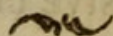


# DESCRIPTION OF AN EUDIOMETER,

*And of other Apparatus employed in Experiments on the Gases,*

BY W. HENRY, M. D. F. R. S. &c.

(Read Nov. 11, 1811.)



**C**HEMICAL instruments have generally, by their progressive improvement, been rendered more complicated and expensive; but the one, which I am about to describe, if it has any merit, is recommended by greater simplicity and economy, than those which have hitherto been applied to the same purpose. While it possesses these advantages, I am not aware that it is liable to objection from any sources of inaccuracy, that do not equally exist in all other eudiometers.

In its construction, it most nearly resembles, and indeed was originally suggested by, one which was invented, several years ago, by Professor Hope of Edinburgh. His apparatus consists of a tube sealed at one end, which holds precisely a cubic inch, and is

accurately graduated into 100 equal parts. This tube is fitted by grinding into the neck of a bottle, capable of holding two or three ounce measures of water, and having, near the bottom, another opening or neck, which is occasionally closed by a glass stopper. The bottle being filled with the eudiometric liquid, the tube containing the gas under examination is next put into its place; and on inverting the apparatus, the gas ascends into the bottle, where it is briskly agitated in contact with the liquor. An absorption takes place; and, to supply this, the stopper is taken out under water, which rushes into the bottle. The agitation, and opening of the stopper, are renewed alternately till no farther diminution is produced in the gas.

To this instrument, though very simple and ingenious, there are several objections: For 1st. by the absorption of part of the gas, the remainder becomes of less density, and is, therefore, less easily taken up by the liquid. 2dly. By the repeated admission of water, the eudiometric liquor becomes much weaker towards the close of the process, when its unimpaired strength is most wanted. 3rdly. If any defect exists in the joints of the vessel,

the external air rushes into the instrument to supply the vacuum.

All these objections, it occurred to me, after using the apparatus two or three times, might be obviated by substituting a bottle of caoutchouc or elastic gum, the sides of which, by collapsing as the absorption goes on, must place the included gas under an uniform degree of pressure during the whole experiment.\* As a neck to the elastic bottle, for

\* It would be unjust to Mr. Pepys, who has benefited chemical science by the invention of a variety of useful apparatus, not to state that he published the first account of an instrument, in which a bottle of elastic gum is used for containing the eudiometric liquid. (Phil. Trans. 1807.) As in his apparatus, however, the liquid is injected from the elastic bottle into the graduated tube, no contrivance was necessary for facilitating the return of the gas from the former into the latter; and his eudiometer, therefore, is adapted only for those liquids, which, like the solution of nitrous gas in sulphate of iron, act by a very moderate degree of agitation. The liquid, which I prefer, on account of the greater cheapness and facility of making it, is prepared by boiling a little quicklime, sulphur, and water, together in a Florence flask, decanting the clear fluid, and shaking it strongly in a bottle about three-fourths filled with it. To effect the absorption of oxygen gas by this liquid, especially towards the last, when it bears a small proportion to any other gas with which it is mixed, brisk and long continued agitation is necessary.

the purpose of receiving a graduated tube not differing from that of Dr. Hope, I employ a piece of tube of about  $\frac{1}{2}$  an inch diameter, and about one inch long. Into one end of this, the graduated tube is accurately fitted by grinding; and the other end is made somewhat funnel-shaped as shewn by Plate VI. fig. 3. *b*. The outer surface of the wider tube being previously ground, to destroy its smoothness, the neck of the elastic bottle is firmly tied upon it, care being taken to bring the folds of string so low, that no space may be left for the lodgment of air between the bottle and the tube.

The apparatus is used in a similar way to that of Dr. Hope, the gas being measured from time to time to ascertain when the absorption ceases. The only difficulty, which is likely to be experienced, and which a little practice will overcome, is to return the whole of the gas from the bottle into the tube. Before measuring the residuary gas, it is proper to remove the graduated tube from its attachment, either under water or mercury; for otherwise the elasticity of the sides of the bottle increases a little its apparent quantity.

