

XX.—*An Air-bath of Constant Temperature between 100° and 200° C.*

By HERMANN SPRENGEL.

THE temperature of boiling water, varying but slightly with the atmospheric pressure, is (on account of its easy attainment) the acknowledged standard in operations, such as drying. But if the degree of temperature has to be higher or lower than this, we generally avail ourselves of gas-lamps, whose heating power is regulated by an automatical action, existing between the heated medium and the supply of gas which feeds the lamp, as in Scheibler's ingenious electro-magnetic apparatus (*Zeitschrift für analytische Chemie*, vol. vii, p. 88, 1868). Simplicity, however, speaks in favour of the water-bath principle (Tichborne's and E. Reynolds' glycerin-bath, *Chem. News*, vol. iv, p. 319, 1861; Deville and Troost's boiling zinc, cadmium, sulphur, mercury, *Compt. rend.*, lvii, p. 897, 1863), and I must plead this as an excuse for describing an arrangement which may be considered obvious.

My instrument (almost a copy of the common water-bath) is charged (in place of water) with a liquid boiling without decomposition at the desired temperature, and is made of a material on which this liquid, even whilst boiling, does not act, or at least not readily. Such is the case with diluted sulphuric acid and lead, if the temperature required is not much above 150°.

The top of the leaden air-bath is provided with an upright worm, cooled by air, in which the vapour from the boiling acid condenses. The products of condensation, thus continually flowing back to the acid, cause the latter to remain unaltered both in volume and in specific gravity, and therefore in its boiling point.

The outside case of the double-walled air-bath is a $6\frac{1}{2}$ " cube; the inside a 5" cube. The worm, made of about 30' of gas-piping of $\frac{3}{8}$ " diameter, is 15" high and 4" wide. The coils of the worm are kept apart from each other $\frac{1}{8}$ " by means of solder; and the worm is kept in its upright position by two iron supports, soldered to the sides of the air-bath. The top is likewise provided with a stoppered neck, through which the outer chamber may be filled with the acid, and with an aperture leading to the inner chamber for the purpose of holding a thermometer. The door is a sliding one, and made of copper or glass. The lead is about $\frac{1}{16}$ " thick, and weighs 6 lbs. to the square foot. The weight of such an apparatus is 30 lbs, and its cost (labour excluded) about 15s. All joints coming in contact with the acid,

should be of lead, *i.e.*, should be fused together by means of the hydrogen blowpipe.

For fear of destroying the lead too quickly, it is not advisable to use the acid stronger than 1.74 sp. gr., boiling at 200° C. (*vide* Dalton's tables). My personal experience lies within the limits of a few trials, made with an acid of 1.55 sp. gr., boiling at 150°. Four years ago, however, I had such an air-bath made for Dr. Völcker, who has been using it ever since for maintaining a constant temperature of 150°. On his authority I am permitted to state, "that the apparatus has given every satisfaction, and that the bottom only required renewing after an almost daily use of three years."

If the acid has once been brought to the desired boiling-point, the management of the apparatus demands no further care than to light a gas-lamp of such a power underneath it, that the steam of the boiling acid rises to about the middle of the worm. This limit, recognisable by touch, will eventually rise or fall in harmony with a more or less rapid ebullition produced by any accidental increase or decrease of the flame. It is better to have the worm removed from the heated atmosphere over the air-bath to a cooler one, or replaced (for the same reason) by a long condensing tube of lead or glass, either upright or slanting. This tube need not be a fixture, but may be fitted into a projecting and conical neck in the top of the air-bath. For obvious reasons such a tube may be recommended as a convenient appendage to the ordinary water-bath.