

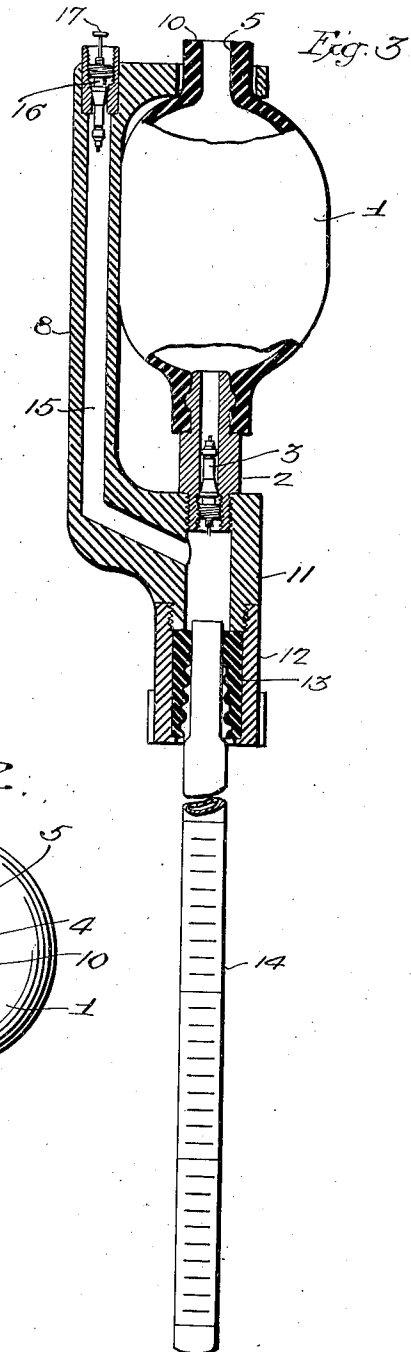
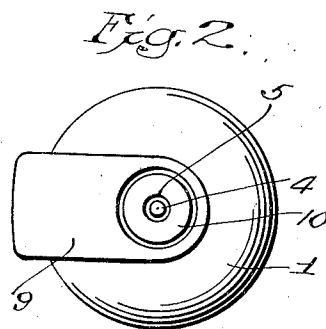
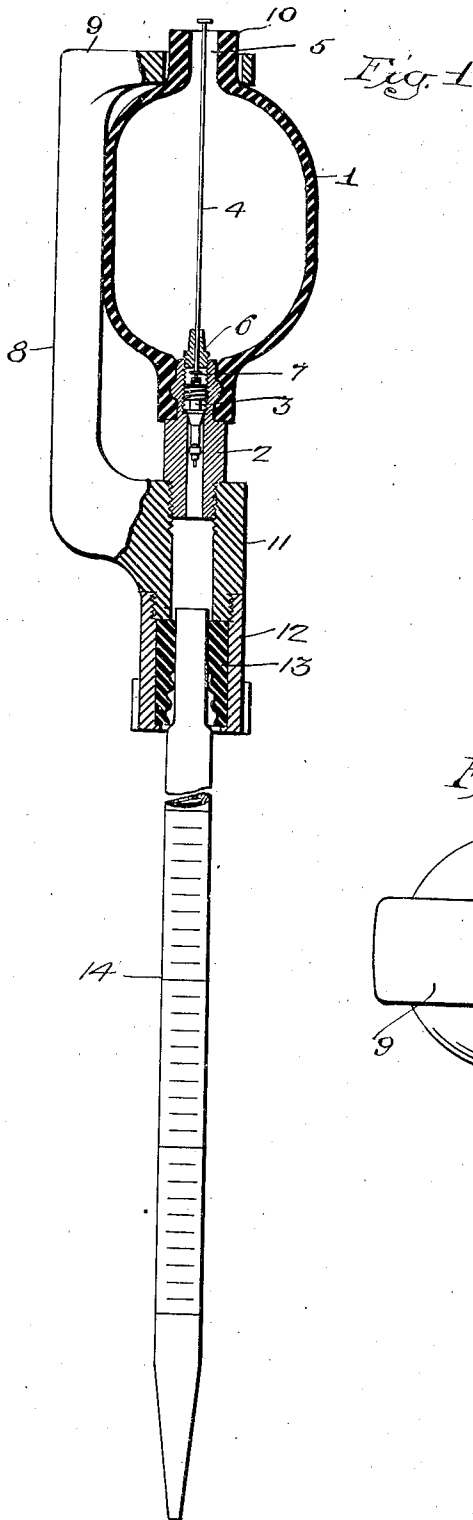
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SUCTION DEVICE

