

May 16, 1939.

M. F. BETZOLD ET AL

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BURETTES

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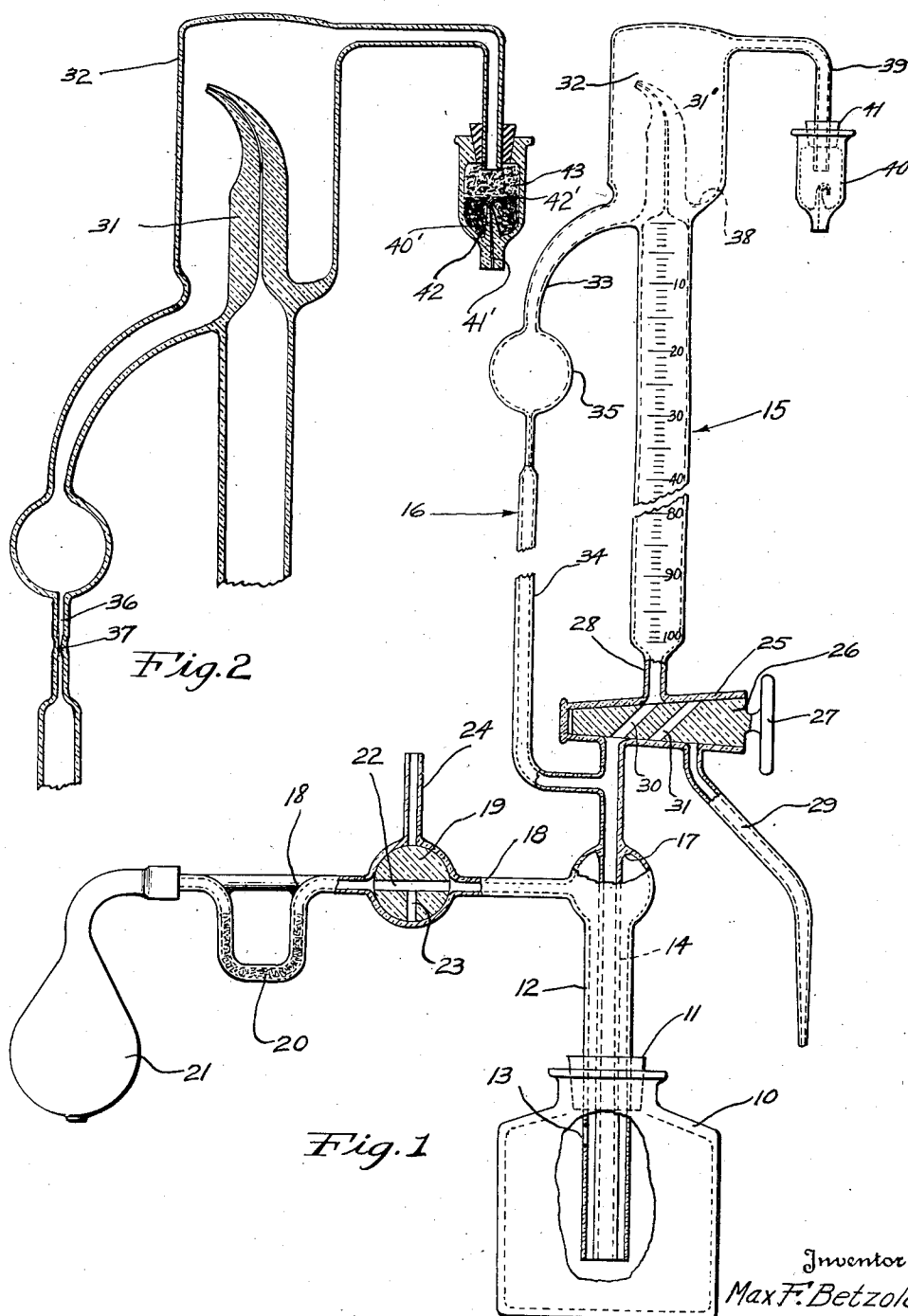


