

find no danger ahead in respect of the quantity of human food which may be produced.

Only the novelist might be able, by the aid of an unfettered imagination, to say how many human beings the United States alone will be able to feed in comfort. With the aid of scientific agriculture, with the help of the agricultural chemist we may safely say that a thousand million people will not so crowd our means of subsistence as to make Malthus more than a pleasing theorist. As I pointed out in my vice-presidential address at Buffalo, the death of humanity is not to come from starvation but from freezing, and many a geologic epoch will come and go before this planet dies of cold.

A NEW FORM OF AIR-BATH.¹

BY EWALD SAUER, PH.D.

IN a recent article on the prevalent forms of air-baths, H. Petersen shows² conclusively that the designs ordinarily in vogue, whether made from copper or from aluminum,³ are far removed from the ideal of such an apparatus. The deficiencies are chiefly in the direction of variable temperature and insufficient ventilation for the purpose of rapidly removing the liberated steam. The use of jacketed air-baths, as Soxhlet's apparatus,⁴ while providing for constant temperature, limits the range of temperature to the boiling points of the liquids employed, and is subject also to limitations in size.

In order to obviate these difficulties, I have designed an air-bath, which while resembling externally the ordinary forms, differs from them in a few essential points. The main feature is the introduction of two bottoms which are connected with each other by several open tubes. These two bottoms are also joined together in the front and in the rear, while on the sides the space is open. A funnel-shaped opening in the center of the lower bottom allows the flame of an ordinary burner to freely

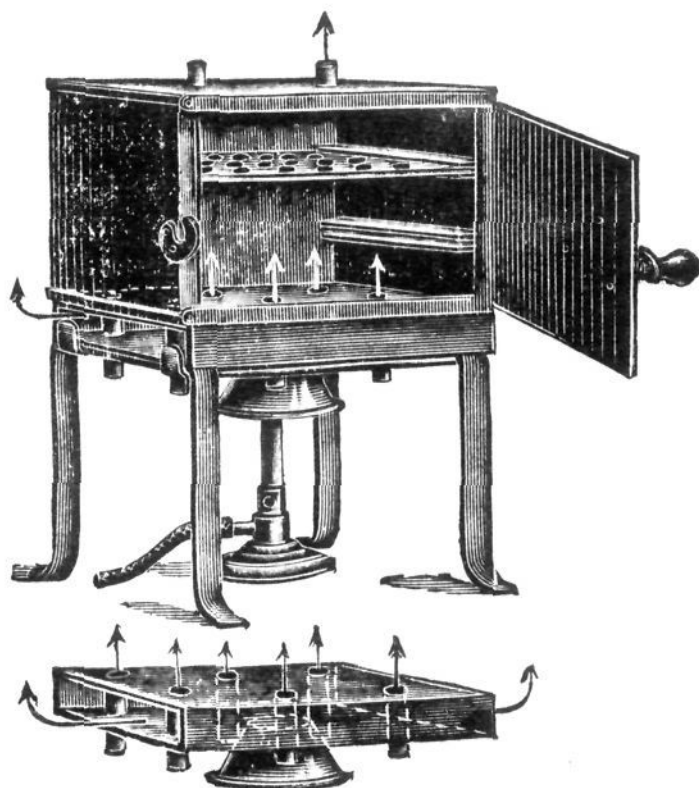
¹ Read before the Cincinnati Section, Oct. 14, 1893.

² *Ztschr. angew. Chem.*, 1892, 36.

³ *Ber. d. chem. Ges.*, 1892, 3637-40.

⁴ *Ztschr. angew. Chem.*, 1891, 363-68.

play on the lower surface of the upper or true bottom of the bath.



By means of this disposition the flame and the heated air current pass between the two bottoms about the series of connecting tubes, and issue on both sides. As a result, not only is the upper bottom heated, but also the series of tubes, while through the latter a current of hot air possessing the temperature of the upper bottom enters the interior of the bath. This hot current does double duty. In the first place it maintains a constant temperature in the bath; in the second, it effects a rapid removal of the aqueous vapor, which would be liberated as usual by the simple external heating.

That this device enables the chemist to secure the two desiderata of a constant temperature throughout the interior of the bath, and quick evaporation, is evident from the following tables of experimental results :

TABLE I.

Force of Bunsen burner flame.	Temperature upper part of air-bath, degrees.	Temperature lower part of air-bath, degrees.
1	220	215
$\frac{1}{2}$	128	127.5
	104.5	104.5
$\frac{1}{4}$	83.5	83

The differences noted above are largely due to the different lengths of the mercury column of the thermometer enclosed in the heated space.

TABLE 2.

Charge.	Temperature when empty.	Lowest temperature observed.	Temperature at close of evaporation.	Duration, minutes.	Grams of water evaporated.	Remarks.
5 grams asbestos and 10 grams water in a glass dish.....	124.5°	111°	120°	15	10	Several experiments with uniform results showed that the location of the charge in the bath did not affect the time required.
	118.5°	111°	115°	40	10	
10 grams water in an aluminum dish....	124°	111°	114°	14	10	Several experiments showed conclusively that as soon as the water was completely evaporated the temperature returned rapidly to that indicated at the beginning.
	103°	96°	102°	14	10	
5 grams milk and 5 grams pumice stone in an aluminum dish....	100.5°	92°	95°	12	5	Slight darkening of the residue.
	85°	82°	85°	15	5	

The end of the operation is readily recognized by the fact that no moisture issues from the upper openings (indicated by an arrow in the diagrams), *i. e.*, a cold beaker held over the openings is not dimmed.

These new air-baths are manufactured from both copper and aluminum by Max Kaehler & Martini, 50 Wilhelmstrasse, Berlin.