

the use of a constant volume of a solution, as of a caustic alkali, knows the amount of time and trouble required for measuring out the reagent used, and the generally unsatisfactory nature of such apparatus for this purpose, as that provided with glass stop-cocks. Therefore, the following described automatic pipette was designed for the rapid measurement of the alkali hydroxide and sulphide solution used in the Kjeldahl method for nitrogen, but may be adapted to other uses as well.

The body (A) of the pipette is made of a section of wide glass tubing (the neck of a flask serves well), provided at the bottom with a rubber stopper perforated with two large holes; into each of these holes is fitted a short piece of glass tubing, one of which is

constructed and when properly made will deliver a volume of, say 50 cc., constant to within one-half cc.

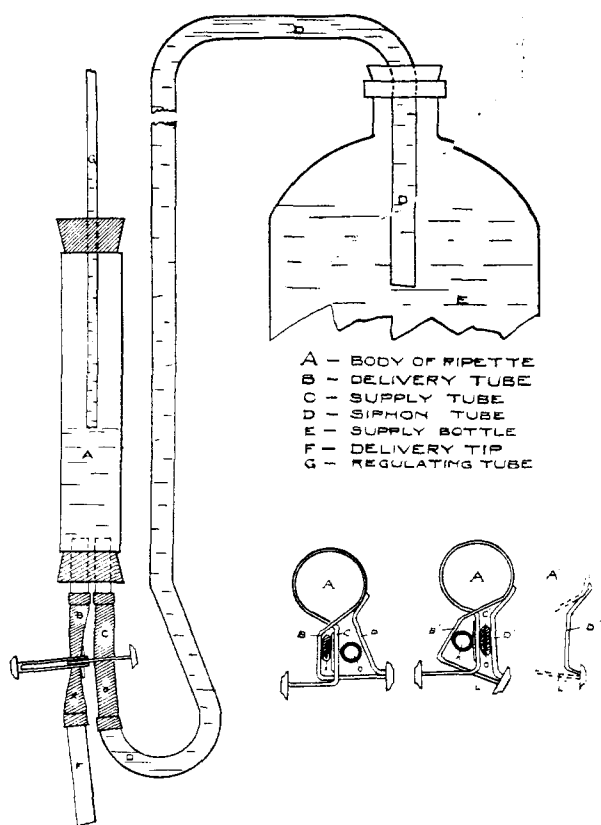
The writers desire to acknowledge their indebtedness to Mr. J. W. Ames, chief of the Chemistry Department of this Station, for his kindness in giving this device a practical trial.

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APPARATUS FOR RECEIVING AND MEASURING OIL OR NAPHTHA DISTILLED WITH STEAM.

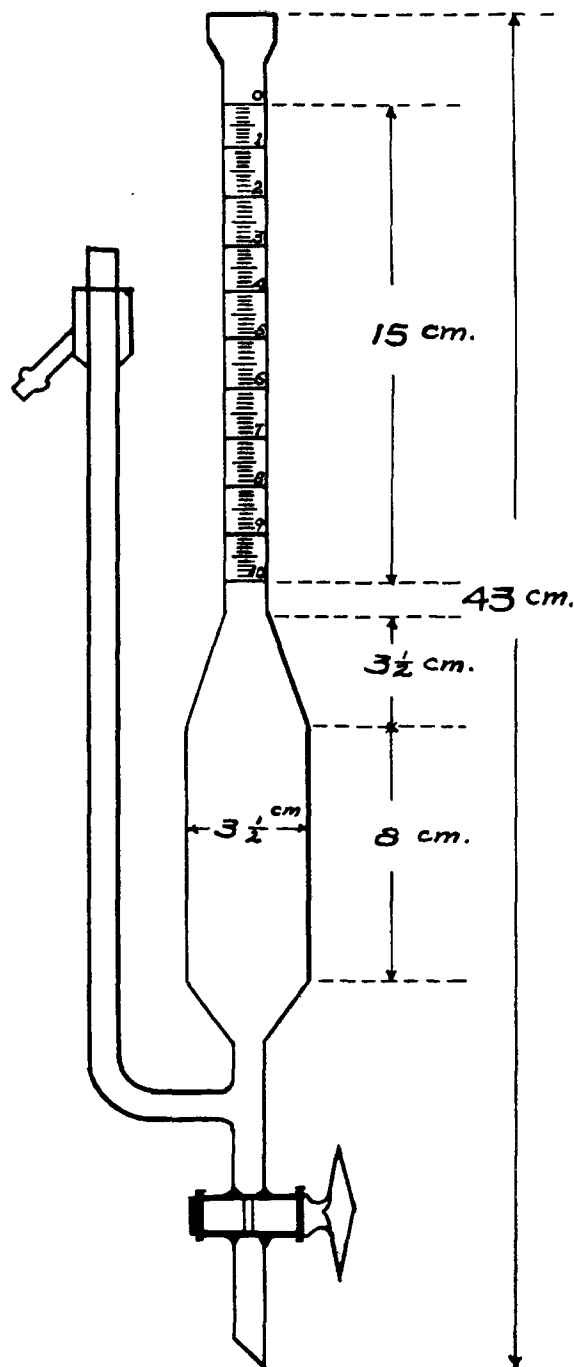
By O. H. WURSTER.