Fig. 1

Fig. 2

Inventor
Max F. Betzold
Charles Rascher
and Charles A. Torp

By P. John Tinscott
Attorney

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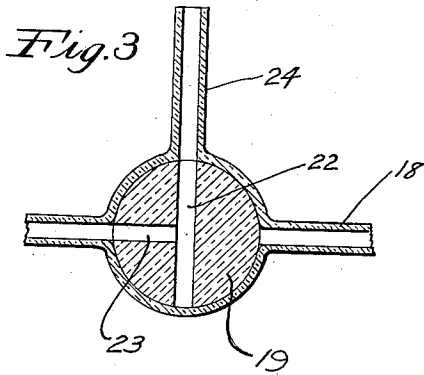
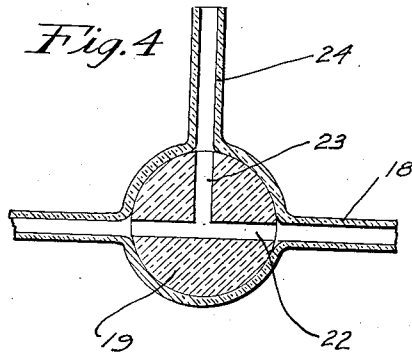
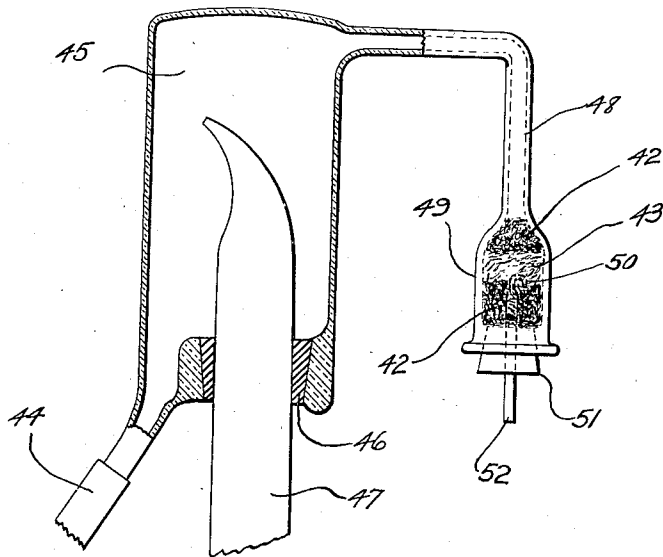


Fig. 5

Inventor
Max F. Betzold
Charles Rascher and
Charles A. Torp

By *P. John Tinscott*
Attorney

UNITED STATES PATENT OFFICE

2,158,102

BURETTE

Max F. Betzold, Charles Rascher, and Charles A. Torp, Chicago, Ill., assignors to Rascher & Betzold, Inc., Chicago, Ill., a corporation of Illinois

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6 Claims. (Cl. 23—259)

The present invention relates to burettes and has for one of its objects the provision of an automatic burette which is of simple and efficient form, with an accurate zero point, and provided with means for preventing evaporation from the solution in the reservoir to which it is connected, when the burette is not being used.

Another object of this invention is to provide in a burette means for more efficiently filling the same and for preventing the accumulation of the liquid in the overflow chamber.

Another object of this invention is to provide in a device of this character a detachable overflow chamber provided with an integral air-cleaning and purifying chamber for filtering (and purifying) air (by removing dust and carbon dioxide) which moves into and out of the overflow chamber and burette. This simplifies cleaning of the overflow chamber and also the manufacture thereof. The overflow chamber may also be sealed to the burette and a detachable air purifying chamber may be provided.

More particularly, an object of this invention is to provide a restriction in the overflow tube which carries liquid from the overflow chamber back into the receptacle whereby on filling the burette the graduated tube of the burette will be filled first instead of the overflow tube, as in prior constructions.

Specifically, the restriction used in the overflow tube is preferably one of capillary dimensions, whereby the flow of the fluid upwardly through the overflow tube during filling of the burette is materially slowed down so that the graduated tube is filled before the overflow tube can be filled. While not absolutely necessary, it is preferable to also provide an expansion chamber in the overflow tube above the restricted portion. The expansion chamber also serves to take expansion and contraction in the overflow tubes.

Another object of this invention is to provide a constriction in said restriction at one point at least whereby to retard the upward flow of liquid through the overflow tube to such an extent that it is possible to fill the burette before the liquid, which also rises into the overflow tubes, fills the expansion chamber.

Another object of this invention is to provide a valve of simple construction adapted to connect the graduated burette tube with the conduit leading to the liquid in the bottle or flask containing the liquid with which the burette is to be filled or alternately connect the burette tube with the outlet conduit from which the desired

amount of liquid is withdrawn into a beaker or the like, as is customary when using devices of this character.

