NOTE ON A CONVENIENT APPARATUS FOR THE CHEMICAL AND BACTERIOLOGICAL EXAMINATION OF THE ATMOSPHERE.

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As impurities in the air, or at least such gases as have to be estimated in the ordinary way in the atmosphere, are present in comparatively small quantities, and as the error of experiment naturally affects such determinations in proportion to the volume of air examined, we have thought it best to adopt a plan whereby a very large volume of air may be tested, instead of using a few litres as has usually been done previously.

Some years ago one of us had occasion to examine large volumes of ozonized air, and the accuracy of the anemometer as a means of measurement was clearly established. Indeed, it was partly owing to the experiments referred to that the present apparatus was made.

We have recently had occasion to examine the atmosphere in and around a large chemical works where smelting processes were conducted, and the satisfactory way in which the apparatus worked seemed to justify the matter being brought to the notice of this Society.

In order to bring whatever liquid is used to fix the impurities sought for into contact with the air to be examined, we are satisfied that a jet apparatus is the most efficient and, at the same time, the most expeditious. For example, it is possible, in the course of half an hour, to treat at least 100 cubic feet of air, and, with the exception of CO_2 (which is admittedly somewhat difficult to determine by this method on account of the slowness of absorption), we believe that almost all other impurities can be dealt with in an exceedingly efficient and expeditious manner.

Briefly, the apparatus consists of a pump capable of giving a pressure equal to about 2 inches of water, which is used to force the air under examination through the perpendicular tube of an ordinary atomizing jet. The jet is placed inside a fairly large carboy, and the exit for the scrubbed air is an essential feature. This consists of a little spray trap, which is always kept wet during the process. The air is forced through the carboy by means of pressure from the pump, and the volume passed is finally measured by the anemometer. The anemometer must be protected against any form of back-pressure. The size of the carboy, the jet, and, within certain limits, the pressure, may be varied to suit any particular purpose, but we much prefer to work on a reasonably large scale.

Satisfactory results can be obtained with a powerful foot-pump, provided the

metal parts are covered so as to guard against contact of the moist air with the metal, but, wherever possible, we prefer to use a pump similar to the one we have here to-night, driven by some convenient power. The chief points about this pump are that it has a flexible piston, that it does not require any form of lubrication, and that the few metal parts present are coated with anti-sulphuric enamel. This renders the likelihood of chemical action quite out of the question.

We do not claim that this apparatus is novel, except in so far as the use of an anemometer is concerned and the treatment of large volumes of air, but we do claim that it is a convenient and very reliable means for determining the impurities sought for.

We find that the spray method has been previously employed, and it is doubtless a very old plan, but we are not aware that it has been used either for bacteriological purposes or for dealing with large volumes of air as we suggest.

The only fault that appears to exist in the use of the apparatus is the inconvenience of the liquid being carried forward during the experiment. The accuracy, however, which is obtained by working on such large volumes more than compensates for the trouble which is thus involved.

With regard to special estimations, we may mention that we have not established that CO_2 can be readily estimated by one scrubbing, but it is not important, as one can easily obviate the errors arising from CO_2 when estimations of other gases are made.

We have obtained some encouraging results on the determination of SO_2 as $BaSO_4$ after oxidation of the aqueous liquid, but further experiments are being made in this direction.

Metallic impurities, such as lead, zinc, etc., in the form of dust or fumes, flue, gases and the like, can be readily dealt with by means of dilute alkali. If, however, soda is used it should be prepared from metallic sodium. Dust can also be readily removed by merely scrubbing with water.

Ozone can be readily estimated by the usual methods, and nitric oxide, free and albuminoid ammonia can be likewise estimated by this method.

In addition, the speed which may be obtained on a large scale is such as to justify, in our opinion, the possible application of this method for removing dust particles from the air in the case of breweries, photographic works, etc.

On a much smaller scale, but adopting exactly the same principle, an apparatus is shown which may be readily and quickly used for bacteriological examination of the atmosphere. In this case the only difference is that the volume of air is much smaller, and therefore need not be measured by means of an anemometer; but the air which has been forced through the jet can be measured by collection in a graduated vessel.

We prefer to directly scrub the air with sterile nutrient broth, precaution being first taken to thoroughly sterilize the apparatus. In order to obviate possible risk of contamination, if the broth were removed in the ordinary way, a little side-opening is made which will permit of a sterile pipette being used for removing the broth. In this way it is quite easy to determine, from a known volume of air and using a known volume of broth, the number and nature of the organisms found. We suggest that

this method is particularly applicable to examination of the atmosphere of breweries and similar works where the introduction of foreign micro-organisms is of vital importance. Of course, instead of using nutrient broth, it is quite possible to use sterile wort or other suitable liquid media.

We are aware that the same results are obtained with other forms of apparatus, but we do not think that the same degree of accuracy has been obtained. We have established that it is possible to remove all the micro-organisms in the atmosphere with this apparatus. In the case of the Hesse apparatus, we think there is a certain risk of not removing all the micro-organisms; and, again, with Hueppe's method, where the air is bubbled through warm nutrient gelatin, we think that objection can be taken as to the thoroughness of this operation compared with that of the atomizing method which we suggest.
