

AN UNUSUAL INCRUSTATION ON GENERATOR COILS.

(CONTRIBUTION FROM THE LABORATORY OF THE YORK MANUFACTURING COMPANY, YORK, PENN.)

There was recently submitted to our laboratory, for analysis and explanation, a scale or incrustation of unusual character. It had been formed on the coils of pipe in the generator of a refrigeration plant built on the absorption system. The conditions in this plan of refrigeration are as follows. The generator is very similar in construction to a tubular boiler, the tubes being of two-inch iron pipe through which steam circulates. These steam coils are surrounded by strong aqua ammonia, 20° to 22° Bé. in strength, from which the heat of the steam coils drives the gaseous ammonia which is to be condensed and used as a refrigerant. The aqua ammonia comes to the generator at a temperature depending upon the cooling water used in the condenser, not often being lower than 55° Fah. and ranging at times up to 75° Fah.

The scale under consideration was formed on the outside of the steam coils and hence was deposited from the aqua ammonia and therefore represents materials dissolved by the latter. The incrustation had a maximum thickness of about one-sixteenth inch, was of an olive-green color on the outside surface, rusty from the iron pipes on the inside surface and of a somewhat varying light green on a broken cross section. Its texture presented a stony, somewhat crystalline appearance, its hardness was about 5, and its specific gravity 5.117.

The surprising feature of this material appeared upon analysis, which resulted as follows:

| | |
|----------------------------|-------|
| Insoluble matter..... | 0.26% |
| Organic (oily matter)..... | 0.59 |
| Copper oxide..... | 0.65 |
| Ferric oxide..... | 6.32 |
| Zinc oxide..... | 92.00 |
| Total..... | 99.98 |

It was found upon inquiry that at the plant in question some of the parts had been made of galvanized iron. The aqua ammonia coming in contact with these galvanized surfaces dissolved off some of the zinc and this in turn was deposited on the surface of the steam coils under the influence of the heat. The ferric oxide came from contact with the iron pipes.

In this connection it may be of interest to note that the action of anhydrous liquid ammonia upon galvanized and tinned iron pipe was made the subject of experimental investigation in our laboratory several years ago. The result of that inquiry, briefly stated, is that a galvanized surface is readily corroded by the ammonia while a tinned surface is but little affected.

The apparent lesson to be drawn is that galvanized iron should be avoided in all ammonia fittings.

C. H. EHRENFELD.

TO DETERMINE FAT IN SWEETENED CONDENSED MILK.

Weigh out 25 grams of the sample, dissolve in water and make up to 100 cc. Transfer 6 cc. to a double tube milk flask provided with a small bore tube graduated to give percentage of fat for 5 cc. milk. Add 4 cc. of ether and 4 cc. acetic acid (80 per cent. or more absolute acetic acid). Acetic acid of this strength will dissolve the curd but has no effect

on the sugar. Place the flask in a vessel of warm water and heat until the ether is expelled. A layer of milk fat will now be seen floating on the surface of a clear and colorless liquid. Fill the flask with hot water thus raising the fat into the graduated tube. The percentage of fat can now be read, the sample whirled in a centrifugal machine and another reading made. Multiply the reading by four.

C. B. COCHRAN.

A QUICK METHOD FOR THE DETERMINATION OF ARSENIOUS OXIDE IN PARIS GREEN AND OTHER INSECTICIDES.

Among the numerous methods that have been suggested for the analysis of the common insecticide, Paris green, are the methods of Thorne, Smith¹ and Avery.²

By the use of any of these methods it is possible to obtain very accurate results. In the Smith method, however, the determination of the end-point offers some difficulty, and in both the Smith and the Avery methods, the expenditure of considerable time is involved.

The following method is presented because of its simplicity, and because of the rapidity with which it may be carried out. With the standard iodine solution already at hand, it is possible to perform the analysis within about twenty minutes, or within one-fourth of the time required for the work when either of the other methods is employed.

