REPORT OF AMERICAN INDUSTRIAL COMMISSION TO FRANCE

The American Industrial Commission to France, organized and sent out by the American Manufacturers' Export Association of New York City, left New York at the end of August, 1916, and spent seven weeks inspecting the principal industrial centers of France. The itinerary arranged by the French authorities, represented by Mr. Maurice Damour, Deputy for Bordeaux, and Chief of the French Industrial Commission to the United States of 1915, included all of the important industrial cities of France and covered the entire range of French industrial activity. The investigatory character and large spirit of the French Commission, whose visit to America was being repaid, was strictly adhered to throughout, with gratifying sentimental success as regards the impression created upon the members of the inviting Government, the press, and the French people generally.

The personnel of the Commission was as follows:

W. W. NICHOLS, *Chairman*, Vice-President, American Manufacturers' Export Association, New York.

J. G. BUTLER, JR., Vice-President, Brier Hill Steel Company, Youngstown, Ohio.

S. W. FAIRCHILD, President, Drug Section, New York Board of Trade.

A. B. FARQUHAR, Vice-President, Chamber of Commerce of the United States.

G. B. FORD, City Planning Engineer, Member of Geo. B. Post & Sons, New York City.

S. F. HOGGSON, President, Hoggson Brothers, New York City.

F. J. LEMAISTRE, Consulting Chemical Engineer, E. I. du Pont de Nemours & Company, Wilmington, Delaware.

J. R. MACARTHUR, President, MacArthur Bros., New York City.

C. O. MAILLOUX, Consulting Engineer, New York City.

C. G. PREIFFER, Vice-President, Geo. Borgfeldt & Company, New York City.

J. E. SAGUE, Former New York Public Service Commissioner; former Vice-President, American Locomotive Company, New York City.

E. A. WARREN, Vice-President, Universal Winding Company, Boston, Mass.

E. V. DOUGLASS, Secretary, American Manufacturers' Export Association, New York City.

E. GARDEN, French Secretary to the Commission.

The Commission recognized that America must become an important factor in European reconstruction after the war and that whatever tends to throw light on the specific needs of one nation cannot fail to call attention to the similar needs of all.

The following survey of the chemical and allied industries in France was prepared especially for THIS JOURNAL by Mr. LeMaistre.—[EDITOR.]

A SURVEY OF THE CHEMICAL AND ALLIED INDUSTRIES IN FRANCE DURING THE WAR

By F. J. LEMAISTRE

Member of the American Industrial Commission to France

The war has completely changed the normal conditions of the French chemical industry and greatly increased its importance. The following is but a brief survey of the present conditions of this important industry. It is to be regretted that vital statistics are missing in this report. This is due to the government regulations prohibiting factories working on orders for the government issuing statements of any kind. In an analysis of existing conditions, it should not be overlooked that, in many cases, best operating practices have not been selected, due to stress of production at maximum capacity.

From the few plants visited by the Commission, we gathered the impression that the war had convinced many French manufacturers that they were operating on altogether too small a scale, consistent with low cost of production and that, if, after the war, they were to place themselves in a position to compete with German manufacturers, it would be essential to drop certain lines of manufacture and encourage the combination of the others as far as possible.

It has been suggested in numerous instances by those well advised that in coördinating the more important branches of the chemical industries it will be necessary to abandon the old, inefficient plants as well as those plants illogically located both as to railway facilities and distribution of finished products. Such statements were made at many different points during our trip through France by those best qualified to judge. Books have been published expressing this opinion by some of the best advised chemists in France. Such statements as these may be found in the monthly bulletins of the *Société d'Encouragement pour L'Industrie Nationale*.

As regards chemical plant construction, the tendency appears to be to erect permanent buildings which compare very favorably with our best types in America. In many instances, however, insufficient consideration has been given to possible plant expansion, which is in line with the general conservatism of the French people.

France had been a heavy purchaser of chemicals from Germany prior to the war. There is now a general disposition to seek American sources of supply. It is intimated, however, that, if the United States is to compete with Germany in this respect, it will be an essential prerequisite that the American manufacturer study French conditions closely, the French being perfectly candid in their statements that in many instances the German chemical manufacturers were better informed of their probable requirements than they were themselves. Some economists have gone so far as to intimate that the ultimate success of this trade development with France will depend upon the proper distribution throughout the country of American representatives, conversant with the French language and thoroughly familiar with the chemical trade. Men of wider range of knowledge than those usually assigned to such tasks must be employed by the American manufacturer.

The old difficulty of the decimal system was referred to, it being exceedingly difficult for the French people to understand why so progressive a country as America should be so slow in the adoption of the metric system. The chemists of America have here an opportunity to take the initiative in this much needed reform in our own country. The present time seems opportune, as many mills and factories with orders for export have, during the past two years, been forced to educate their employees in the metric system.