In most cases, the graduated tube may be cylindrical as shewn by fig. 5; but when

the residue of gas is expected to be very small, I employ a tube the sealed end of which is drawn out to a narrower diameter, so as to admit of more minute divisions (see fig. 6.) On the contrary, when only a small portion of gas is expected to be absorbed, the tube may be narrowest at the open end.

To satisfy myself of the adequacy of this instrument to its purpose, I compared the analysis of artificial mixtures of oxygen and nitrogen gases, by its means, with that effected by nitrous gas used in Mr. Dalton's mode; by phosphorus; and by detonation with hydrogen. The results, in order to avoid all bias in favour of any of the processes, were registered by Mr. H. Creighton, (to whom I am indebted for the annexed drawing) and when compared after the experiments were finished, they did not differ from each other more than  $\frac{1}{250}$  of the whole mixture.

In graduating tubes for eudiometry or any other purpose, I have long been in the habit of using a contrivance, which renders the operation greatly quicker, and insures perfect accuracy. It consists of a tube (Plate VI. fig. 7.) open at both ends, and not more than .08 of an inch in diameter. This is carefully divided into equal parts, which may be en-

tirely arbitrary; but those, which I employ, are each ten grains of mercury at 60° Faht. the whole tube containing 100 grains. It is some trouble to divide this tube; but, when once prepared, any number may, by its means, be easily graduated. The successive portions of mercury, used in dividing wider tubes, are measured by this, into which they are drawn, either by plunging it into a jar filled to sufficient height with that fluid, or by the action of the mouth.

The two figures in the plate, which remain to be described (fig. 1. and 2.) represent an apparatus, which I have found extremely useful for submitting various gases to the long continued action of electricity. The platina wires, for conveying the electric fluid, are inclosed in two short pieces of almost capillary tube *b c*, which are sealed round them, and then ground away so as to expose merely the points at *d d*. These tubes are hermetically sealed into the small globe at *b c*, so that the points of the wires may be at a proper striking distance. The vessel may be filled with gas over mercury, and closed by the stopper *g*, fig. 2, or the elongated stopper *c*, fig. 1. But if it is desirable entirely to

exclude mercury, some small globules of which always remain in the globe when filled over that fluid, a metal cap may be cemented upon the neck of the vessel (fig. 1.) which, after exhausting it by the air pump, may be filled with gas from a receiver furnished with a proper stop-cock. An apparatus of this kind was used in the experiments on muriatic and oxymuriatic acids, which I have described in the Philosophical Transactions for 1812; and may be advantageously applied to other purposes.

Fig. 2.

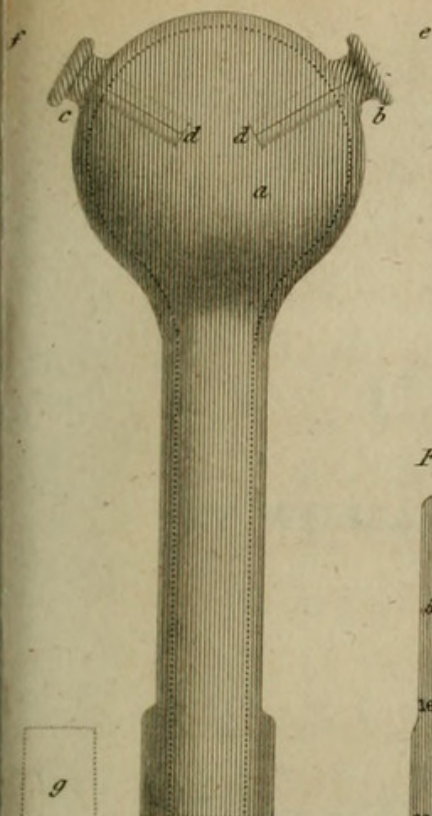


Fig. 6.

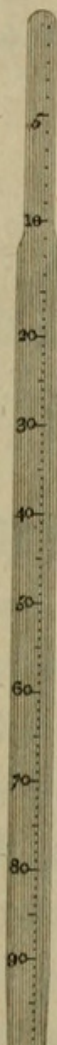


Fig. 7.