The details of the method are briefly as follows:

A 2 gram sample of the insecticide is weighed out and is placed in a 250 cc. measuring flask with 25 cc. of water, and 25 cc. of concentrated hydrochloric acid. The flask is then heated to a temperature of about 80° C., until the sample has dissolved, which usually requires about five minutes. Care should be taken not to heat the solution to the boiling point, since it is possible that small amounts of arsenious chloride might be lost at this temperature. After the solution has been allowed to cool, it is diluted to 250 cc., and 25 cc. portions are removed for analysis. Each of these portions is placed in an evaporating dish, is diluted with about 300 cc. of water, is treated with an excess of solid sodium bicarbonate, and is finally titrated with the standard iodine solution, using starch as the indicator. The end point in the titration may be observed most readily when a porcelain evaporating dish is used as the containing vessel. In standardization of the iodine solution, 1 gram of pure arsenious oxide should be weighed out and carried through the procedure adopted in the analysis of the sample of Paris green.

In order to compare the accuracy of the new method with that of the two others, parallel analyses of two different samples of Paris green were conducted. The results obtained are recorded in Table I.

TABLE I.

| Number of determination. | By method of Smith. | | Percentage of As ₂ O ₃ . By method of Avery. | | By new method. | |
|--------------------------|---------------------|-----------|--|-----------|----------------|-----------|
| | Sample A. | Sample B. | Sample A. | Sample B. | Sample A. | Sample B. |
| 1.. | 54.47 | 52.02 | 54.62 | 52.10 | 54.51 | 52.00 |
| 2.. | 54.53 | 52.02 | 54.58 | 52.08 | 54.51 | 52.00 |
| 3.. | 54.51 | 52.16 | 54.68 | 52.08 | 54.52 | 52.16 |
| 4.. | ... | ... | ... | ... | 54.51 | 52.05 |
| Ave. | 54.50 | 52.10 | 54.62 | 52.08 | 54.51 | 52.05 |

¹ J. Am. Chem. Soc., 21, 769 (1899).

² Bureau of Chemistry, Bulletin No. 107, p. 26 (1907).

The results obtained in standardizing the iodine solution with pure arsenious oxide are given in Table II.

TABLE II.
Grams of As_2O_3 equivalent to one cubic centimeter of the iodine solution.

| Number of determination. | By method of Smith. | By method of Avery. | By new method. |
|--------------------------|---------------------|---------------------|----------------|
| 1..... | 0.002894 | 0.002896 | 0.002898 |
| 2..... | 0.002894 | 0.002896 | 0.002897 |
| 3..... | 0.002895 | 0.002896 | 0.002898 |
| Average..... | 0.0028947 | 0.002896 | 0.0028977 |

C. C. HEDGES.

CORNELL UNIVERSITY,
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NEW PLANTS.

THE INDIANA STEEL COMPANY'S PLANT AT GARY, IND.¹

By W. D. RICHARDSON.

The commencement of operations in the largest metallurgical plant which has ever been planned and constructed is an event well worth recording not only in commercial, technological and engineering literature but in chemical literature as well. While to the superficial observer it may appear that in the working of a plant such as that at Gary, mechanical problems overshadow the

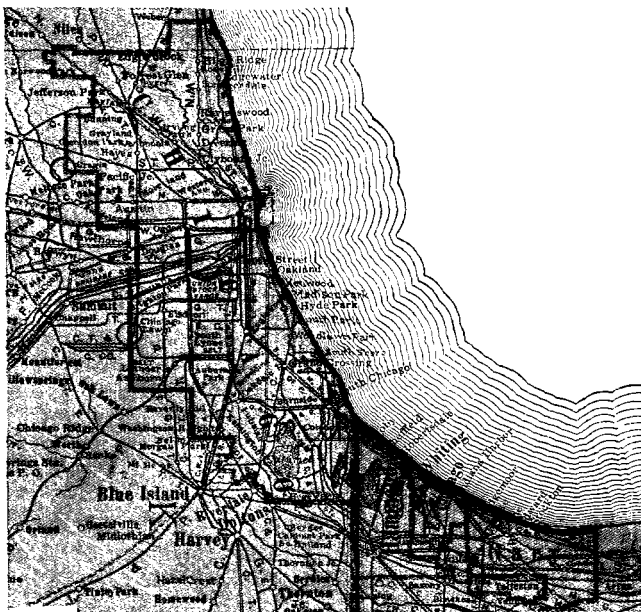


Fig. 1.—Map showing location of Gary.