A further object of this invention is to provide a simple valve structure for controlling the flow of the air which is pumped into the burette to raise the liquid from the bottle into the burette and to cut off this flow if and when desired and also exhaust the air at the proper time.

A still further object of this invention is to provide a metal alloy plug valve or the like for the burette which will not corrode and does not stick in the glass seat with which it cooperates, the alloy being such as not to be affected by alkaline solutions, whereby to prevent valve from sticking and leaking. Such a plug does not need a lubricant but is sufficiently lubricated by the solution which is used in the burette, thus preventing contamination of the solution by a foreign lubricant which can work into the apparatus and coat the insides thereof, making the burette less easy to read.

Other objects of this invention will appear hereinafter as the description thereof proceeds, the novel features, arrangements and combinations being clearly set forth in the specification and the claims thereunto appended.

In the drawings:

Fig. 1 is a front elevational view partly in section of a burette embodying our invention;

Fig. 2 is a cross-section of the upper part of the burette;

Figs. 3 and 4 show different valve positions for one of the valves embodied in this invention; and

Fig. 5 shows a modification of our invention which is shown partly in section for the sake of clearness.

In certain types of burettes there is provided an overflow chamber at the top thereof and an overflow tube leading therefrom back into the liquid container upon which the burette is supported and with which the burette is adapted to have communication. The overflow chamber is necessary in order to secure a zero point for the burette to thereby eliminate one meniscus reading. This overflow tube has communication at all times with the liquid in the bottle or flask and, therefore, when the liquid is being forced upwardly under air pressure into the burette the liquid also flows upwardly through the overflow tube and, in flowing upwardly through the overflow tube, the rate of travel of the liquid is much greater than the rate of flow of the liquid through the burette tube. That is, the level of a volume of liquid in the overflow tube rises very much

more rapidly than in the graduated burette tube. The result is that the liquid reaches the overflow chamber and may even flow out of same through the air cleaner inlet. This, of course, would not be desirable and under no conditions is it desirable to have the overflow chamber filled with the liquid since it would make it more difficult to obtain the zero point and this liquid might partially evaporate so that the concentration of the liquid is increased when the liquid returns to the bottom. This invention contemplates for one of its objects, providing a simple, yet effective, means for preventing the flow of liquid in the overflow tube from reaching the overflow chamber when the burette is being filled. We will now proceed to describe our improved burette construction.

In the drawings, 10 represents a bottle, flask or similar receptacle containing the liquid with which the burette is to be filled. This is provided with a rubber stopper 11 having a central opening for receiving the outer conduit 12 on the lower portion of the burette. Alternatively the connection with the bottle may be made by means of a ground glass joint. It is through this tube that the air is introduced into the bottle 10, the air traveling downwardly through the outer tube and outwardly through the opening 13 above the liquid level in the bottle. The lower end of the burette is also provided with an inner conduit 14 through which the liquid travels upwardly under pressure into the burette tube 15 and overflow tube 16, this conduit and the outer conduit 12 being joined in sealed relation as at 17.

Communicating with the outer conduit 12 is a laterally extending conduit 18 which has a three-way valve 19 arranged therein and also a suitable air-cleaning material, such as soda lime, such as indicated at 20, and which is well known in this art. Air under pressure is introduced into the conduit 18 by means of the bulb 21 in the manner which is well understood in this art.

The valve 19 is of the ordinary plug type and is provided with a diametrically arranged passage 22 which extends through the plug and is adapted, as is shown in Fig. 1, to permit the flow of air through the conduit 18. This valve also has a lateral passage 23 communicating with the passage 22 whereby air may be exhausted into the atmosphere if and when desired through the exhaust conduit 24, the valve being arranged as illustrated in Fig. 4 for this purpose. In Fig. 3, the valve is shown arranged to cut off the return of the air from the conduit 12 through the conduit 18.

Mounted on the top of an inner conduit 14 is a valve casing 25, the inner surface of which is substantially conical in shape to receive the conical plug 26 which is rotatable therein, the latter having an operating handle 27 formed thereon. This plug valve 26 is made of glass or of a suitable material, such as silver or metallic alloys or other like material, which are resistant to the action of the liquids to be supplied to the burette, such as acids, alkalies, and oxidizing and reducing agents in solution.

