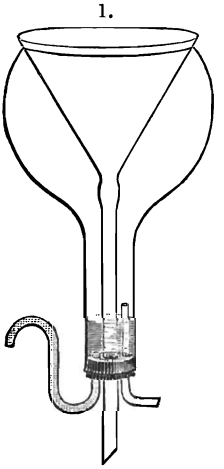
Art. XVI.—*Notes on Convenient Forms of Laboratory Apparatus;* by D. Albert Kreider.

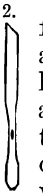
[Contributions from the Kent Chemical Laboratory of Yale College—XLII.]

Hot Filter.—A convenient and satisfactory hot filter, so indispensable in many laboratory processes, may be easily improvised whenever steam is available, in the form which appears in fig. 1. It is always ready; hot at a moment's notice, and without a flame to endanger the filtration of combustible substances. The encasement for the funnel is made by removing the bottom of an ordinary flask of suitable size in the well known way of starting the crack with a scratch of a file and then directing it by applying a piece of iron heated to redness. Flasks unfit for other purposes may be utilized in this way and they are more serviceable than large glass funnels, because of the tendency of the latter to crack if cold when the steam is turned on. The neck of the flask is closed by a stopper containing perforations for the funnel, steam and waste tubes; the latter of which, in the absence of a drain pipe, may lead to any convenient receptacle. By prolonging the conducting tube of the steam somewhat above the level at which the condensed water is drawn off, higher temperature will be attainable and spattering avoided. Escape of steam with the water is prevented by the turn in the waste pipe. When steam taps are not accessible, steam may be applied from a wash-bottle.

1.



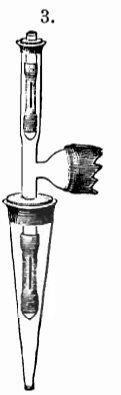
2.



Valve.—In forcing a liquid or gas indifferent to rubber from one vessel to another, the ordinary Bunsen valve is apt to collapse in such a way as to permit a back flow. I have found that a stout glass tube of desirable size, sealed at one end and drawn out with an opening in the restriction, as indicated in figure 2, and a piece of rubber tubing containing a smooth slit placed over it, makes a valve in which collapse is impossible, and the power of which increases with the pressure to be overcome. That a valve similar in appearance to the one here described has been used, is not unknown to me: but the similarity is confined to the appearance, as will be evident from the following description: The restriction should not be greater than is necessary to leave a

small space between the tube and the rubber when the latter is loosely drawn over it: but in order to work easily, should be long enough to permit a slit of about a centimeter's length to close tightly, which will require it to be about twice the length of the slit. A slit one centimeter long will be found to open under very slight pressure, and to accomplish its purpose it is only required to close sufficiently for the external pressure to force the rubber against the opening in the tube. This opening should be carefully rounded and a little higher rather than any lower than the surrounding glass, and is better made before sealing the end, in order to keep the tube perfectly straight. The rubber should fit tightly about the larger parts of the glass tube and be put on with care to have the smoothly cut slit straight and loose enough to close tightly. If the slit is placed about 90° from the opening in the tube, sufficient space will remain to permit the escape of the gas or liquid, but the moment the pressure outside becomes greater than that within, the rubber will be pressed tightly over this opening and thus a return made impossible. When dry the valve was found not to resist high pressure perfectly; but when wet, or better when both glass and rubber, including the slit, were moistened with glycerin, a column of mercury 730^{mm} high was held for several days without changing more than the barometer. The valve thus lubricated with glycerin when used as a protection in an ammonia wash-bottle, will prevent absolutely the access of ammonia to the mouth, and if made according to the directions will act with very little pressure. Placed in the connection between the vacuum flask and water pump ordinarily used in filtration, it has been found a valuable check on the valve of the pump, and when the latter was impotent this device prevented any water being drawn into the filtrate. In a process soon to be published, in which a partial vacuum is used, this valve holds the vacuum in continual readiness and adds greatly to the convenience of the process.

Force Pump.—By adjusting two of the valves just described to the opposite extremities of a T-tube, with the horizontal limb enlarged or sealed to a larger tube so as to permit the attachment of a large and stout piece of rubber tubing closed at one end, as shown in fig. 3, a convenient and powerful little force pump is obtained. A small bore, stout T-tube is cut off short at the two ends at right angles to one another: to one is sealed a tube just large enough to permit the insertion of a valve; to the other, a large tapering tube, slightly lipped so as to hold a piece of rubber tubing firmly and allow of tying the latter if necessary. Of the third end of the tube, a valve like that shown in fig. 2 is made. The compressing rubber should not be of greater


3.

length than the hand is able to cover completely and may be closed with a glass stopper selected to fit tightly. Providing the space through the T-part is kept at a minimum compared with that of the compressing rubber, rapid pumping will be found possible and the power limited only by the strength of the user's grip. A column of water was quickly raised and forced from the top of a tube sixteen feet in length. The apparatus will be found convenient in the absence of a regular pump and can be quickly constructed of materials always at hand. Originally it was made, in about fifteen minutes, of a T-tube to which the necessary enlargements were connected by rubber tubing and the unused space filled by a glass rod. The valves may be inserted directly into the ends of the compressing rubber, but the form shown in the figure will be found more serviceable. By attaching the lower end to a tapering tube as shown, the pump is easily inserted into any sized perforation of a stopper and adds greatly to its convenience.

The pump has been found serviceable in various applications. For filling burettes it will be found more advantageous than the siphon plan. The standard solution bottles are fitted with two-holed stoppers from one of which a tube of sufficient length is bent so as to reach into the burette. The pump can be applied to various bottles by the adapter shown in the figure and the solutions forced into the burettes. To prevent any evaporation in the tube a glass stop-cock may be inserted. On several occasions it has been applied to a Kipp generator in which higher pressure was momentarily required. In various other ways it has been found a useful piece of apparatus.