Hydrogen of approximately the same purity (99.97 per cent hydrogen) was prepared in the same Kipp from J. T. Baker's "C. P." zinc said to contain a trace of arsenic and antimony.

SUMMARY

A generator is described with which hydrogen containing not more than 1 part in 10,000 of impurities can be prepared from zinc and acid. Methods of testing for contaminating gases are described. The relation between the volume of gas generated and purity of the product is given by an equation which was verified experimentally.

BUREAU OF STANDARDS
WASHINGTON, D. C.

AN APPARATUS FOR RAPID GASTRIC ANALYSIS TOGETHER WITH A METHOD FOR THE PRESERVATION OF STARCH SOLUTION

By RAYMOND J. MILLER

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Considerable of the success accomplished along the line of gastric investigation conducted at the Jefferson Medical College recently is due to an apparatus designed by one of the members of the research staff, the author of this contribution. With the aid of this apparatus the manipulation of different solutions used in the several analyses has been shortened. The apparatus demonstrates its real value not in the handling of one case for analysis but rather when three or more are to be run.

FIG. 1

a—Alkali Burette	d—Syphon Device (Starch)
b—Thiosulfate Burette	e—Formation Reservoir
c—Automatic Pipette	f—Starch Solution

In gastric analysis as conducted in this laboratory the following determinations are considered of most importance:

- 1—Total Acidity: Titration with $N/100$ potassium hydroxide.
- 2—Free Acidity (Sahli Method): Titration with $N/100$ sodium thiosulfate, finishing with starch solution.
- 3—Formol Titration or Amino Acid Nitrogen Complex: Addition of neutral formalin and titrating with $N/100$ potassium hydroxide.

The apparatus is designed to meet the requirements for these three determinations.

APPARATUS

To set up the apparatus the following material is necessary:

- 1—Double burette stand.
- 2—Two certified burettes, 30 cc. capacity, graduated to 0.05 cc.
- 3—Capillary glass tubing, 1 to 2 mm. inner diameter.
- 4—Four glass T tubes: Three, inner diameter 3 mm. One, inner diameter 4 mm.
- 5—Red rubber tubing, inner diameters of 1 to 2 mm. and also 4 mm.
- 6—Pinchcocks, three plain and one special two-way cock.
- 7—Adhesive tape.

Fig. 1 shows the apparatus as completed and in running order in the laboratory. The burette on the right is connected

to the alkali reservoir, that on the left to the thiosulfate. At the top of the burettes is placed an arrangement which is shown in detail in Fig. 2. Near the base of the burette stand two devices will be observed. The one on the right leading to the tip of the alkali burette is an automatic pipette used in the formol titration, and is shown in detail in Fig. 3. The attachment on the left leading to the tip of the thiosulfate burette is an ordinary gravity device for the rapid addition of starch solution.

FIG. 2

Fig. 2 illustrates the overhead arrangement whereby the burette can be filled by suction and when the same is released any excess solution drawn over is immediately withdrawn back into the reservoir, leaving the burette reading 0.00 cc.

Fig. 3 shows the automatic pipette which, as soon as its charge is delivered, automatically fills up to approximately its former level and is again ready to be discharged. The principle upon which this device depends is a two-way pinchcock as illustrated at A, Fig. 3. This type pinchcock was designed by another author and reported some time since.

Very little has been said in regard to the assembling of material for the several devices as it has been taken for granted that the figures are self-explanatory. Perhaps but one thing needs an explanation and that is the purpose of the adhesive tape. It will be observed in Fig. 1 that the automatic pipette *c* and the starch

dropping device *d* are attached directly to the up-right support of the burette stand. Adhesive tape was found to be the best means of fastening these devices to the support.

