AN AUTOMATIC HYDROGEN SULPHIDE GENERATOR.

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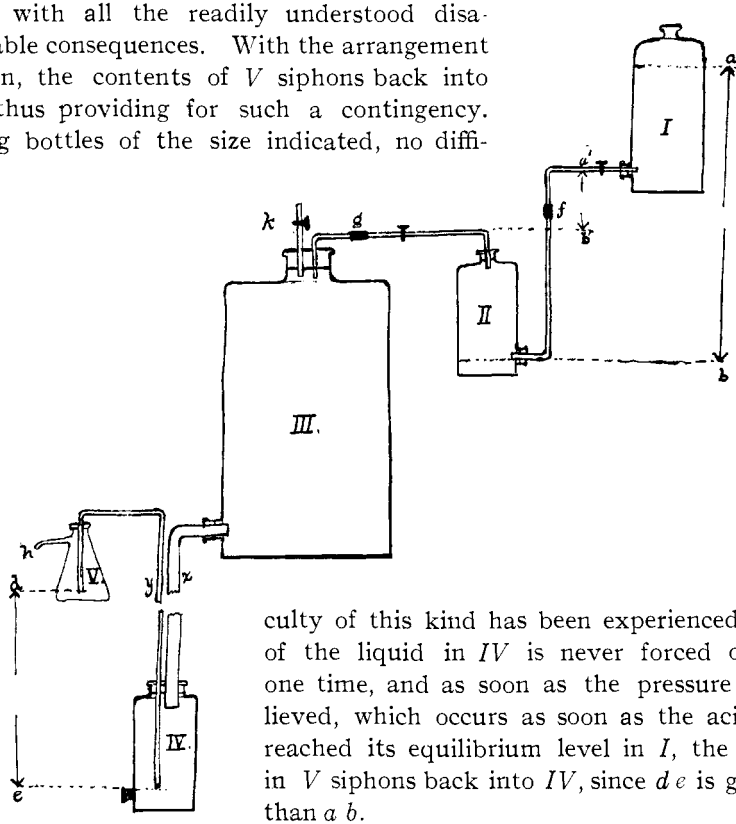
The number and variety of hydrogen sulphide generators that have been described in the literature from time to time, or advertised for sale, is suggestive of the small proportion of them that are really efficient. The one herein described is a modification of the apparatus described by Bradley[1] and has been in use during the past year by a class of over 30 men. It has been perfectly satisfactory, and the satisfaction experienced in its use leads me to describe it for the benefit of others who may have need of a simple and efficient generator. The essential difference between it and some of the older types is in the means used to draw off the spent acid as fast as it settles to the bottom of the sulphide compartment. It is the accumulation of this liquid and consequent dilution of the fresh acid that interferes most seriously with the successful operation of any automatic device of this nature.

In the diagram, *I* is an aspirating bottle of about five liters capacity, and is the acid reservoir. *II* is an aspirating bottle of two liters capacity, and serves to accommodate the gas generated after closing the outlet cock *k*, or its equivalent. *III* is an aspirating bottle of sixteen liters capacity, containing ferrous sulphide in sticks or lumps. A smaller bottle may be used, but it is not so efficient. From the lower opening of this bottle a glass tube, *x*, of at least 15 mm. internal diameter, leads to another aspirating bottle, *IV*, which has a capacity of two liters. From near the bottom of *IV* a glass tube, *y*, extends to near the bottom of *V*, which is a filter flask of about 750 cc. capacity. The tube *y* has an internal diameter of not more than 5 mm. The lower opening of *IV* is used in drawing off the slime which accumulates from time to time, especially if the acid used contains arsenic.

