

The woodcut shows well how apparatus of the kind can be fixed and used on board ship. The aspirator and the condenser were kept steady by blocks bearing against the table battens. It shows also a convenient way of keeping bent tubes and other light articles, which are held up by a piece of india-rubber tube, slit lengthwise, and attached to the beam by a tack. An india-rubber clamp is thus formed sufficiently strong to retain any small article of suitable shape. Long tubes may be supported by more than one clamp.

For a particular description of the method of determining the carbonic acid by this apparatus, the reader is referred to the special memoir on the subject.<sup>1</sup> In this place it will be sufficient if the nature of the method is briefly indicated. The sample of sea water freshly drawn was brought into the flask *a*, and mixed with a saturated solution of chloride of barium in sufficient quantity to precipitate the sulphates. Heat was then applied, and the contents of the flask distilled off to very near dryness in a current of air freed from carbonic acid. The carbonic acid liberated from the water was retained by the baryta-water in the receiver *c*, and U-tubes *d*, *d*. Its amount was determined by measuring the baryta remaining in solution.

An ingenious modification of Bunsen's apparatus, by Jacobsen, was used for boiling the atmospheric gases out of the water (see fig. 8). It consists of three principal parts—the flask, the bulbed tube, and the receiver for the gases. The flask is spherical, with a strong welted lip, and holds about 900 c.c. The peculiarity of the apparatus consists in the form of the bulbed tube, and in its connection with the flask. The bulb *a*, in which the water is boiled to expel the air from the apparatus, is of the pear shape represented in the figure, in order to have the exit tube as nearly as possible at its highest point, so as to prevent the accumulation of any air in its upper part. Its capacity is about 60 c.c. The lower end of the tube is closed, but about half an inch from the end it has a very small hole *c* in the side. The perforated india-rubber cork *d* fits the neck of the flask accurately, and through the perforation the tube passes air-tight and with some friction. The receiver *b* holds from 50 to 60 c.c., and has the entry and exit tubes contracted as shown in the figure. It is joined to the bulbed tube by an air-tight india-rubber connection, and carries at its exit another piece of tubing, for a purpose to be mentioned presently. The upper part of the apparatus is supported by the clamp *m*, and by the bent rod *f*, which is clamped firmly on the lower part of the bulbed tube. The flask is supported in the water-bath *g* by the clamp *h* attached to the retort-stand *k*, which in its turn is lashed to the blowpipe table.

When the apparatus is to be used, a sufficient quantity of boiled distilled water is introduced into the bulb, and the cork *d* pushed over the opening *c*. The sea water to be examined is run directly into the flask from the deep-sea water bottle, through a tube with a narrow opening reaching to the bottom of the flask, the tube being gradually withdrawn

<sup>1</sup> Dittmar, *Phys. Chem. Chall. Exp.*, part. i. p. 103, 1884; see also *Journ. Chem. Soc.*, p. 464, 1878.