Fig. 1.

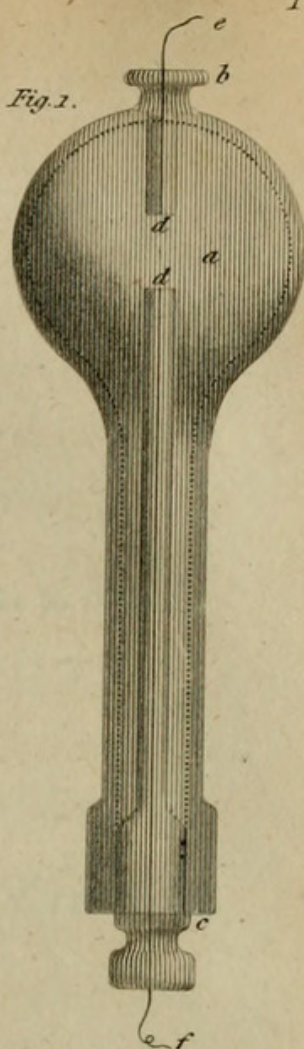


Fig. 5.

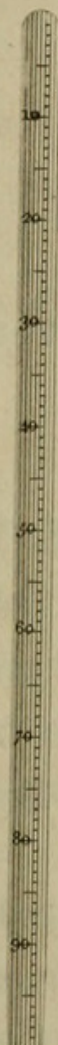


Fig. 4.

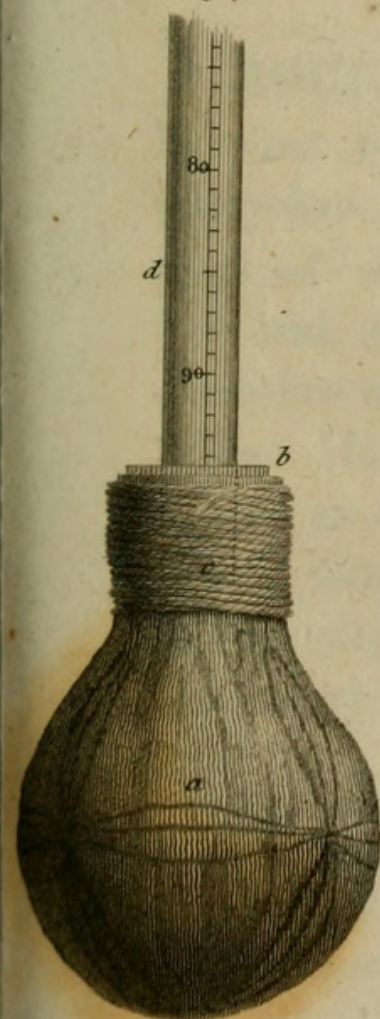
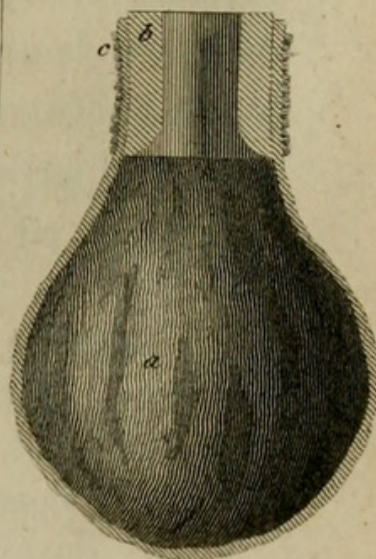


Fig. 3.





Henry, William. 1813. "Description of an EUDIOMETER, and of other Apparatus employed in Experiments on the Gases." *Memoirs of the Literary and Philosophical Society of Manchester* 2, 384–390.

**View This Item Online:** <https://www.biodiversitylibrary.org/item/52257>

**Permalink:** <https://www.biodiversitylibrary.org/partpdf/304923>

**Holding Institution**

Natural History Museum Library, London

**Sponsored by**

Natural History Museum Library, London

**Copyright & Reuse**

Copyright Status: Public domain. The BHL considers that this work is no longer under copyright protection.

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.