The vertical distance *a' b'* must be more than the sum of the depths of liquid in the wash bottle and precipitation flasks, in order that the generator may be able to start under all conditions. The vertical distance *d e* must be considerably greater than *a b*, so that any excess of gas may escape through the acid and not through *IV* and *V* in which case it would, of course, destroy the water-seal. The object in making *x* large is to allow the slime to flow off from *III* and settle in *IV* without clogging the tube. The tube *y* is of small bore in order that the internal friction may compensate in part the inertia of the acid and the friction in the acid delivery tubes, thus acting as a sort of "dash-pot." The tube *y* extends to near the bottom of *V* because when the outflow of gas from the generator is suddenly stopped, the acid in the generator—particularly if there has been a large demand for gas—is sufficient to generate quite a little gas. The

[1] *Am. Chem. J.*, **21**, 370.

pressure is thus suddenly increased, and owing to the inertia of the large mass of acid in *II* and *I*, the bottle *IV* will be very nearly emptied. A second occurrence of this nature would result in breaking the water-seal, with all the readily understood disagreeable consequences. With the arrangement shown, the contents of *V* siphons back into *IV*, thus providing for such a contingency. Using bottles of the size indicated, no difficulty of this kind has been experienced. All of the liquid in *IV* is never forced out at one time, and as soon as the pressure is relieved, which occurs as soon as the acid has reached its equilibrium level in *I*, the liquid in *V* siphons back into *IV*, since *d e* is greater than *a b*.



It is advisable, though not necessary, to have the acid tubes jointed by rubber connections at *g* and *f* as shown, and to have stop-cocks as indicated, in case it should be necessary to take the apparatus apart at any time. If acid free from arsenic is used, this precaution is unnecessary, but if an arsenic-containing acid is used, enough arsenic sulphide will accumulate in time to clog the acid tubes. The acid delivery tube terminates in *III* in a fine jet. A spray tip would be better, but it has not been found necessary.

It has been found advisable to deliver the gas to the individual tubes or stop-cocks in the precipitation room through very fine capillary tubes placed inside the rubber connection, either between the stop-cock and the generator or between the stop-cock and the delivery tube. These capillaries are conveniently made of pieces of manometer tubing of a size to fit snugly in the rubber tube, and about two cm. long. The ends are

softened in a flame until the aperture is so small that one can scarcely blow through it. These tubes are of great value in maintaining the pressure of gas in the generator at something like constancy.

It is desirable to use hydrochloric acid (sp. gr. 1.2) diluted with two parts of water. Of course, sulphuric acid can be used equally well if it is sufficiently dilute to avoid crystallization of the ferrous sulphate.

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NOTE.

A Convenient Funnel Support.—It frequently happens when a chemist has to make a large number of slow filtrations, that he finds himself embarrassed by the lack of a sufficient number of funnel supports. The writer recently overcame an experience of this kind by improvising a simple and inexpensive holder which has since proven so convenient, especially for holding small funnels, that he desires to bring it to the notice of his fellow chemists and others who may perhaps sometimes find use for it.

Fig. 1.

Fig. 2.

For supporting funnels up to 10 cm. in diameter, take a piece of No. 18 copper wire about 10 cm. long and bend it around the stem of the funnel until it assumes the form of a key, Fig. 1. Then open out the arms of this key and bend the ends downwards and inward so that they will hook over the top of the beaker or other receiving vessel, Fig. 2. The holder rests on the top of the beaker at the points *a a*. The funnel is supported by the loop *c*, which partially encircles the stem and holds it against the inner side of the beaker as shown in Fig. 3.

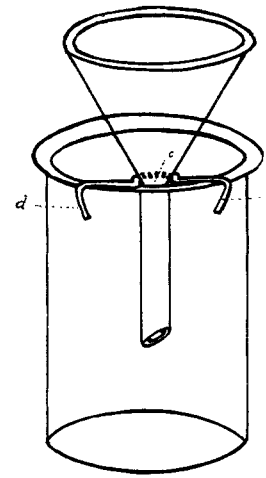

Fig. 3.

A sufficient length of wire should be used in forming the hooks *d d*, so that the support cannot fall into the receiving vessel when the funnel is withdrawn from it. The length and size of the wire as well as the size of the loop formed around the stem of the funnel can be varied to suit the size of the funnel as well as the kind of receiving vessel used.

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