STARCH SOLUTION

The delicacy of starch solution as an indicator for iodimetric and thiosulfate titrations is well known. Its rapid deterioration, mainly due to the presence of molds, has thus far required the observation of the following precautions in its preparation:

- 1—That the starch solution be made up fresh each day.
- 2—That the cold starch solution be placed in small bottles, sterilized for 2 hrs. on a water bath at 100°, closing with soft sterilized stoppers and keeping the individual bottles to be opened as the occasion required (Stokes).
- 3—That preservatives be added. Of these the following have been used: Mercuric iodide (Gastine); potassium chloride, saturated (Bang); potassium iodide; zinc chloride; chloroform; etc.

In pursuance of gastric investigations in the department of physiological chemistry of the Jefferson

Medical College, the problem of preparing a starch solution which would remain intact over a considerable period of time with as little addition of foreign material as possible was studied by the author. As a result the following procedure was developed for use in the laboratory in connection with the determination of free acidity of gastric juice by the Sahli method.

Rub up in a mortar, with sufficient cold distilled water to form a paste, 10 g. of soluble starch (Lintner). Boil 2 l. of distilled water for 15 min. To approxi-

mately 750 cc. of the boiling water add the starch paste and stir thoroughly. Continue heating for 10 min. Place the hot solution in a clean graduated cylinder and make up to a liter with the remainder of the boiling water.

Rinse the flask to be used as a reservoir with scalding water as well as the siphon device (see Fig. 1).

Immediately place the hot starch solution in the reservoir, 1 cc. of toluol may or may not be added. If it is added, it is well to shake or stir the solution throughout. Immediately float a layer of liquid

petrolatum, $\frac{1}{4}$ in. deep, over the surface of the hot solution. Place the short leg of the siphon device in position within the reservoir. Carefully charge the siphon with the pinchcock open. When so charged the siphon is in running order until the reservoir becomes practically "dry."

The addition of toluol to the solution, it is believed, can readily be omitted and is added only to ensure a preservation of the solution in the siphon during the first usage of the starch solution.

In Fig. 1 it will be noticed that the end of the short leg of the siphon is bent upward. The object of this is to avoid disturbance of the layer of residual dextrin (Blake) which generally sediments at the end of 24 hrs. standing.

This starch solution used in this apparatus has been found to give no trace of reddish coloration with iodine for a period of 6 mos. A further study of the solution was rendered impossible because of the exhaustion of the reservoir supply. Aside from the saving of valuable time by using the above procedure, the fact that starch solution having practically the same properties as a freshly prepared one with little or no addition of foreign material, was always at hand, was of great importance.

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RAPID AND CONVENIENT METHOD FOR THE PREPARATION OF CONDUCTIVITY WATER¹

By C. B. CLEVENGER

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The frequent and increasing need for good conductivity water makes it highly desirable to have a convenient method for its preparation. A description of such a method is especially important because some of the procedures in use are unsatisfactory in one or more respects.

The apparatus used in this laboratory is a modification of the one first described by Bourdillon.² It was originally used here by Dr. S. F. Acree but without all of the present features. The improvements and the non-acquaintance of many chemists with this still give occasion for this publication.

According to Kendall,³ with the exception of some high dilution experiments noted by himself⁴ and Washburn,⁵ the purest distilled water, after exposure to the atmosphere, has a conductivity which is practically accounted for by the carbon dioxide that is absorbed under atmospheric conditions. Kendall found that the conductivity values of water in equilibrium with the air ranged from 0.75×10^{-6} to 0.90×10^{-6} reciprocal ohms at 25° C. It is, therefore, futile to prepare and use water having lower values than the above unless it is carefully protected from the carbon dioxide of the air at all times. It is only for conductivity measurements of the greatest precision that

¹ Published by permission of the Director of the Wisconsin Agricultural Experiment Station.

² *Trans. J. Chem. Soc.*, **103** (1913), 791.

³ *J. Am. Chem. Soc.*, **38** (1916), 1480, 2460.

⁴ *Ibid.*, **39** (1917), 7.

⁵ *Ibid.*, **40** (1918), 106.

FIG. 3