We have found that an alloy having the approximate composition set forth herebelow is hard and suitable for this type valve and when ground into the glass seat in the burette provides a close-fitting valve and one which will not corrode. Silver, being soft, does not permit grinding of the valve into its seat as easily as the hard alloys herebelow and the valve itself can not be given the smooth hard finish that these alloy

valves are capable of having. This alloy given as an example has the following approximate composition:

	Per cent	
Nickel -----	56	5
Chromium -----	24	
Copper -----	8	
Molybdenum -----	4	
Tungsten -----	2	
Manganese -----	1 1/4	10

The graduated burette tube 15 is mounted on top of the valve casing 25 and has a conduit 28 at the lower end thereof communicating with the interior of the casing 25. The valve casing 25 also is provided with an outlet tube 29 and the valve 26 has two diagonally extending, diametrically arranged passages 30 and 31 which operate in the following manner. With the plug valve 27 in the position illustrated liquid may flow into the graduated burette tube from the bottle 10 or flow from the bottle 10 into the graduated burette tube, or vice versa. When the valve is turned to a position 180° from the position shown, the valve passage 31 connects the burette with the outlet tube 29 to permit the contents of the graduated burette tube to be drained therefrom as desired, and in the quantities required. It will be noted that the valve casing 25 forms a connecting medium for the graduated burette tube, conduit 14 and outlet tube 29 and also forms a supporting means for the burette tube 15.

Integrally formed on the upper end of the burette tube 15 is a tapered outlet 31', the inner diameter of which is very small and tapering down to capillary proportions at the tip thereof. The tapered outlet 31' is arranged within an overflow chamber 32 and it will be noted from Figs. 1 and 2 that the outlet is curved in a direction toward the left wall of the overflow chamber so that liquid emerging therefrom will be directed against that wall and flow down the side of that wall into the upper end 33 of the overflow tube, without first falling on the bottom of the chamber 32.

The outlet end of this tube is drawn down to approximately a 0.5 mm. opening whereby the flow of the solution out of same is at a high rate of speed, whereby upon closing the valve 26 all of the solution outside the end of this tube continues its motion in a direction against the wall of the over-flow tube, thus preventing any drops from clinging to the tube which may be drawn back into the burette when the solution is being withdrawn from the burette at the lower end thereof. The accuracy of the zero point is therefore greater and tests reveal that the accuracy is within .01 ml.

The upper end 33 of the overflow tube is connected to the lower end 34 of same by means of an expansion chamber 35. Just below the expansion chamber 35 the overflow tube is reduced considerably in diameter so as to provide a passage 36 having practically capillary dimensions. This will restrict the flow of fluid through the overflow tube and in order to additionally restrict the flow, we propose to form the constriction 37 in the restricted tubular portion 36 to make the passage at this point even smaller so that liquid will flow past this point but at an extremely slow rate, even when the liquid is under pressure.

The bottom 38 of the overflow chamber 32 slopes downwardly toward the overflow tube 33 whereby any liquid which may at any time be

in the overflow chamber will drain back into the overflow tube 16 and from there back into the bottle 10 through the inner conduit 14 with which the overflow tube 16 has constant communication. The overflow tube also has a laterally and then downwardly extending integral tube 39 through which air enters and exhausts and on the end of this tube there is placed an air-cleaning and purifying chamber 40 having a rubber stopper 41 fitting snugly in the neck thereof and having a central opening through which the tube 39 extends. The air cleaner 40 comprises a chamber filled with a suitable air-cleaning and purifying medium, such as soda lime, the lower end of the chamber containing glass wool 42, or the like, which permits the air to pass into and out of the tube 39, but prevents the cleaning and purifying material from escaping. To prevent clogging of the chamber 40 there is provided an outlet tube 40' which has an outlet and 41' communicating with the atmosphere and an inner end formed in the shape of a hook 42' so that it will not collect moisture descending through the chamber 40, but will permit air to pass into and out of the chamber 40. Any moisture collects in the bottom where the steel wool is present and by having the upper end of the outlet tube 40' above the glass wool the moisture does not prevent the free ingress and egress of the air.