The French government recognizes the benefits

derived by the German manufacturers due to the fullest privileges regarding the use of denatured alcohol in the industries. Recent legislation has been proposed which will undoubtedly place the French chemical manufacturer on a more satisfactory basis than heretofore as compared with their German neighbors. Alcohol manufacture and control has received a very close study during the past two years. Mr. R. P. Duchemin's report entitled "L'Emploi et Le Régime de L'Alcool dans les Industries Chimiques et Pharmaceutiques," appearing in a recent bulletin of the *Société d'Encouragement pour L'Industries Nationale*, fully discusses all phases of this problem.

It is of interest to note that about 4,000,000 people are employed in the wine industry in France.

TECHNICAL EDUCATION

Considerable attention is being given to the important subject of technical education. The French people recognize that they are extremely backward in this branch of their educational work and that they compare unfavorably with Germany and Switzerland in numbers of trained chemists. On a unit population basis, Switzerland has 300 chemists and Germany 250, while France has only 7.

It has been suggested that chemical courses in American universities should be made known to French educationalists and that interchange of professors and advanced students be encouraged.

According to the statement of a professor of one of the universities in Paris, the present inferiority of the French chemical industry is due to:

- 1—Lack of standard factory methods.
- 2—Insufficient general knowledge.
- 3—Lack of technical education.
- 4—Banking conditions.

In the readjustment period after the war, it is more than possible that the United States may receive a number of men for post-graduate work and study in our colleges having chemical engineering departments. The business men of France, as well as those financially interested in the chemical industries, appreciate more fully than ever that chemists with only a theoretical knowledge are not competent as plant managers. Men holding such positions must also be thoroughly familiar with engineering. It must be admitted, however, that the experience of intensive chemical manufacture in war time has shown that French chemists, when given responsibility, have developed accordingly. It is realized that the former common practice of confining the chemist to mere analytical work must not be reverted to if efficiency is to be maintained.

The more progressive manufacturers appreciate the importance of the development of industrial research laboratories such as have proven so profitable in Germany, as well as in this country.

CHEMICAL LITERATURE

In addition to the standard monthly chemical periodicals, there have recently been issued several journals devoted especially to industrial chemistry, the aim being to publish articles of special interest to chemical engineers confronted with factory troubles. Publications such as these should be encouraged by all the interested parties, and if combined with the

advantages of a large society made up of research and industrial chemists will do much towards the elimination of petty jealousies now existing between the several small groups of chemists distributed throughout the country. The special traditions of each section of France need not be sacrificed by consolidation into one large society. It is apparent that many of the chemists throughout France are not familiar with the best thought of their own country, due, in the main, to the lack of a satisfactory medium of distribution of such information and lack of travel and free intercourse. In our own country, it has been demonstrated that free intercourse among industrial chemists can be had without sacrificing the secret processes of the different industries represented.

It was our observation that very few of the French technical men know of our more important chemical journals. This is a condition which could be readily corrected to our mutual advantage.

Under the respective headings given below, will be found some general information obtained from those interested in the respective industries. On account of the broad scope of the Commission's work, these remarks are merely a brief survey of the more important branches of the chemical industry.

DYES

After the war, France will be in a better position than formerly to manufacture economically many of the chemicals used in large quantities in this industry. The French Commission, appointed to survey this industry, in their report in the July-August issue of the *Bulletin of the Société d'Encouragement pour L'Industrie Nationale*, state that "more coke ovens will be required if this industry is to be placed on a satisfactory commercial basis." It is also stated that "some agreement must be made with other countries for a steady supply of intermediates." The development of this industry, however, brings up for discussion the question of patents and tariffs, and due consideration must be given to the fact that, until the outbreak of the war, Germany had enjoyed an exceptionally favored position as regards French duties. Under such conditions, the French dye industry could not be properly developed. Some consideration has already been given, at the Allies' Economic Conference at Paris, to combining with the British dye industries to work to a common end, with the view of establishing a definite policy of action for the very complicated conditions which must arise after the war. Whereas too much confidence is not placed on plans for future action, it is thought that a tariff plan approved by the Allies will be better than the drifting policy France has followed in the past.

Statements have also been made that, for some period after the war, there will be an opportunity for the sale of considerable quantities of American dyes in France, because it is to be expected that time will elapse before the newly equipped chemical plants will be capable of furnishing more than a part of the requirements of France and her colonies. The problems arising out of the development of a thoroughly coordinated dye industry in a country depleted of

money and men must be classified as among the most difficult of France's commercial problems.

In 1912, France manufactured coke equivalent to 3,925,000 tons of coal and purchased coke equivalent to 2,847,000 tons of coal, representing a total coke consumption in the metallurgical industries equivalent to 6,772,000 tons of coal or a total tar production of 505,250 tons.

