

A SAFETY GENERATOR FOR GASES.

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Although the time-honored "thistle-tube apparatus" for generating gases has the advantage of being quickly constructed, still there are many disadvantages which frequently make its use inadequate and inconvenient.

First, the total lack of control of the pressure of the gas. Should the reaction proceed with too great violence, the gas, unable to escape rapidly enough through the delivery-tube, especially when under water, frequently forces out the cork, spattering the acid contents. If, however, under these conditions, the cork should resist the excess pressure of the gas, then the acid is forced over into the delivery-tube and ultimately into the collecting apparatus.

Secondly, the lack of control of the supply of the gas. Once the reaction has begun the gas continues to come off until the materials have been exhausted, even after its use has been discontinued. In other words, there is lack of economy. New materials are required if the apparatus has not been in use for some time. There is no mechanism whereby the reaction could be stopped when the gas is not in use.

Thirdly, in cases where heating is necessary to start the reac-

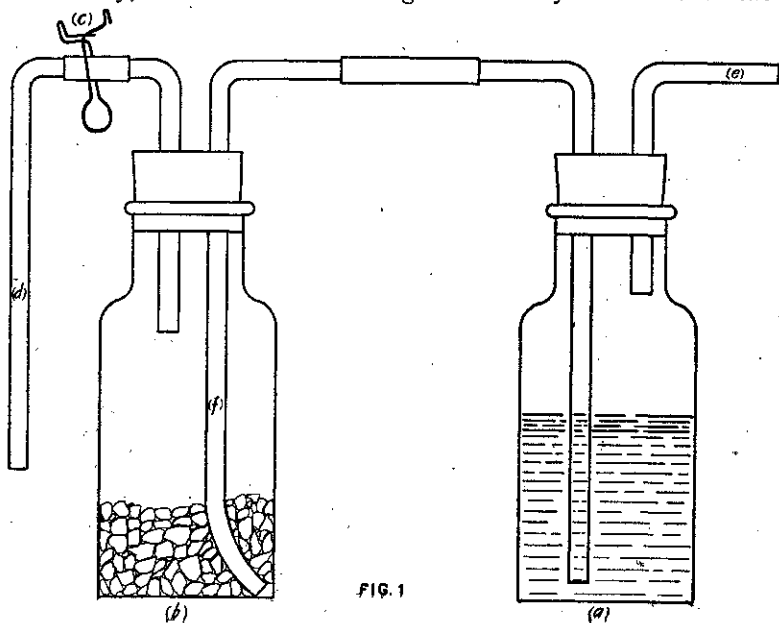


FIG. 1

tion, and the delivery-tube is under water, the liquid would "suck back" into the generator, should one forget to remove the delivery-tube at the same time the flame is removed and as a result, the heated glass frequently cracks.

These are only a few of the serious and most obvious disadvantages in the use of this apparatus which requires constant attention, if all possible accidents are to be avoided.

The writer has therefore designed an apparatus, which, although it requires at the outset a little more care and time to construct, can be used again and again, does away with the above disadvantages and has several unique advantages of its own.

Figure 1 shows the apparatus set up ready for use. Bottle (a) contains the acid, (b) the substance, (c) is a pinch-cock of the Mohr or Hoffmann type depending altogether whether the gas is to be shut off at once or whether its supply is to be regulated, (d) the delivery-tube, and (e) the tube through which pressure is applied. Tube (f) is bent so as to reach to the corner of the bottle. The gas is generated by opening the pinch-cock, blowing into tube (e), which forces the acid over into the bottle (b) and starts the reaction. The reaction can be stopped by closing the pinch-cock, when the pressure of the gas will force the acid back into bottle (a). It is only necessary to open the pinch-cock again and blow into (e) to repeat the process.

An inspection of the diagram will reveal the following facts. The check on excess pressure is always in operation when the reaction becomes too violent. The supply of the acid is automatically regulated by the pressure of the gas in bottle (b). Should it be necessary to add new materials, the bottles can be readily removed and connected again. At times, when the supply of the gas is stopped in the generating bottle, gas will still continue to come off from bottle (a) due to small particles of the substance having found their way over into the acid. This gas can also be collected by simply removing the delivery-tube and attaching it at (e).

Sometimes the pressure of the gas in (b) is less than that of the liquid at the exit of the delivery-tube when immersed. This would drive the acid back into (a). Closing the rubber tube connecting the two bottles by means of a Hoffmann pinch-cock would remedy this difficulty and insure a steady supply of gas on account of increased pressure.

In many laboratories where qualitative analysis is given, no general house supply for hydrogen sulphide is available. In those

cases, this apparatus can be used by the student to great advantage. Each worker is assured of his supply of gas at any moment, and does away with the inconvenience of having the students crowd around a single Kip generator.

Again, the whole apparatus lends itself very readily to being cleaned and used for different acids and materials.

It is not necessary to confine oneself to bottles only. Flasks or large test-tubes can be substituted and in cases where heating is required to start the reaction, the liquid can be heated in one flask and while hot, forced into the generating flask.

This apparatus is a modification of the Kip generator and works on a similar principle.

A serious objection may be raised in that contact of tube (e) and the mouth is necessary. This can be readily overcome by using a piece of rubber tubing which can be detached when not in use, thus preventing possible contact with the acid should any of it happen to get into tube (e), or a rubber bulb attachment can be substituted, and should be detached when the reaction has begun.

This apparatus can be readily used to generate such gases as hydrogen, hydrogen sulphide, carbon dioxide, etc. In fact, all those gases that can be prepared with a Kip generator.

ACETYLENE GENERATOR.

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A slight modification of this apparatus gives an acetylene gas generator which can be used for demonstration purposes. The apparatus shown in Figure 1 can be turned into such a generator by substituting a three-hole stopper in bottle (b) and adding the thistle-tube attachment as shown in Figure 2.

Water is placed in the thistle-tube, some calcium carbide in bottle (b) and bottle (a) is filled two-thirds with water, or sulphuric acid, if the gas is to be washed. The delivery-tube is removed and an acetylene burner is substituted as shown (d). When the reaction has been started by admitting water into bottle (b) from the thistle-tube, the acetylene gas which is generated, $\text{CaC}_2 + 2\text{H}_2\text{O} = \text{Ca}(\text{OH})_2 + \text{C}_2\text{H}_2$, takes the course of least resistance and goes through the burner.

This form of apparatus has the following advantages: The pressure of the gas is automatically controlled, since an excess