has been noted since the change described above, over six years ago.

The whole installation is supported on angle iron, painted with a rust-proof paint and may be inspected by members of the Institute any time.

COLLEGE OF THE CITY OF NEW YORK

NEW APPARATUS FOR DETERMINATION OF HYDROGEN SULFIDE IN WATER—PART I

By GEO. B. FRANKFORTER

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Hydrogen sulfide has been known with absolute certainty since the 15th century. It was first recognized in natural water under the name "sulfur vapors" and the water was known as "sulfur water." It was known to Paracelsus who studied sulfur carefully and used it extensively in his medical work. He must have known of its presence in certain natural waters.

Scheele, however, was the first to give exact knowledge concerning its properties. He designated it as a compound of sulfur, phlogiston and heat, and made an effort to determine the amount of sulfur in the gas.

Since Berthollet's¹ classical work on its composition many methods have been employed for its quantitative determination. In general the methods of analysis are grouped into two classes, gravimetric and volumetric. The first exact method for its determination was given by Bunsen,² in which he used iodine. Bunsen recognized some of the difficulties in the method, for he states that the quantity of iodine used must be small for good results. He also noticed for the first time that hydrogen sulfide decomposes very readily so that the estimation is often not very exact. Since Bunsen's time the iodine or iodometric method has been modified so as to meet the different conditions under which the gas occurs. For instance, special apparatus and special modifications in the iodine method are necessary for its determination in illuminating gas, and special apparatus is necessary or at least highly desirable for its rapid determination in natural water as it decomposes when exposed to the air and light.

My attention was called to the fact that water from a sulfur spring, after it had stood for a day or so in a clear glass bottle—whether directly exposed to air and light or not—showed but a trace of gas, although it was present in the water in appreciable quantities when the sample was taken. I was aware that the gas, when dissolved in water containing air, readily decomposes liberating free sulfur, but I could hardly believe that the sulfur water hermetically sealed would change very rapidly if the water contained dissolved air.

In the case of a spring water containing approximately 1 cc. per liter, the gas was entirely dissociated in six hours after the sample had been taken from the spring. So rapid was the dissociation in this particular spring that it was quite impossible to obtain concordant results without making the analysis right at the spring.

¹ *Ann. chim.*, 1791.

² *Ann. Chem. Pharm.*, 86, 265.

In order to do this, however, it was found necessary to carry considerable apparatus along, making the whole method quite unsatisfactory. I therefore experimented with a number of different forms of apparatus which could be carried around without difficulty, and which would simplify the process in such a way that it might be used for field service. After trying out a number of forms the two following were found to give perfectly satisfactory results.

Figure I consists of a flask, "A", which holds exactly 500 cc. of water when filled to "G". "C" is a burette with a stopper, "D," connected with flask "A" by means of a three-way cock, "B". "F" is a funnel tube also connected with "A" by means of a three-way cock "E".

Manipulation is as follows: The three-way cock "E" is turned so that the opening in the end of the cock is directly connected with "A." "B" is likewise

turned so that the opening in the end of the cock is connected with "A." The flask is then thrust into the water to be examined. Water enters "E" forcing the air out through "B" until the flask is full. On removing the flask, "E" acts as a siphon allowing the water to run out to the level "G." By this means exactly 500 cc. of water can be measured. Cock "E" is now turned a quarter way around, connecting funnel "F" with "A." One cc. of starch solution is introduced, "E" is closed and the water is titrated with standard iodine solution from burette "C." From the amount of iodine solution used the quantity of hydrogen sulfide may be calculated according to the following equation:

In rapid work, and especially in field work, it is very

essential that the quantity of gas be read off directly without calculations. In working out this method, therefore, a standard solution was so prepared that 1 cc. of the iodine solution would be equivalent to exactly 1 cc. of hydrogen sulfide gas, under normal conditions.

Figure II is the form which was finally adopted as giving most satisfactory results. It consists of a bulb, "A," which acts as the receiver, and which is connected at the bottom with a tube, "I," which extends up into the bulb so that when cock "H" is open bulb "A" will hold a definite quantity of water. The quantity which "A" will hold when exactly perpendicular is quite constant, at least enough for all ordinary purposes.

"B" is a stopcock connecting "A" with burette "C." "F" is an outlet necessary for filling the flask and for introducing starch solution as an indicator. "D" is a stopcock on the upper end of the burette connected with a funnel tube, "E." The latter is necessary for filling the burette and also for enclosing the standard iodine solution so that the apparatus may be shaken or even turned upside down without losing any of the solution.