chemical at every point, this is not strictly the case. The science of metallurgy embraces both mechanical and chemical methods, and while in the mills mechanical methods predominate, in the operation of blast furnace and open-hearth furnace chemistry comes to the fore. That the chemical operations of the blast furnace, although carefully studied for long periods of time, may yet be fundamentally improved,

¹ For further descriptions, particularly of the mechanical features of the Gary plant, consult the *Iron Age*, Jan. 7th and Jan. 14th, and following numbers: The *Iron Trade Review* of Jan. 7th and succeeding numbers; *System*, Jan., '09, and *Engineering Record*, July 20, Aug. 17 and Nov. 2, 1907.

is well attested by the recent successful introduction of the Gayley dry blast in various furnaces throughout the country.

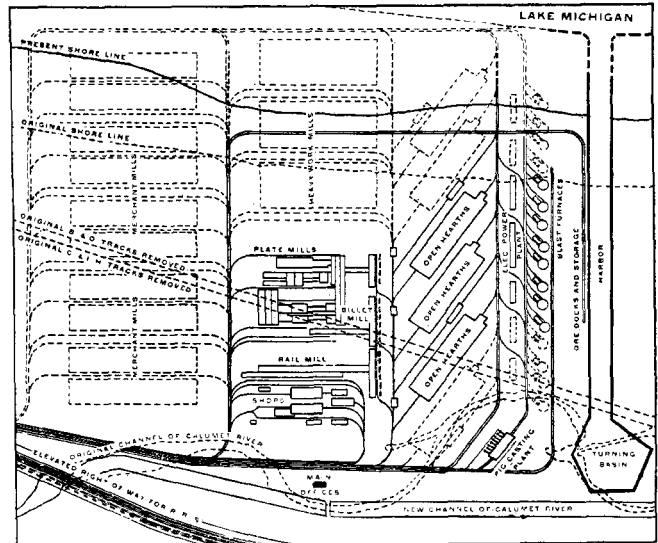


Fig. 2.—Sketch map of Gary—general plan of the new steel plant. Furnaces, mills and shops already completed or under way are indicated by solid black lines; future construction and extensions by dotted lines. To avoid confusion, duplicated railroad tracks are eliminated, the simple lines in and out of the open-hearth buildings representing six service tracks. Note how furnaces and mills have been placed to facilitate switching.

The builders of the Gary plant have done more than construct a steel works. They have in two or three years converted a waste of dune-sand and scrub oaks into a habitable region and laid the foundations of a prosperous and well-paved modern city.

The Indiana Steel Company is a subsidiary of the U. S. Steel Corporation. In 1905 the corporation set aside \$10,000,000 for building the Gary works. In 1906, \$21,500,000; in 1907, \$18,500,000; a total of \$50,000,000. No appropriation was made for 1908, inasmuch as the total amount expended even up to the present time is not greatly in excess of \$40,000,000. The original announcement stated that an appropriation of \$75,000,000 was contemplated from first to last. The Indiana Steel Company is a separate corporation, but is organized as a subsidiary of the Federal Steel Company. The operation of the plant, however, is carried on under lease to the Illinois Steel Company.

The President of the Indiana Steel Company is Mr. Eugene J. Buffington. The plant was designed and is being constructed under the direction of Mr. G. G. Thorp, Vice-President, Mr. A. B. Neumann, Chief Engineer, and Mr. W. P. Gleason, General Superintendent.

Location and Area.—The plant is located at the southern point of Lake Michigan, in Lake County, Indiana, about forty miles from the center of Chicago. The approximate area occupied at the present time is about 700 acres, and the area available for future extensions amounts to 1000 acres.

Water Supply.—The water supply is derived entirely from Lake Michigan, being taken from a crib one and one half miles from shore, through a six feet tunnel. The water gravitates to the pumping station, from which point it is supplied to the plant by means of horizontal-shaft direct-connected motor-driven centrifugal pumps. These are two