To the lateral arm is attached the rubber tube and pinch cock which supplies the pipette with the solution from the reservoir. The reservoir is either a common bottle, provided with a syphon, or an aspirator bottle. The higher the level of the reservoir above the tip of the pipette, the quicker the pipette will be filled.

In place of the glass cups used in the Stas pipette, I make use of the following arrangement to catch the overflow from the open end.

A large test tube is fitted with a cork with two holes. Through one the jet of the pipette is passed. One arm of a rather wide bent glass tube is inserted in the other hole. This is the drip tube, and is provided with a rubber tube to carry away the excess of solution.

It is easy to see the mode of action. When the pinch cock leading to the reservoir is opened, the solution enters and fills the pipette; the air escapes through the drip tube. When the solution is to be delivered, the lower cock is opened, and the fluid run out until the mark is reached; the air meanwhile enters by the drip tube, and for this reason care must be taken to have the drip tube as wide as possible, and not to allow the rubber drainage tube to dip beneath the fluid in the vessel it connects with.

The error due to reading the meniscus in a reverse position is easily corrected, and in many cases will be eliminated in standardizing the solutions.

I give the simplest form, and one readily made from easily available materials.

If one is somewhat expert in glass blowing, the end of the large test tube (or the wide tube used instead) can be drawn out and bent, so that its extremity can be left open for the admission of air. There is some advantage in this in case the volume of the pipette is large, but it is not necessary in every case.

ON THE ACTION OF COLD, CONCENTRATED SULPHURIC ACID, ON LEAD AND ITS ALLOYS.

By Lucius Pitkin.

Until quite recently it has been regarded as almost indisputable that the purer the lead, the less action would sulphuric acid have upon it. In opposition to this idea, a very interesting paper was presented by Mr. James Napier, before the Glasgow Philosophical Society, a full report of which can be found in the *Chemical News* for December, 1880.

Briefly abstracted it is as follows: Sulphuric acid was shipped in cases of sheet lead, all of which either bulged badly or burst. To ascertain the cause of this action, the acid, the lead, and the gas causing the pressure were analyzed.

The acid was of Sp. Gr. 1,842 and the following composition, H_2SO_4 99.78—SO_2 0.02—Pb SO_4 0.13—Ca SO_4 0.07.

The lead was of extraordinary purity, containing according to the analysis Pb 99.96—Cu. 0.04. The gas evolved was pure hydrogen.

Exposing a known surface of the lead to the action of cold concentrated sulphuric acid, gas was given off equivalent to 41 cubic inches per square foot lead exposed.

Another sample from a concentrating pan, (No. 1) of the same composition gave under similar circumstances, 16 cubic inches per square foot. A second sample of lead (No. 2) having a composition of Pb. 99.50 Cu. 0.08. Sb. 0.42 yielded only $\frac{1}{3}$ cubic inches per square foot.

As a basis for further experiments, Mr. Napier took a soft lead not analyzed, similar to No. 1, which averaging several determinations yielded 9.4 cubic inches per square foot. Calling this lead No. 3, the following alloys were made and yielded the following amounts of gas by the action of sulphuric acid.

I.	Lead No. 3, Sb.	99.25	0.25 cu. inch.
II.	Lead No. 3,	89.88	0.10 cu. inch.
	Cu.	0.39	
	Sb.	0.75	
III.	Lead No. 3,	99.63	1.42 cu. inch.
	Cu.	0.37	
IV.	Lead No. 3,	99.64	2 cu. inch.
	Zn.	.37	

The paper was discussed by the society, and the President in summing up, said the following points appeared proven:

1. Chemically pure lead was unsuitable for sulphuric acid evaporating pans.
2. Lead containing certain impurities, and especially zinc, was unsuitable.
3. Antimony seemed to render the lead more durable.

4. The subject required further investigation.

It is to this investigation that the remainder of this paper will be devoted.

The lead taken as a basis for the alloys which I have experimented upon, was a chemically pure lead made by Merck, of Darmstadt, and guaranteed by him. The method employed differed from that made use of by Napier, who measured the gas evolved from a known surface of lead.