It will be understood that, except for the rubber stoppers, the bulb 21, metal valve 26, air-cleaning material, etc., the parts are all constructed of glass, as is customary with instruments of this nature. The burette operates as follows:

Assuming that all of the liquid is still in the bottle 10 and there is no pressure in the burette, the operator turns the valve 19 into the position illustrated in Fig. 1. He then proceeds to pump air into the conduit 18 by pressing on the bulb 21, from whence it passes through conduit 12 and opening 13 in the bottle 10, as previously described. The pressure of the air on the upper surface of the liquid forces the liquid upwardly through the conduit 14, some of the liquid then passing upwardly through the overflow tube 16 and some into the burette tube 15 through the passage 30. Due to the small diameter of the overflow conduit the liquid level rises rapidly therein and if not restrained the liquid will fill the overflow chamber 35 before the graduated burette tube is filled. However, due to the restricted portions 36 and 37, the flow of the liquid is immediately retarded when the liquid level reaches these restricted portions and the liquid flows very slowly into expansion chamber 35. The liquid level in the burette continues to rise at the same, or at even a greater rate, and soon becomes higher than the liquid level in the overflow tube. Finally the liquid fills the burette tube and is discharged through the outlet 31 against the side wall of the chamber 32. This liquid then drains back into the overflow tube as previously described. Even using appreciable air pressures, it has been found in actual tests that the restrictions 36 and 37 so restrict the flow of the liquid that, while the liquid level may reach the restrictions before the burette tube 15 is even one-tenth filled, nevertheless the flow is so cut down thereafter that the burette tube becomes entirely filled, at least before the expansion chamber 35 becomes filled with a liquid. In fact, ordinarily the expansion chamber is less

than one-half full when the graduated burette tube is filled, even using high pressures.

It will be obvious that with this arrangement, it is possible to fill the burette without the necessity of watching same closely, as has been necessary with previous devices, or by using low air pressures and, substantially the only liquid reaching the overflow chamber 32 is that which enters through the outlet 31.

It is not necessary to continue pumping air all the time until the burette tube is filled. It is only necessary to introduce a sufficient quantity of air into the bottle under pressure to cause the tube to be filled if no more air is introduced. Consequently, long before the burette tube is filled the operator can turn the valve 19 into the position shown in Fig. 3 so that the air in the burette will be retained therein and any air in the bulb 21 will be exhausted through the outlet 24. When the burette tube has been completely filled, then the valve 19 is turned into the position shown in Fig. 4, thus permitting the air in the bottle to escape until the air pressure in the bottle is substantially atmospheric. After this the liquid in the overflow tube and overflow chamber flows downwardly, as previously described, into the bottle. Valve 19 is then turned into the position shown in Fig. 3 to prevent contamination of the solution by carbon dioxide in the air and to prevent evaporation from the solution which increases the concentration of the solution.

Of course, before turning the valve 19 to permit the air to escape from the apparatus the valve 26 is turned to prevent any of the liquid in the burette tube 15 from flowing back into the bottle. This can be done by turning the valve to a position 90° from that illustrated. After the air has been exhausted from the apparatus, desired quantities of the liquid may be withdrawn by turning the valve 26 to a position 180° from that illustrated. This positions the passage 31 in communication with the conduit 28 and permits the liquid to flow out of the burette through the outlet tube 29.

In Fig. 5, we have illustrated a modified form of our invention which can be used with a burette of the type illustrated in Fig. 1 or other types of burettes in which the liquid may flow out of the overflow chamber through an outlet tube 44. In this form of the invention the overflow chamber 45, which is similar to that illustrated in Fig. 1, is provided with a central opening at the bottom thereof and a rubber cork 46, or the like, is fitted into that passage which also has a central opening therethrough to receive the upper end of a burette tube 47, so that the overflow chamber may be detachably mounted on the burette tube, as illustrated. Also in this form of the invention, the tube 48 which permits the entrance and exit of the air has integrally connected therewith a cup-shaped portion 49 which is adapted to contain the air-filtering and purifying medium soda lime 43. Since the overflow chamber 45 can be inverted, after being removed from the burette, it is an easy proposition to fill the integral cup-shaped portion 49 with the air-cleaning material. The cup-shaped portion may be closed by means of a rubber stopper 51 having a small outlet tube 52 formed with a hook portion 52' similar to 42' in Fig. 2, extending through said stopper to permit the air to enter and leave the cup-shaped portion and overflow chamber. Glass wool 42 is provided at the top and bottom of cup-shaped portion 49, the lower layer collecting the moisture as in Fig. 2. The overflow chamber 45 may

be connected to the tube 44 which drains back into some suitable receptacle or may be connected as shown in Fig. 1 to an expansion chamber, such as 35, by means of a suitable length of rubber tubing or the like. The advantage of this construction is that it permits the operator to clean the overflow chamber very readily and, in view of the integral cup-shaped air-cleaning material receiving chamber 49, the device is more readily constructed and does not require a separate receptacle, such as 40, in Fig. 1.