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SUCTION DEVICE

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In the use of pipettes and similar devices for transferring or collecting liquids, it is customary to draw the liquid into the tube with suction created by mouth. This practice involves a definite hazard in the possibility of drawing the liquid, which may be of an injurious nature, into the mouth, and many serious and even fatal accidents have occurred from this cause. In the larger types of pipette from which the contained liquid may empty by gravity, this method of drawing the liquid into the tube has the further disadvantage of being difficult to control for accurate measurement of the liquid due to the necessity, after the liquid is drawn in, for sealing the end of the tube in order to prevent the liquid from discharging, this operation requiring withdrawal of the tube from the mouth and a consequent momentary interruption of the suction so that the finger may be placed over the end of the tube.

One object of the present invention is to provide an evacuating or suction device suitable for use with pipettes, and adapted in principle for many other useful purposes, that will entirely eliminate the aforesaid hazard.

Another object is to provide a device of the stated character that shall be capable of close manual control under the continuous observation of the operator so that volumetric measurements may be accomplished with accuracy and rapidity.

Another object of the invention is to provide a device of the character described that shall be simple and practicable in form and operation, and that may be manufactured at relatively low expense.

The invention resides further in certain structural details and arrangements of parts herein-after described and illustrated in the attached drawing, wherein:

Figure 1 is a vertical sectional view of a preferred embodiment of the invention in its application to a conventional type of pipette;

Fig. 2 is a top plan view of the device, and

Fig. 3 is a sectional view illustrating a modification within the scope of the invention.

With reference to Figs. 1 and 2 of the drawing, the embodiment of the invention therein disclosed comprises a bulb 1 of rubber or similar resilient material having an opening in each end. In one of these openings is secured a nipple 2 in which is mounted a valve 3 and of the type, for example, conventionally employed in pneumatic tires. The valve 3, which is normally held closed by spring pressure in the conventional manner is arranged in the nipple so that it may open

against the spring under the effect of fluid pressure exerted from the bulb side, but suction within the bulb acts with the spring to hold the valve closed. A rod 4 extends through the bulb and through the opening 5 at the opposite side of the bulb, and projects slightly beyond the mouth of said opening, the inner end of this rod being guided in an element 6 threaded into the end of the nipple 2. The inner extremity of the rod 4 is provided with a button 7 which engages the end of the valve stem and which prevents retraction of the valve rod 4 from the element 6. Pressure on the outer projecting end of the rod has the effect of opening the valve 3.

It will now be apparent that if the bulb 1 is collapsed and the contained air discharged, through the opening 5 for example, and if subsequently the opening 5 is closed and the rod 4 depressed by placing a finger over the opening and the collapsing pressure then released to permit the bulb to assume its normal shape, the resulting suction will be impressed upon the passage through the nipple 2, and, the valve being open, air will then be drawn through the nipple to the interior of the bulb.

As shown in the drawing, the bulb 1 with its nipple 2 is supported in a frame 8 which has at one end an arm 9 with an aperture embracing the nipple 10 at the one end of the bulb through which the aperture 5 extends. At the opposite end of the frame 8 is a hollow boss 11 which is internally threaded at the inner side of the yoke for reception of the correspondingly threaded end of the nipple 2, and on the outer side of the boss is threaded a sleeve 12 which supports an inner sleeve 13 of resilient rubber. This inner sleeve is adapted to receive the end of a pipette 14 and to form a sealed joint between the pipette and the frame. In the present instance, the pipette is graduated as shown.