In the following experiments, the action of the sulphuric acid was measured by the amount of lead or alloy converted into sulphate, which was ascertained by weighing the alloy before immersing in sulphuric acid, and after the action, cleansing from any adhering sulphate and reweighing.

In all forty (40) samples of lead and alloys of known composition were acted upon by the acid and the action measured. In some cases the results may appear anomalous, but not more so than the case reported by Napier, in which lead of the same composition gave off under similar circumstances, in one case 41 cubic inches per square foot, in the other only 16 cubic inches. In the making of the alloys, great care was taken to obtain as homogeneous a mixture as possible, and in order to avoid oxidation, the fusion was performed under a layer of powdered charcoal. The making of 40 alloys was thus by far the most tedious part of the investigation.

The alloys experimented upon were those of lead with antimony, tin, bismuth, cadmium, silver and zinc. After the preparations of the alloys, they were carefully rolled to about the same thickness, and the same surface exposed in each case to the action of the same amount of acid for a like time.

The surface exposed was 2 sq. in., and the amount of acid used 10 c.c. The action was allowed to proceed 24 hours at a temperature of 20° C.

The acid employed was C. P. sulphuric acid of Sp. Gr. 1,825. In the tables the first column gives composition of alloys ; the second, the loss of lead per sq. foot of surface exposed, the weight being in grammes ; the third, the amount of gas evolved calculated from the quantity of lead converted into the sulphate.

1	C. P. Lead.	1.296 grms.	9 cu. in.
2	"	2.088 "	14.5 "
3	"	2.952 "	20.5 "
4	"	2.232 "	15.5 "

Average loss for pure lead, 2.160 grms. per sq. foot.

Average gas evolved from sq. ft., 15 cu. in.

In all cases quite a vigorous evolution of hydrogen took place at the instant of immersion, while in an hour scarcely any action was perceptible. It will be noticed that the quantity of hydrogen evolved agrees quite closely with the amount given off by lead not in Mr. Napier's experiments.

In the case of the alloys, however, I did not find that the addition of foreign metals produced such a change in the amount of lead converted into sulphate, as the following figures will show.

In computing the amount of gas, the loss is calculated for convenience as entirely lead.

ANTIMONY ALLOYS.

5	Pb.	100	Sb.	0.5	parts	1.872	gms.	13	cu. in.
6	Pb.	100	Sb.	1	"	2.016	"	14	"
7	Pb.	100	Sb.	2	"	2.016	"	14	"
8	Pb.	100	Sb.	3	"	1.512	"	10	"
9	Pb.	100	Sb.	5	"	1.584	"	11	"
10	Pb.	100	Sb.	10	"	1.584	"	11	"

It will be seen from this that under the conditions of the experiment, the antimony did not seem to affect the lead to such a degree as in Mr. Napier's researches, although retarding the action of the acid.

It shows, however, what a large amount of antimony may be present without affecting the solubility of the lead.

TIN ALLOYS.

11	Pb.	100	Sn.	0.5	parts	2.802	gms.	19	cu. in.
12	Pb.	100	Sn.	1	"	3.744	"	26	"
13	Pb.	100	Sn.	2	"	3.080	"	22	"
14	Pb.	100	Sn.	3	"	2.952	"	21	"
15	Pb.	100	Sn.	5	"	3.232	"	23	"
16	Pb.	100	Sn.	10	"	2.380	"	17	"

In the case of the alloys with tin, the action is in all cases augmented, but does not seem to increase in proportion to the amount of tin present.

BISMUTH ALLOYS.

17	Pb.	100	Bi.	0.5	parts	1.800	gms.	12	cu. in.
18	Pb.	100	Bi.	1	"	4.032	"	28	"
19	Pb.	100	Bi.	2	"	1.656	"	11	"
20	Pb.	100	Bi.	3	"	1.728	"	12	"
21	Pb.	100	Bi.	5	"	2.232	"	16	"
22	Pb.	100	Bi.	10	"	3.600	"	25	"

The figures in number 18 are evidently anomalous, and probably were the result of an imperfect admixture or separation of the Bi and Pb. If they are disregarded we would have the general action of bismuth in the alloys with lead as retarding in quantities less than 5 per cent., and above that figure hastening the formation of lead sulphate.

