stations north of New Orleans, even though such waters have what would ordinarily be considered a low content of alkali. Foaming is a common difficulty after reaching the region where the intake is from the river.

The question as to what condition actually causes foaming is of great importance. Whether finely divided particles in suspension are responsible, may not now be an element in the case, for it may be argued that boilers are never free from this condition, but it is entirely conceivable that the waters of a division might receive such efficient treatment, both chemical and mechanical, as to eliminate all of the suspended matter.

The problems connected with railway service are altogether different, therefore, from those that attend the use of stationary boilers. They involve no very profound chemical principles, and perhaps on that account have received little attention; but the industrial importance of the matter is very great, and, if for no other reason, it may perhaps be worth mentioning as an illustration of an improved and more healthy state of affairs in the industrial world, which shows itself in giving attention to wastes and greater care in small economies. When we acquire, as there are many indications that we are attempting, the habit of looking after all possible wastes and losses, from principle, the profits are more sure to look out for themselves.

UNIVERSITY OF ILLINOIS,
URBANA, ILL.

A RAPID METHOD OF BABBITT METAL ANALYSIS.[1]

BY H. YOCKEY.

Received February 23, 1906.

THE following method of Babbitt metal analysis has been in use in this laboratory for eight or nine months, and has proved to be very satisfactory. While the principles and reactions involved are all old and well established, I have never been able to find them in print, put together in this manner and used for this purpose. The complete analysis requires from three to three and one-half hours.

Babbitt and bearing metals usually contain lead, antimony, tin and copper. Small amounts of zinc and arsenic are some-

---

[1] Read at the March meeting of the Cincinnati Section of the American Chemical Society.

times found, but these are usually volatilized during the heating the metals receive before casting.

Weigh and treat, in a small beaker or casserole, 1 gram Babbitt metal filings or borings with 20 cc. of nitric acid (sp. gr. 1.42) and water (1:2). Place on the water-bath and cover with a watch-glass. When spattering ceases, wash spatterings from the glass back into the beaker, and evaporate to dryness. Then bake in an air-bath one hour at 120°. Attention is called to the baking of the oxides, as without baking results are low. Moisten well with concentrated nitric acid and add 30–40 cc. hot water and boil vigorously five minutes. Filter off the mixed oxides of tin and antimony, wash with hot water, dry and ignite in a porcelain crucible, using a few drops of concentrated nitric acid to oxidize any metal reduced in burning the filter. Weigh as $Sb_2O_4 + SnO_2$.[1]

Dilute the filtrate from the above to 250 cc. in a calibrated flask. Take out with a pipette 50 cc. Add 10 cc. of ammonia (1 part of ammonia, sp. gr. 0.9, to one part of water) and 6 cc. glacial acetic acid. Heat to incipient boiling and titrate the lead with a solution of ammonium molybdate (1 cc. = 0.01 gram lead) which has been standardized against pure lead dissolved in nitric acid. Use tannic acid (1 to 300) as indicator.

To the remaining 200 cc. of the solution add sodium carbonate until a precipitate forms, then add 1 or 2 cc. of ammonia. Stir well, and allow to settle; if copper is present, the well-known deep blue color of the copper-ammonium ion will be observed. Then titrate with standard solution of potassium cyanide until the color disappears. The lead carbonate and hydroxide present do not interfere.

While conducting the above, weigh out a fresh portion[2] of Babbitt metal, and determine the antimony by the method by Andrews as described by Walters and Apfelder.[3] One gram of filings is treated in a 150 cc. beaker with 1 gram potassium iodide, 40 cc. concentrated hydrochloric acid (sp. gr. 1.2) and 40 cc. of water. Boil gently one hour, and filter, washing the precipitate

---

[1] This precipitate may contain some copper, iron and phosphorus.—ED.

[2] This Journal, 17, 872. [Andrews advises that the antimony be heated with sulphur and determined as sulphide.—ED.]

[3] Ibid. 25, 635.

with hot dilute hydrochloric acid (1 : 10), then with hot water, finally once with alcohol. Treat a duplicate filter-paper in the same way, dry both at 100° C. one hour and weigh the precipitate as metallic antimony. Calculate antimony to Sb_2O_4, and subtract the same from the weight of mixed oxides of tin and antimony, giving the weight of SnO_2 from which tin is calculated.

Copper is usually present in Babbitt and bearing alloys in small amounts, seldom over 1 per cent., and a weak solution of potassium cyanide is used for titrating. One cc. KCN = 0.0025 gram copper.

Results obtained by this method:

SAMPLE NO. 1.

	1. Per cent.	2. Per cent.	3. Per cent.
Lead	78.47	78.60	78.54
Tin	12.09	12.06	12.06
Antimony	9.06	9.01	9.02
Copper	0.25	0.27	0.25
	99.87	99.94	99.87

Lead by $PbSO_4$ method = 78.55 per cent.

SAMPLE NO. 2.

	1. Per cent.	2. Per cent.	3. Per cent.
Lead	68.76	68.86	68.84
Tin	15.93	15.83	15.79
Antimony	15.02	15.10	15.04
Copper	0.14	0.14	0.14
	99.85	99.93	99.81

Lead by $PbSO_4$ method = 68.82 per cent.

NATIONAL LEAD COMPANY, CINCINNATI, OHIO.

A STUDY OF CERTAIN METHODS FOR DETERMINING TOTAL SOLUBLE BITUMEN IN PAVING MATERIAL.

BY S. AVERY AND R. CORR.

Received January 2, 1906.

THE present paper presents the results of a comparative study of some of the numerous methods proposed for the determination of bitumen, soluble in carbon bisulphide, in the finished surface of an asphalt pavement.