In the operation of this device, the outer attenuated end of the pipette 14 is immersed in the usual manner in the liquid to be drawn into the pipette. Thereafter, the rubber bulb 1 is collapsed by pressure of the fingers, the air escaping through the aperture 5. While the bulb is in the collapsed state, the finger is then placed over the opening 5 to seal the latter, the rod 4 at the same time being depressed by pressure of the finger and the valve 3 thereby opened. The pressure on the bulb 1 is then released and the resulting expansion of the bulb creates a suction on the tube 14 which draws the liquid into the latter. The rise of the liquid in the tube is clearly visible to the operator, and when sufficient liquid

has entered the tube, as indicated by the graduations, the flow may be stopped by removal of the finger from the opening 5, which permits the valve to close and admits air to the interior of the bulb through the opening 5. If it be desired to permit a portion of the liquid taken into the tube to escape, this may be accomplished by depression of the valve rod 4 while maintaining the finger tip in such position that the opening 5 of the bulb is not sealed. Under these conditions, the liquid will flow by gravity from the tube. This discharge of liquid from the tube may be accelerated by completely sealing the opening 5 with the finger and exerting pressure on the bulb to collapse the latter whereby the air in the bulb is forced downwardly into the top of the pipette. All of these operations are capable of close control, with the movements of the liquid in the tube entirely visible to the operator, so that extremely accurate regulation of the flow either into or from the pipette is afforded. With a graduated tube of the character illustrated, accurate measurements of liquid may be made with great facility. If prior to taking up the liquid in the tube 14 it be desired to agitate the body of liquid from which the withdrawal is made, this may be accomplished efficiently and rapidly by expelling the air from the bulb 1 downwardly through the tube and into the said body. It is apparent that all of the hazards previously experienced in the use of pipettes, wherein the suction is effected by mouth, is eliminated by this device, and that, further, a more accurate and rapid measurement of the liquid in the tube can be obtained.

In Fig. 3, I have illustrated a modification within the scope of the invention. Since in this embodiment the elements of the assembly are essentially the same as those of the embodiment illustrated in Figs. 1 and 2 and previously described, the principal parts are designated by the same reference numerals. In this embodiment, the position of the valve 3 in the nipple 2 is reversed, so that fluid pressure applied to the nipple through the medium of the bulb 1 is not effective to open the valve, whereas the valve will open under suction exerted by expansion of the bulb, assuming, of course, that the opening 5 at the top of the bulb is closed. In this case, the frame 8 is formed with a passage 15 which extends from the interior of the hollow boss 11, at a point intermediate the valve 3 and the inner end of the tube 14, to the outer end of the frame. The outer end of the passage 15 is controlled by a valve 16 of a type, for example, similar to the valve 3 previously described, the valve 16 being arranged so that it will remain closed under all normal working conditions, and may be opened only by pressure exerted upon the projecting end 17 of the valve stem.

In the operation of this device, liquid may be drawn into the tube 14 by first collapsing the bulb 1, thereafter placing the finger over the opening 5 to seal the latter, and then releasing the bulb to permit expansion, the resulting suction opening the valve 3 and being imposed upon the tube 14. The resulting flow of liquid upwardly into the tube 14 may be interrupted at the will of the operator either by removing the finger from the opening 5 or by opening the valve 16 by pressure of a finger upon the projecting end of the valve stem. Normally, interruption of the inward flow of liquid into the tube 14 will be effected by simply uncovering the opening 5 of the bulb. If now it be desired to discharge all or a

portion of the liquid from the tube 14, this may be accomplished by opening the valve 17 to admit air to the interior of the boss 11 and to the upper or inner end of the tube 14.

I have found it of advantage to locate the valve, as in the embodiment of Fig. 1, at the inner end of the bulb or closely adjoining the mouth of the pipette, rather than at the outer end of the bulb, since by this means the cut-off action of the valve with respect to the pipette is more rapid. By this means lag in operation is avoided and the column of liquid in the pipette is maintained substantially without change as of the moment the valve is closed. Accurate measurement of the liquid is thus facilitated. Somewhat the same effect is obtained in the embodiment of Fig. 3 by extending the passage 15 to a point closely adjoining the inner end of the pipette. I have found it of advantage also to employ a spring-pressed valve of the general character described, instead of a valve of the ball type, for example, as it is essential for maximum operating efficiency that the valve action be definitely positive.

