a constant level therein, a pipe connecting said tank to said bag to supply water thereto at a constant head to inflate said bag, a valve positioned in the pipe between said tank and bag to control the rate of supply of water to said bag to correspondingly control the rate of flow of the liquid from said receptacle, and means positioned intermediate said valve and said bag for indicating both the rate of flow of water to said bag and the rate of discharge of the liquid from said receptacle.

2. A liquid metering device comprising, in combination, a plurality of sealed receptacles, a discharge line, an outlet on each receptacle connected to said line, an inflatable bag positioned within each of said receptacles and adapted to be inflated to displace the liquid in said receptacles and to force said liquid through said outlets to said line, a source of constant head inflating liquid, pipes separately connecting each bag to said source, a discharge line for each bag, a valve in each of said pipes adapted to be selectively adjusted to alternately connect each bag to said source and said discharge, a tank for supplying liquid to said receptacles so positioned relative thereto to deflate said bags when the latter are

connected to said discharge and said tank is connected to said receptacles, supply pipes connecting said tank to said receptacles, and valves in said supply lines for selectively connecting and disconnecting said tank to said receptacles.

3. A liquid metering device comprising, in combination, a plurality of sealed receptacles each containing a liquid to be discharged, an outlet for each receptacle, an inflatable bag positioned within each receptacle and adapted to be inflated to displace said liquid to discharge the latter from the receptacle through the outlet thereof, a source of constant head inflating liquid, means for connecting said source to one of said bags to inflate the latter to discharge the liquid at a constant rate from one of said receptacles, means for allowing the simultaneous disconnection of said one bag from said source and connection of another bag thereto without altering the rate of discharge or said liquid from said receptacles, and means for varying the rate which said inflating liquid is supplied to said bags to correspondingly vary the rate of discharge of the liquid from said receptacles.

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