The naphtha content of a certain class of soaps and soap powders and the "oil" content of paraffine



connected to a siphon tube (D) for filling, bent as shown in the drawing, the other to a glass tip (F) for delivery, by suitable lengths (B) and (C) of rubber tubing. The top of the pipette is closed by a well fitting rubber stopper, carrying a single glass tube (G) of small diameter, which must be long enough to extend well above the level of the liquid in the supply bottle (E); by moving this tube in the stopper, the volume delivered by the pipette can be regulated.

A piece of strong steel wire, shaped as shown in drawing D", is soldered or preferably brazed securely to a heavy pinchcock of the common type; the completed article is shown in A and A'. This pinchcock is placed on the rubber tubes of the pipette so that tube X, for delivery, is normally compressed, and the pipette fills; on working the pinch-cock, O is closed, X for delivery opened, and the pipette is emptied. The apparatus is easily and cheaply con-



wax are frequently determined by distilling the naphtha or oil with steam. The distillation may cover a period of several hours. To facilitate the collection of condensed oil and water, and the measurement of the oil, the graduated receiver shown was designed. The naphtha collects in the calibrated

portion of the tube, and its volume can be read at any time. The water settles out and overflows automatically.

LABORATORY OF
M. WERK COMPANY,
CINCINNATI, Aug., 1911.

ADDRESSES.

SOME PROBLEMS IN CHEMICAL ENGINEERING PRACTICE.¹

By DR. F. W. FRERICHS.

Received Aug. 23, 1911.

The address, which I have prepared, comprises the development of three problems which actually have come under my observation. They were selected with a view of demonstrating the variety of questions, the solution of which may be expected from chemical engineers, the detail work which is necessary, and the care and training which are required for their successful solution.

The first problem solves the extraction of bismuth from ores. In this problem, the principal work is research, to develop the process which could be applied to the economical treatment of large quantities of ore. After the process was developed the translation into practice was comparatively simple and safe to predict.

The second problem treats the transplanting of a process from Europe to the United States and will prove that a process which is profitable in one location may be a failure under different conditions.

In the third problem the details of the process were known, and it was only required to construct complicated apparatus to carry out the process on a given scale.

In my opinion, problems similar to those represented could be used successfully for object studies in post-graduate work of chemical engineers, but it is necessary that the work be conducted by teachers, who themselves master the subjects, and who master them to such an extent that they readily would be willing to invest money of their own in the installment of plants, for which the research might be the foundation.

EXTRACTION OF BISMUTH FROM CARBONACEOUS ORES.

Bismuth is not of very rare occurrence and it can be produced greatly in excess of the consumption, which, in 1910, was about 200,000 pounds for the United States. The metal is used almost exclusively for medicinal preparations and its consumption does not materially vary with its price.

About ten years ago, being then a manufacturer of medicinal preparations, I looked for an independent supply of bismuth and turned my attention to Colorado, where I understood bismuth ores had been found. Personally going to Colorado, I examined the field but found everybody very reluctant to give information about bismuth ores. It was known that several lots had been mined in recent years, but there was

no market for it in the U. S., the smelters accepting it only for gold and silver values, charging a penalty for bismuth, since it deteriorated the lead, which was added in smelting the ores.

By the efforts of an assayer in Leadville, these lots of ores had been sold to a firm in England, where they were shipped by way of Galveston. It seemed to be a condition of the sale that the sellers were kept to secrecy and were not to sell subsequent lots to anybody else but the purchasers of the ore. If they should sell to any other party, contrary to the understanding, the buyers threatened not to buy any more ore from them.

This being the case, I could not secure any large lot of ore, but obtained a sample of several hundred pounds to make experiments.

The sample was a siliceous ore, had the appearance of yellow clay and was typical of ores carrying about one oz. of gold, 15 ozs. of silver, 5 per cent. bismuth, and 5 per cent. lead in the dry ore. A sample of the dry ore, finely powdered and treated with diluted muriatic acid, gave up all of its bismuth, except about 2 per cent, and these 2 per cent could not be extracted by concentrated muriatic acid. The mixture of ore with diluted muriatic acid was exceedingly slimy and did not readily filter nor did it settle.

Another sample of the ore was ignited in the open air for several hours, was finely powdered and would then give up all of its bismuth to diluted muriatic acid. The mixture was not slimy and filtered and settled fairly well. The amount of bismuth extracted in this manner from samples weighing from 100 to 1,000 grams corresponded well with the quantity of bismuth found by analysis in the original ore.

Analyses and extractions were repeated many times with ores from as many localities as I could get hold of, until I had full confidence in my analyses.

Being thus convinced that all the bismuth indicated by analyses of the ore could be extracted, and knowing that I could sell the gold and silver values in the tailings to one of the smelters, I believed myself to be ready to purchase a larger lot of ore, if opportunity should offer.

This opportunity presented itself sooner than I expected. A mine in which previously no bismuth ore had been found was nearing in its development an adjoining property in which bismuth ore had occurred and this mine had struck bismuth ore. The adjoining mine had produced several lots, running from 5 per cent. to 15 per cent. bismuth, 1 to 2 oz. of gold, and 5 to 10 oz. of silver. It seemed probable, but not certain, that a similar grade of ore could be

¹ Address read at the semi-annual meeting of the American Institute of Chemical Engineers, at Chicago, Ill., June 21, 1911.