The manipulation is as follows: Cocks "H" and "G" are opened, the apparatus is grasped by the burette and "A" is thrust into the water to be examined and held there until the bulb is full. It is

then withdrawn, held perpendicular until the water is on a level with the top of the tube "I." The quantity of water is therefore automatically measured, the tube being so adjusted that it measures 250 cc. Stopcock "H" is then closed and 1 cc. of starch solution introduced through "F." "G" is then closed and the water titrated with standard iodine solution from burette "C".

Calculations were made in the same manner as was described above for Fig. I.

With either of these forms, a sample of water may be taken directly from the spring or source of supply and a determination of hydrogen sulfide made in less than one minute.

As has already been stated, it was found that hydrogen sulfide decomposed much more readily than had been supposed. In some cases decomposition began in a few moments after taking the sample, as was indicated by opalescence due to free sulfur.

In order to test out the above forms of apparatus a great number of analyses were made. In addition to testing the apparatus, data concerning the rate of decomposition were obtained. Several series of experiments extending over a wide range I hope may appear in THIS JOURNAL in the near future.

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ADDRESSES

THE PRESENT PATENT SITUATION¹

By MAXIMILIAN TOCH

On February 1, 1913, the new rules for procedure in patent litigation became effective, and after fifteen months a calm review of the benefits derived from the new rules is opportune. To those who are unacquainted with these new rules let me state briefly that the old custom of patent litigation was in taking of testimony before a Master in the office of either the defendant's or the plaintiff's attorney, and this Master came in to swear in each new witness, but never remained, and even if he did remain he had no authority to decide upon the propriety of the questions asked. The testimony was taken down invariably in long-hand. The costs were appalling, for the fees of a patent attorney are from \$50 to \$100 per day, the fees of the experts are the same, the cost of printing or typewriting is very great, and although it has often been said that no poor man can litigate a patent I know that no man in medium circumstances can fight one either, for in six months \$20,000 can disappear faster than ice under the midsummer sun.

The new rules in themselves are excellent. They provide that the testimony shall be taken in open court before a judge; they provide that the testimony shall be taken in shorthand, and a very important case can be finished in nineteen working days and even less; and if a Judge is not overwhelmed nor overburdened with work he can render a decision within a month thereafter. An excellent feature of the new rules is that upon petition the opposing experts will be required, within a certain number of days after the case has been put at issue, to file their expert opinions in the form of an affidavit, so that each side will have these affidavits before them as a basis for preparing for cross-examination of the expert witnesses in open court, and to enable them to see each other's positions, as far as these affidavits

will disclose them, in order to enable them to produce such fact witnesses as they may deem it necessary to produce to meet the attacks which the affidavits may indicate will arise. This, to a considerable extent, relieves the new practice from the surprises that may be sprung at the trial, and which, the nature of surprises in the expert side of the case would make it almost impossible for the opposing party to meet, since such matters frequently require experimentation. The affidavit of the complainant's expert witness, of course, is required to be put in first, and a certain number of days afterwards, that of defendant's expert. The cross-examination of the experts is conducted in open court.

My plaint is that we are suffering under the régime of a parsimonious republic. In the great Southern District of New York there are, at this writing, but four judges who are available for patent work: one of them has resigned, one of them is on leave in Europe, and the other two are staggering under a mass of litigation. Nor is it to be assumed by any means that a Federal Judge is a patent Judge only, for in one day I have heard motions on questions of immigration, bankruptcy, interstate business relations, injunctions in matters already decided, trademarks, copyrights, and patents; so that a Judge must needs be keen of eye and ear, clear of mind, and in the finest physical and mental condition possible to withstand the terrific onslaughts that are made upon what should be otherwise a man of mental equipoise.

In the parsimony of our republic the Attorney-General of the United States has decided that the vacancy which exists in this district shall not be filled with a new Judge, for the \$7500 meagre and insignificant salary can be saved if a Judge from some other district will occasionally come down and sit in the place of the one who resigned. In the meantime, infringements go on, injustice is meted out right and left, decisions cannot be had on cases pending on account of the overwhelming amount of work which crowds the dockets—all because our parsimonious, and,

¹ Presented at the 6th Semi-annual Meeting of the American Institute of Chemical Engineers, Troy, New York, June 17-20, 1914.