NEW APPARATUS IN WATER ANALYSIS.

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It is the purpose of the writers of this paper to present some new forms of apparatus which have been devised for use in the Chemical Laboratory of the Filtration Testing Station in connection with the improvement of the water supply of the City of Philadelphia.

I.

The first apparatus described is used in the determination of the free and albuminoid ammonia, according to the method of Wanklyn, consisting of a battery of six stills as shown in Fig. 1.

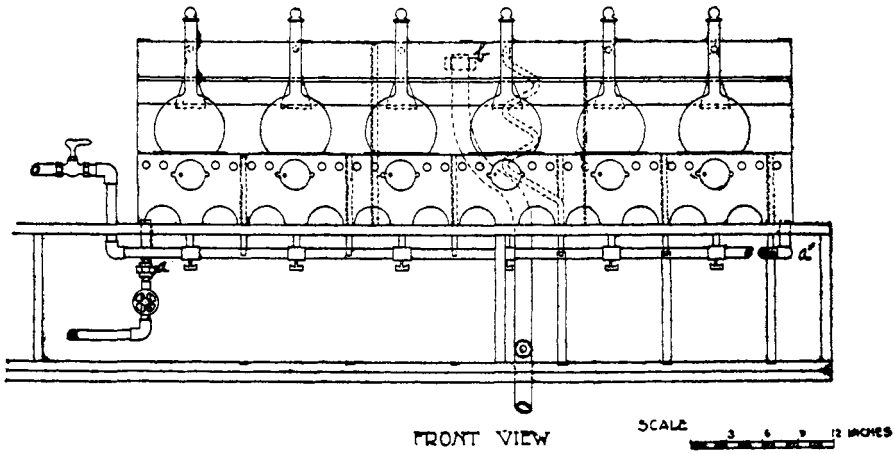

Fig. 1.

The flasks have side necks and ground glass stoppers, the capacity of the bulb being about 1800 cc. They are supported upon a burner shield constructed of galvanized sheet iron, the flasks resting upon wire gauze in holes 4⅜ inches in diameter. The burners are of a modified Fletcher type and are governed by individual cocks and a valve connected with the general supply. The flasks are united with the block tin worms by the side necks, which

are provided with rubber tubing—and extend into the tubes some distance beyond the point of contact of the rubber with the block tin (see Fig. 2), another piece of tubing overlapping this joint making a tight connection. The worms are ⅜ inch internal and ½ inch external diameter, coiled in a helix 2½ inch internal diameter with a 4½ inch pitch, being expanded at the entrance to

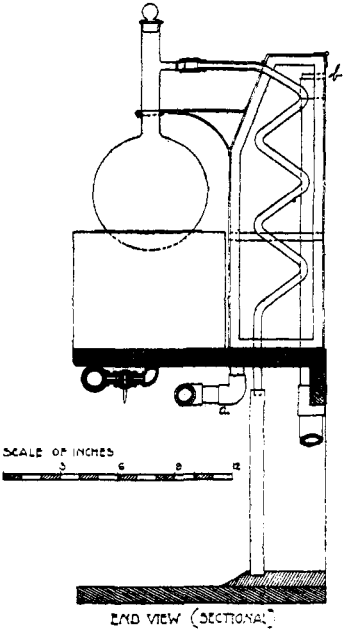

Fig. 2.

allow for the connection with the side necks of the flasks, and contracted for 1 inch at the outlets. The condenser is made of cold rolled sheet copper, 24 oz. per square foot, braced on the inside and provided with a lid hinged at the back and overlapping the front. The water is supplied at the extreme ends *a* and *a'* and overflows at the top *b* thus insuring thorough circulation. The whole system is supported upon a wooden shelf, allowing the operator ample space for handling the distillates, the Nessler tubes resting in sockets on a wooden slab upon the table. The salient features of this apparatus appear in its compactness, the manner

of connecting the flasks with the tin condensing worms, and the ground glass stoppers avoiding disconnection with the condensing tubes for the introduction of the alkaline permanganate prior to liberating the albuminoid ammonia.

Before making a determination, the system is cleansed by boiling off 50 cc. of distillate from 500 cc. of pure water rendered alkaline with sodium carbonate. 500 cc. of the sample are introduced and the determination made in the usual manner.

II.