The burette illustrated can be completely closed to the outer atmosphere except through the soda-lime chamber and this prevents the evaporation of portions of the solution and consequently the concentration is not increased. Since the air does not circulate freely through the soda-lime chamber there is little possibility of evaporation at this point. Air circulates through this chamber only when the burette is being filled or emptied but not when the burette is not in use. It is during the periods when the burette is idle and filled with a solution that evaporation occurs mostly.

Obviously, those skilled in the art to which this invention pertains may make various changes in the particular arrangement and construction of the parts illustrated in the embodiments of our invention shown and described herein without departing from the spirit of this invention and, therefore we do not wish to be limited except as hereinafter set forth in the claims.

Having thus fully described our invention, what we claim and desire to secure by Letters Patent of the United States is:

1. A burette comprising a valve casing, a valve rotatable therein, a graduated burette tube supported on said valve casing directly thereabove, and a pair of conduits on the opposite side of said casing spaced longitudinally thereof, one of said conduits being adapted to be connected with the source of liquid supply and the other comprising a discharge conduit, passages in said valve adapted to selectively connect said burette tube with either one or the other of said conduits, and an overflow conduit having continuous communication with the conduit through which liquid is supplied to said burette tube and with the upper end of said burette tube through an opening in the upper end of the latter, and independently of said valve, said overflow tube having an expansion chamber therein and a constriction of relatively small internal diameter below said expansion chamber.

2. A burette comprising a valve casing, a valve rotatable therein, a graduated burette tube supported on said valve casing directly thereabove, and a pair of conduits on the opposite side of said casing spaced longitudinally thereof, one of said conduits being adapted to be connected with the source of liquid supply and the other comprising a discharge conduit, passages in said valve adapted to selectively connect said burette

tube with either one or the other of said conduits, and an overflow conduit having continuous communication with the conduit through which liquid is supplied to said burette tube and with the upper end of said burette tube through an opening in the upper end of the latter, and independently of said valve, said overflow tube having an expansion chamber near the upper end thereof and a restricted opening of relatively small diameter immediately below said expansion chamber.

3. In a burette of the class described, the combination with a burette tube, of an overflow chamber, an overflow conduit for draining the overflow fluid back into a receptacle with which the same is adapted to be connected, a supply conduit for supplying both said burette tube and said overflow conduit while the former is being filled, and a restricted portion in said overflow conduit of an internal diameter, substantially less than the normal diameter of said overflow conduit and of substantially capillary proportions, said overflow conduit having an expansion chamber arranged therein above said restricted portion.

4. A burette comprising a burette tube, an overflow conduit communicating with the upper end of said tube, a conduit for supplying liquid to said burette tube, and an air-pressure conduit adapted to be arranged in communication with a liquid receptacle, means for forcing air into said air-pressure conduit and a valve in said air-pressure conduit adapted to selectively open and close said air-pressure conduit or discharge air from said air-pressure conduit into the atmosphere as desired.

5. A burette comprising a burette tube having an air-cleaning and purifying chamber in sealed relation therewith, said chamber having an air exit at its lower side and an outlet tube arranged within said chamber in sealed relation with the chamber and communicating with said exit, the upper end of said outlet tube extending upwardly into said chamber and being bent outwardly and then downwardly and terminating substantially above the bottom of said chamber.

6. A burette comprising a burette tube, an overflow tube, a conduit adapted to be connected with a receptacle in which there is a source of liquid supply for filling said burette tube, a valve for connecting and disconnecting said conduit and tube, an air-pressure inlet for creating pressure on the liquid to be supplied to said tube, means for opening and closing said inlet, and an outlet for fluid in said tube adapted to be selectively opened and closed by said valve, said means for closing said air inlet also preventing entrance or escape of air from the liquid receptacle to which the burette is connected.

MAX F. BETZOLD.
CHARLES RASCHER.
CHARLES A. TORP.