It is estimated by one of the foremost industrial chemists in France that by the adoption of the standard German practice they should have obtained a yield of 53,177 tons of benzol or about four to five times the quantity obtained during 1915. It is further estimated that by the adoption of the standard method of washing illuminating gas there would be 24,000 tons of benzol available from the 5,000,000 tons of coal used in the gas industry, which would make a total benzol production for France of about 76,500 tons. On the same basis of calculation, there would also be available 31,000 tons of naphthalene and 3,100 tons of anthracene.

ELECTROCHEMICAL INDUSTRIES

Great activity has been in evidence in these industries which have a popular interest outside of the chemical profession. In the French Alps alone the horse-power development since the war started has increased from 500,000 to 1,500,000 H. P. and plans are under way for further extensions. There are no figures available to determine what percentage of this increase has been for the chemical industries. Many new lines of manufacture have been started, some of which are fairly established. Many, however, will have to be closely investigated, as, under the existing conditions of operation, cost has been sacrificed in the interest of larger production. At one electrochemical plant visited by the Commission, magnesium, sodium and aluminum were being made, as well as sodium hydroxide, compressed oxygen, etc.

ATMOSPHERIC NITRIC ACID

We were informed that extensive developments have been made in the manufacture of nitric acid from the air during the past two years. The government authorities are fully aware of the importance of the permanent development of this industry on a sound economic basis, inasmuch as upon it are dependent the fertilizer trade and the manufacture of dyes and explosives.

Prof. Fleurent, in his book entitled "Les Industries Chimiques en France et en Allemagne," published by the Conservatoire Nationale des Arts et Metiers, 1916, gives a very interesting discussion on the following processes for the manufacture of nitric acid and nitrogen fertilizers from atmospheric nitrogen: Birke-land, Schönherr, Pauling, Serpek, Haber, Cyanamid.

French chemists have given very close study to the Serpek method of manufacture of nitric acid from the air. In this process bauxite is used. If this process can be worked out on a satisfactory basis, it will connect the nitrate industry with the very important aluminum industry.

As regards Cyanamid manufacture, the production in France is small as compared with other countries.

The following figures were collected by the International Institute of Agriculture:

Year	CYANAMID PRODUCTION—METRIC TONS			
	France	Germany	Canada	World
1912	5000	22,000	32,000	105,000
1913	7500	24,000	48,000	155,000

More recent figures indicate that the world production in 1916 was approximately 210,000 metric tons. The bulk of this increase is attributed to Germany owing to the fact that Germany has had to depend on artificial nitrates, which was not the case in France.

PHARMACEUTICAL CHEMICALS

Those interested in this branch of the industry are fully cognizant of the fact that, through a lack of initiative on their part, they have allowed the control of the manufacture of pharmaceutical chemicals to go to Germany.

The existing French law does not permit patenting any particular pharmaceutical composition and it is claimed that the French tariff has encouraged the German manufacturers in the manufacture of these products. A well developed program for the manufacture of pharmaceutical chemicals and synthetic perfumes has been outlined which ought to do much towards placing these industries on a more permanent basis.

The French perfume manufacturers consider that, on account of climatic conditions, they should have no difficulty in maintaining the lead in the manufacture of perfumes. Mr. Justin DuPont estimates that France exports annually perfumes to the value of \$5,000,000 to \$6,000,000. Active development now exists in the manufacture of artificial perfumes.

SULFURIC ACID MANUFACTURE

The demands of the War Department for sulfuric acid have been such as to insure France being entirely independent of any outside source of supply of this commodity for a long time to come. The largest sulfuric acid plants are located in the south of France.

PAPER INDUSTRY

The Commission visited one of the more up-to-date paper mills of central France at which all grades of paper were being made, from the coarse Manila to the finer grades of writing paper. This plant was operating under water power. The principal woods used were spruce, birch and poplar. Part of the plant was devoted to the sulfite process. From information gathered, it appears that France is independent of outside sources of supply of paper.

It is of interest to note that from Algiers, the French shipped to England in 1912, 117,000 tons of Esparto grass, commonly known as "Alfa." This grass grows wild, needs no cultivation and is used by the English in the manufacture of high-grade writing paper.

CEMENT MANUFACTURE

No Portland cement plants were visited, but we were advised that France had manufacturing capacity for her own requirements and those of her colonies. Conferences with several members of the Chambers of Commerce interested in this industry indicated that considerable of the present cement equipment would have to be replaced by equipment of larger capacity.

REFINING OF SUGAR

On account of government regulation, all refineries are enforced to sell sugar at a fixed price. The single refinery visited by the Commission was working on a government order. The by-product, molasses, is used largely for the production of alcohol, and, as in this country, the residues are employed for combining road materials.