The aforescribed device, while of high utility in conjunction with pipettes, may find other useful applications where evacuation of fluid from a tube or container is required, and there are to be no implied limitations in this respect. It is apparent, also, that the device may be considerably modified as to details without departure from the principle of the invention.

I claim:

1. In a device of the stated character, the combination with a resilient bulb having a pair of openings, one of said openings being adapted for manual control, a normally closed valve for controlling the other of said openings, and a valve rod operatively associated with said valve and extending in the interior of the bulb to the first-named opening, whereby the act of manually sealing said opening may actuate the rod to open the valve, the end of said rod being arranged with respect to said opening to permit the opening of the valve by pressure on said rod while leaving said opening unsealed whereby to afford an unobstructed flow of air through the bulb.

2. In a device of the stated character, the combination with a resilient bulb having aligned openings respectively at opposite sides of said bulb, a normally closed valve controlling one of said openings, and a valve-actuating rod extending from the other of said openings to the valve and constituting a means for manually opening said valve.

3. In a device of the character described, the combination with a suction bulb having a pair of openings, one of said openings being adapted for manual control, of a valve controlling the other of said openings, a spring exerting pressure to close said valve, and means extending to a point adjacent the first-named opening for manually opening said valve against the spring pressure and providing for coordinated accurate control of said valve and opening.

4. In a device of the character described, the combination with a suction bulb having a pair of openings, one of said openings being adapted for manual control, of a valve controlling the other of said openings, a spring exerting pressure to close said valve, and manually-operated means for opening said valve against the pressure of said spring.

5. In a device of the character described, the combination with a suction bulb having a pair of openings, one of said openings being adapted

for manual control, of a check valve controlling the other of said openings, said valve being arranged to permit discharge of fluid through said opening from the bulb and normally preventing flow through said port in the opposite direction, and manually-actuated means for opening said valve to permit the passage of fluid through said opening to the bulb.

6. The combination with a tube and a suction bulb attached to one end of said tube and constituting a means for drawing a liquid by suction into the other end of said tube, said bulb having a port for admission and discharge of air independently of the tube and adapted for manual control, a check valve controlling the connection between the bulb and the tube and arranged to admit air to the bulb from the tube while preventing flow of air in the opposite direction, and manually-actuated means for admitting air to the tube for subsequent gravity discharge from the latter of said liquid.

7. The combination with a tube and a suction bulb attached to one end of said tube and constituting a means for drawing a liquid by suction into the other end of said tube, said bulb having a port for admission and discharge of air independently of the tube and adapted for manual control, a check valve controlling the connection between the bulb and the tube and arranged to admit air to the bulb from the tube while preventing flow of air in the opposite direction, vent means for admitting air to the tube for effecting subsequent discharge of said liquid from the tube, a normally closed valve controlling said vent, and manually-actuated means for opening said valve.

8. The combination with a tube and a suction bulb attached to one end of said tube and con-

stituting a means for drawing a liquid by suction into the other end of said tube, said bulb having a port for admission and discharge of air independently of the tube and adapted for manual control, a check valve controlling the connection between the bulb and the tube and arranged to admit air to the bulb from the tube while preventing flow of air in the opposite direction, a spring exerting pressure to close said valve and said valve being adapted to be opened against the spring pressure by suction of the bulb, and manually-actuated means for admitting air to the tube to effect subsequent discharge from the latter of said liquid.

9. The combination with a tube and a suction bulb attached to one end of said tube and constituting a means for drawing a liquid by suction into the other end of said tube, said bulb having a manually-controllable port for admission and discharge of air independently of the tube, means normally operative when said port is uncovered to seal the tube from the bulb, and manually-actuated means for admitting air to the tube to effect subsequent discharge from the latter of said liquid.

10. The combination with a tube and a suction bulb attached to one end of said tube and constituting a means for drawing a liquid by suction into the other end of said tube, said bulb having a port for admission and discharge of air independently of the tube and adapted for manual control, a valve controlling the connection between the bulb and the tube, a spring to normally close said valve, and manually-actuated means for opening said valve against the spring pressure.

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