and a pressure of from 4.5 to 5 volts. The precipitation was complete in twenty-five minutes.

A potassium cyanide electrolyte proved satisfactory; while in the presence of 2 grams of sodium acetate, 0.2 cc. of normal acetic acid and several drops of gelatin, a current of 5.6 amperes and 4 volts deposited the metal in a beautiful, adherent form in forty minutes. The temperature of the electrolyte was maintained at 60°. The most satisfactory deposits of this metal were obtained, however, from an electrolyte containing from 0.75 gram to 1.5 grams of Rochelle salt. They were brilliant in appearance and perfectly adherent. They resembled such coatings as are produced by fresh aluminium paint. They were preserved without alteration or loss of luster.

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[CONTRIBUTIONS FROM THE HAVEMEYER LABORATORIES, COLUMBIA UNIVERSITY, NO. 180.]

A NEW VOLUMETRIC METHOD FOR THE DETERMINATION OF MANGANESE.

BY F. J. METZGER AND ROBERT F. MCCRACKAN.

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In a previous number of THIS JOURNAL[1] mention was made of the fact that manganese, in sulphuric acid solution, was oxidized to the quadrivalent form by means of sodium bismuthate, and that the manganese remained in solution in this state of oxidation. It is the purpose of this paper to describe a method based on the above principle whereby the manganese may be accurately determined.

Solutions Used.—A 0.1 *N* potassium permanganate solution, and a solution of ferrous sulphate of about equivalent strength. A solution of manganous sulphate was prepared and carefully standardized gravimetrically by weighing as pyrophosphate.

Method.—Place 50 cc. of the standard manganese solution in a 300 cc. Erlenmeyer flask, add 10–15 cc. of concentrated sulphuric acid and allow to cool. Add 1–2 grams of finely powdered sodium bismuthate in such a way that none of the powder sticks to the sides of the flask. Place the flask in a beaker of water so that the level of the solution is several inches below the level of the water in the beaker. Heat slowly to boiling and boil till the precipitate of basic bismuth compound settles well and has a granular appearance (about 20 minutes' boiling is usually necessary). Remove the flask and cool under running water, add a known excess of ferrous sulphate solution, dilute to about 200 cc. and titrate back with standard permanganate solution.

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[1] Metzger and Heidelberger, THIS JOURNAL, 32, 643.

The manganese standard of the permanganate is calculated from the reaction which may be represented thus:

$$Mn^{++++} + 2Fe^{++} \longrightarrow Mn^{++} + 2Fe^{+++}.$$

Or the value of the permanganate in terms of iron multiplied by 0.4918 gives the value in terms of manganese.

The following table of results will give an idea of the accuracy of the method:

No.	Mn. taken.	Mn. found.	Error.
1	0.0981	0.0979	—0.0002
2	0.0981	0.0975	—0.0006
3	0.0981	0.0973	—0.0008
4	0.0981	0.0974	—0.0007
5	0.0981	0.0980	—0.0001
6	0.0981	0.0981	±0.0000

The method is quite rapid and the end point is sharp and distinct, being the usual pink color in a solution containing a white precipitate. The application of the method to the analysis of spiegel and manganese ores is now under way, and we hope to work out a method which will be rapid and accurate and not possess the disadvantages inherent in the Volhard method.

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THE USE OF ORGANIC ELECTROLYTES IN CADMIUM SEPARATION.

BY MARY E. HOLMES AND MARY V. DOVER.

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In a previous paper[1] it was shown that currents below one ampere possess undoubted advantages for electrolytic separations when the rotating anode is employed, that study was concerned with the separation of cadmium from the metals of Groups III and IV and from magnesium at currents of 0.3–0.4 ampere, using the sulphuric acid and also the acetate electrolyte, and comparing the results obtained with those of other investigators working at high currents. It was clear that the possibilities of work in the line of electrolytic separations were almost limitless and that the work on cadmium alone called for a much more extended investigation, using other metals and a greater variety of electrolytes.

The present work was undertaken in order to test further the usefulness of low currents in cadmium separations. The alkaline earth metals were used and the acetate, formate, and lactate electrolytes. Corresponding separations were made with both low and high currents (*i. e.*, five amperes), but in no case did the high currents prove desirable. Whether cadmium was used alone or in presence of other metals, the deposits were dark in color, spongy, not adherent, difficult to dry, and in

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[1] THIS JOURNAL, 30, 1865.