France in 1903 had 296 factories with an output of raw sugar of 1,080,000 tons, equivalent to approximately 6,315,300 tons of beets. France stands second to Germany in her development of the beet sugar industry.

Year	RAW SUGAR OUTPUT IN TONS		GERMANY	
	France	Germany	Sugar yield per 100 kg. beets	Annual consumption per head
1840	22784	14200	5.9 kg.	2.5 kg.
1850	62165	53300	7.3	3.1
1860	126480	126520	8.6	4.3
1870	262136	126000	8.6	4.7
1890	750000	1336000	12.5	8.5
1903	1080000	1921000	14.4	13.0
1905	730000	1605000	14.9	14.9
1906	730000	2400000	14.7	17.0
1909	807500	2037400	16.3	19.5

In 1908, there were approximately 38,000 employees occupied in the beet sugar industry for a period of two months with an average wage of \$0.73 per day. The 520,000 acres under cultivation in France in 1907 was increased in 1910 to 580,000 acres.

In the period 1903 to 1914, the manufacturing tax on beet sugar was reduced by 40 per cent. During this period, the consumption increased 61 per cent. In Germany, during the same period, there was a 33 per cent reduction in taxation, with an increase in consumption of 60 per cent.

The following tabulation indicates the relative importance of the beet sugar industry:

TOTAL WORLD PRODUCTION OF CANE AND BEET SUGAR 1866 TO 1915		
Year	Total Production in Lbs.	Percentage Represented by Beet Sugar
1866	4,579,000,000	30.7
1878	7,266,000,000	44.0
1887	11,375,000,000	53.8
1893	14,501,000,000	53.0
1899	17,942,000,000	62.6
1901	21,757,000,000	62.5
1911	38,083,000,000	50.4
1913	40,788,000,000	49.3
1915	40,998,000,000	44.9

MANUFACTURE OF BUTTER SUBSTITUTES AND TABLE OILS

At the city of Marseilles there is an extensive production of a number of butter substitutes and table oils, which are sold under various trade names. These are consumed by the poorer classes of the community for table use, replacing the more costly butter and olive oil, and by the hotels for culinary purposes. Copra, palm kernels and peanuts from the Orient are the crude materials used in these refineries. The refining of the oils is carried on under very strict inspection and numerous government investigations have been made to determine the nutritious properties of these products.

We were informed that the permanent success of this industry had been largely due to the careful chemical control enforced by the majority of the plants. At the early stages of the development of this industry, it was not considered that chemists were necessary. Practically all the plants of the Marseilles district were operating to maximum capacity on government orders.

PETROLEUM

This industry in France is on such a small scale that it cannot, of course, compare with the American petroleum industry. Prior to the war, the bulk of the crude petroleum was obtained from Russia. The replacement of this by American crude oil has required considerable change in refining practice. The refining equipment, on the whole, is smaller than that used in this country and is not of recent design. The urgent demands of the Department of War for motor fuels have necessitated a very active study on the part of the engineers and chemists with a view to determining the relative values of gasoline mixtures, which are termed "Essences." It is considered that much valuable information has already been collected. This, of course, will be available in times of peace. Given below are the official receipts of American petroleum at the port of Marseilles during the past five years. Marseilles is the second largest city in France and has a population of over 500,000.

Year.....	1911	1912	1913	1914	1915	Total 1911-15
Tons.....	18,302	21,657	24,700	18,674	33,902	117,235

PORCELAIN

In the Limoges district, several of the porcelain factories have been turned over entirely to the manufacture of chemical-ware for the Department of War. They have overcome the initial difficulties of this new line of manufacture and now make chemical-ware equal to the best English and German grades. The manufacture of porcelain-ware for the laboratory has received very close study. The French manufacturers claim that they will be in a position after the war to meet the strictest specifications for this line of goods.

Remarkable development has also been made in the manufacture of optical instruments. This industry will be on a very permanent basis after the war.

CELLULOID

France has been a leading nation in this manufacture for years. This special industry is at a standstill at the present time as the government has called upon all these manufacturers to make nitrocotton.

SODA INDUSTRY

These plants, many of which are located in the south of France, have been taxed to capacity during the past two years. This is also true of the chlorine industry, these heavy chemicals being made on a scale many times greater than ever before. In 1912, France imported 344,348 tons of soda. Of this amount, about 40,000 tons were used in the chemical industries.

SANITATION AND HEALTH

In France, sanitation and health do not receive the same attention as in America. This is especially true in the chemical industry. In more than one instance, operators were kept in poorly equipped rooms, handling toxic chemicals without adequate supervision. Reference is not made here to exigencies which have developed as a result of the war, but to regular operating conditions.