

the attention of investigators. A great advance would arise from a suitable electric process which could dissociate and remove the organic impurities as well as the salts from low-grade sugar solutions. A cheap substitute for bone-black, of equal efficiency and durability should prove a boon. Some good method of continuous mechanical filtration of sugar solutions would be of considerable value, and the same is true of a continuous system of purging the sugar grains from their enclosing mother-liquor after boiling. W. D. HORNE.

THE FIXATION OF NITROGEN.

HARDLY any achievement in Industrial Chemistry has attracted such wide-spread interest as have the processes which render it possible to make use of the nitrogen of the atmosphere in a commercial way. When Priestley first demonstrated that atmospheric nitrogen could be converted into nitric acid under the influence of the electric spark, he little dreamed that his discovery would some day form the foundation of a large and profitable industry. We may be a little hasty in anticipating this last assertion, but the progress which has already been made is almost an assurance of future success. The great achievements in electrotechnics have made it possible to produce electric energy in large quantity and, in turn, make it available for converting the nitrogen of the atmosphere into valuable compounds. It has been known for some time that nitrogen and hydrogen can be united by an electric discharge, or under favorable conditions, by contact with certain substances. These facts have been utilized by many inventors, but thus far, none of the inventions along these lines have proved of much practical value. The progress, however, which has been made in other directions during the last few years in fixing atmospheric nitrogen has been remarkable, and has for the time, overshadowed other achievements in Industrial Chemistry.

The process of Frank & Caro in which the nitrogen of the air is separated and combined under certain conditions with calcium carbide to form calcium cyanamide is giving very promising results. The developments of the applications of the initial trials of this process have justified the erection of several factories in widely separated localities to test its practicability on an extensive commercial basis.

The principle involving the direct conversion of the nitrogen of the atmosphere to nitric oxide and nitric acid by aid of the electric spark is no longer confined to the class-room demonstrations. The experiments of Crookes, Lord Rayleigh, Lepel and others formed the foundation for the industrial application of the earlier discoveries. While the first industrial application of this principle by the Atmospheric Products Company under the patents of Bradley & Lovejoy at Niagara Falls did not prove successful, it stimulated further research along this line, and later developments give much more promising results. In this first attempt, it was clearly demonstrated that nitric acid could be produced on a large scale, and it only remained to cheapen the cost of production. This was accomplished in a large measure by the process of Berkeland & Eyde which was similar in the main to that of American inventors except that the efficiency of the ordinary electric arc is greatly increased by flashing in a magnetic field at a very high temperature. Instead of a multitude of thin streaks of electric light, this process provides for a large disc of flame which affects a large volume of air so that the oxidation of nitrogen is much more rapid and is accomplished with much less expenditure of energy. The experimental factory for testing this principle, erected near Nottoden, Norway, having the advantage of very cheap water power, has given such encouraging results that the production will be attempted on a larger scale. Thus we have at the present time, two processes for the utilization of atmospheric nitrogen operated under entirely different chemical principles, both of which give great promise of ultimate success. Improvements are constantly being made which increase the efficiency, and lessen the cost of production, and we can rest assured that long before we have a nitrogen famine our wants will be supplied.

The importance of these inventions and their successful applications can hardly be overestimated. The demands for nitrogenous compounds, both for industrial and agricultural purposes, are rapidly increasing year by year, while the available supplies are rapidly decreasing; it is estimated that the consumption of nitrate of soda alone amounts to over 1,700,000 tons per annum, and at this rate it is predicted that the deposits will be exhausted in less than fifty years.

While the free nitrogen forms four-fifths by volume of the atmosphere, it is not probable that the

combined forms one millionth part. Considering, therefore, this inexhaustible supply, and considering what it means to agriculture and the arts if it can be utilized, the solution of the problem of conserving the nitrogen of the air in a commercial way, will be recorded as one of the important inventions of modern times.

F. B. CARPENTER.

STANDARD METHODS OF ANALYSIS.

WE have seen with a good deal of interest, a brown-covered pamphlet of thirty-two pages, published by the United States Steel Corporation in the interests of their chemical force and entitled "The Methods of the United States Steel Corporation for the Commercial Sampling and Analysis of Iron Ores."

The work of developing the methods was performed by a committee consisting of: J. M. Camp, Carnegie Steel Co.; Wm. Brady, Illinois Steel Co.; W. B. N. Hawk, National Tube Co.; A. B. Clemence, American Steel & Wire Co.; E. A. Separk, Oliver Iron Mining Co.; G. D. Chamberlain, Carnegie Steel Co.

The preface explains the purpose of the Steel Corporation and the chemists in formulating these methods. "The Chemists' Committee was appointed for the purpose of unifying the methods of sampling and analysis of the materials consumed and produced by the United States Steel Corporation, with the purpose of rendering more accurate the analytical results obtained. Owing to the difference in education or practical training of the chemists in charge of the laboratories of the Steel Corporation, wherein iron ore is analyzed, a wide divergence in the methods of analysis would be expected; by harmonizing these methods, the errors incident thereto would be minimized."

We understand the work of the committee will be continued and the methods for the analysis of other materials developed.

Contrasted with twenty or twenty-five years ago, the condition of analytical chemistry at the present time in this country, and indeed throughout the world, is such that we may face the future hopefully. Many organizations have contributed to the unification of the methods which are in constant use to-day. We need only recall the work of the various committees of the Association of Official Agricultural Chemists on fertilizer, food and fat analysis, of the Committee on Uniformity

of the American Chemical Society under the able leadership of Dr. Hillebrand, and more recently of the Committees of the Society for Testing Materials to realize how great has been the advance from the chaotic condition in which the unorganized methods of analysis existed a few years ago to the fairly well organized condition in which we find them to-day.

Much work remains to be done. Among the contributing organizations which are endeavoring to place commercial analytical methods on the high plane where they belong, what one could be more useful than the large corporation which employs numbers of chemists and operates many chemical laboratories in various localities and, in fact, which finds the daily routine application of analytical methods a guide and a necessity for the control of all its manufacturing operations? The pessimist will say that already we have too many and too various organizations working on the uniformity of chemical methods, and the addition of even one more to the ranks is hardly advantageous. We feel more confident in the matter and believe that for present needs, the various organizations which have been and are working out the details of methods, are working along the right lines. For the future, when they shall have accomplished their work, the representative organization of chemists in this and in other countries must see to it that all the methods of analysis are worked into one comprehensive system, which shall not be fixed for all the time, but shall be kept alive by active committees and continuous additions and improvements as the science develops.

W. D. RICHARDSON.

ORIGINAL ARTICLES.

FREE LIME IN PORTLAND CEMENT.

By ALFRED H. WHITE.

Received October 3, 1908.

This paper describes a simple microscopic test for free lime in Portland cement and discusses the result of its application to a number of commercial cements and to others made in the laboratory.

The usual analysis of Portland cement shows lime to form over sixty per cent. of the weight of the clinker, but does not give any clue to the form in which this lime exists. It is rather generally, although by no means universally, assumed that