CADMIUM ALLOYS.

23	Pb.	100	Cd.	0.5	parts	1.728	gms.	12	cu. in.
24	Pb.	100	Cd.	1	"	1.656	"	11	"
25	Pb.	100	Cd.	2	"	1.296	"	9	"
26	Pb.	100	Cd.	3	"	1.728	"	12	"
27	Pb.	100	Cd.	5	"	1.296	"	9	"
28	Pb.	100	Cd.	10	"	3.528	"	24	"

In regard to cadmium we have it decreasing the solubility of lead to a greater extent even than antimony, while above 5 per cent. it raises its solubility.

SILVER ALLOYS.

29	Pb.	100	Ag.	0.5	parts	1.584	gms.	11	cu. in.
30	Pb.	100	Ag.	1	"	1.728	"	12	"
31	Pb.	100	Ag.	2	"	1.944	"	13	"
32	Pb.	100	Ag.	3	"	1.584	"	11	"
33	Pb.	100	Ag.	5	"	2.016	"	14	"
34	Pb.	100	Ag.	10	"	2.448	"	17	"

Silver seems to exert very little influence, in small proportion, slightly decreasing the action, in large proportion slightly increasing the solubility.

ZINC ALLOYS.

35	Pb.	100	Zn	0.5	parts	2.664	gms.	18	cu in.
36	Pb.	100	Zn	1	"	2.304	"	16	"
37	Pb.	100	Zn	2	"	3.816	"	26	"
38	Pb.	100	Zn	3	"	2.664	"	18	"
39	Pb.	100	Zn	5	"	4.032	"	28	"
40	Pb.	100	Zn	10	"	4.392	"	30	"

The solubilities of the alloys of lead and zinc are thus greater than those of lead with any other metal experimented upon. To sum up the results of the work, it appears :

1. The metals, Antimony, Bismuth, Cadmium, and Silver in small quantities, protect lead from the action of the cold sulphuric

acid ; while in proportions above 5 per cent., they all, with the exception of antimony, increase the solubility.

2. Antimony when present even to the amount of 10 per cent. decreases the solubility of the lead.

3. Tin and zinc alloys are more affected than pure lead.

ACTION OF CONCENTRATED SULPHURIC ACID, AT 100° C., ON LEAD AND ITS ALLOYS.

By L. Pitkin.

The only work of any importance done, in the estimation of the effect produced upon lead by hot concentrated sulphuric acid, is that of Bauer. The acid used by him was 170° T. (Sp. Gr. 1.848), the amount of lead or alloy taken 0.2 gramme, and the amount of acid used 50 c.c. A brief abstract of his work, so far as it relates to alloys used by me, is here given.

I. *Pure lead.*—The first sensible evolution of gas was at 175° C., a stronger action taking place at 190° C., while at 230°—240° C. all of the lead was suddenly changed to sulphate.

II. *Lead and bismuth alloys.*—

(*a*). Pb. 90 per cent., Bi. 10 per cent.

Action begins at 150° C., continues quietly to 190° C., when all of the metal is decomposed.

(*b*). Pb. 96 per cent., Bi. 4 per cent.

This alloy decomposes more quickly than (*a*), the action terminating at 130°—140° C.

(*c*). Pb. 99.27 per cent., Bi. 0.73 per cent.

Rapid and sudden decomposition at 160° C.

III. *Lead and antimony alloys.*—

(*a*). Pb. 90 per cent., Sb. 10 per cent.

A slow and even decomposition takes place, beginning at 190° C., terminating at 240° C.

(*b*). Pb. 95 per cent., Sb. 5 per cent.

Decomposition begins at 180° C., terminating at 225° C.

(*c*). Pb. 99 per cent. Sb. 1 per cent.

Action begins at 250°, ends at 280° C.

IV. *Lead and tin alloys.*—Sudden decomposition at 200° C.

The alloys used by me in determining the effect of hot acid were