The second apparatus to which attention is directed is shown in Fig. 3 and is used in collecting samples from reservoirs or rivers

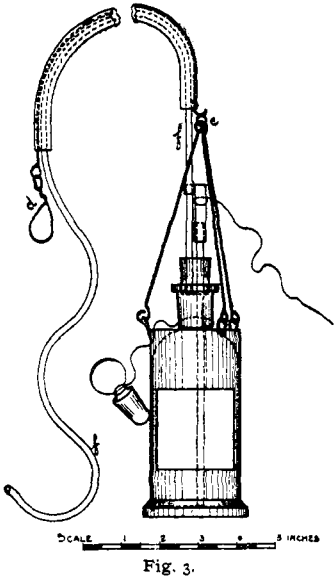

Fig. 3.

for the determination of the dissolved oxygen or carbon dioxide. It comprises a copper case, weighted at the base with sheet lead, holding securely a calibrated bottle of about 250 cc. capacity. This is supported by three copper wires joined at *c* and is suspended by the copper wire *d*. A glass tube passes through one of the holes of the rubber stopper nearly to the bottom of the bottle for the inlet of water; through the other a tube passes for the exit

of air; the former is supplied with a cap and the latter with rubber tubing which reaches to the surface. The wire *d* and the rubber tubing are surrounded by a ¼ inch rubber tube to prevent them from becoming entangled while the sample is being collected. The bottle is lowered until the required depth is reached, when the cap is removed by means of the string attached, allowing the water to enter. The apparatus is kept submerged until air is no longer expelled from the tube *f*, then the sample is raised to the surface, the wires disconnected and the rubber stopper removed, allowing the water remaining in the rubber tube *f* to fill the bottle to overflowing. The glass stopper attached is then inserted, the bottle taken from the case, the sample being ready for analysis.

III.

In the third division of our paper, a method is described for the determination of suspended matter. After an exhaustive study of various methods employed, we have found that the most satisfactory results can be obtained by filtering the water through asbestos.

Long fiber asbestos is soaked several days in a large quantity of clear (not distilled) water, which is frequently decanted and fresh portions are added. At the bottom of a Royal Meissen Gooch crucible, a layer of 3 mm. gravel is spread, this having been previously washed. A small quantity of asbestos is next placed on the gravel; it is necessary to separate the fibers by suspending it in water, as a good filter cannot be made by using a compact mass. After adding the asbestos, the crucible is placed to the lips and the bulk of the water held by the fibers blown out. There should now remain a perfect mat of asbestos covering the gravel and upon this the filter proper is constructed. More fiber is now added, in small portions, tapping the crucible lightly after each addition. When it is filled the forefinger is used to mold the asbestos around the sides of the crucible. The major portion of the water is now expelled by blowing, when the entire inner surface of the crucible should be covered with a compact asbestos lining. Any imperfections found in this surface necessitates reconstruction.

A perforated porcelain thimble is placed inside of the partially formed filter and more asbestos packed around the intervening space, nearly filling the crucible (see Fig. 4). Then the filter is

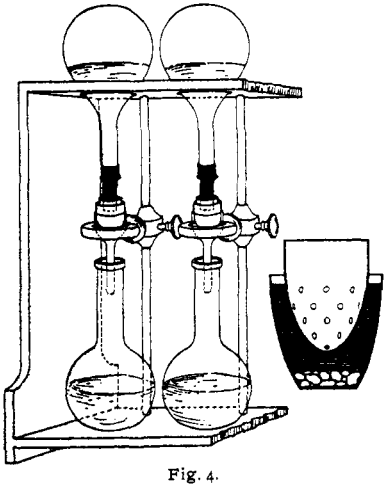

Fig. 4.

ready to be dried and weighed; it is necessary to heat for five hours at 110° C., in order to remove all the moisture, after which it is cooled in a desiccator and weighed rapidly, for the dissolved solids remaining in the filter may render it hygroscopic.

The method is to place the tared filter in the rack as indicated in the drawing, and to supply from a liter flask 1000 cc. of the sample of water for the determination. Loss is prevented while inverting the flask by compressing the rubber tubing at the neck, and by making use of the principle of the pneumatic trough the sample is fed automatically, part of the filtrate being used to wash down the particles adhering to the sides of the flask, again inverting and collecting the same upon the filter.

The crucible containing the suspended matter is dried and weighed under the same conditions as when prepared for use, the difference in weight representing the solid matter in suspension. In working with water carrying an unknown amount of dissolved solids the filter is first washed with some of that water and tared. This form of filter may be used repeatedly before it becomes inefficient, and it has been found convenient to use a battery of six units.