should be proud of the high standards maintained there. It is too often the case that the high-class work done by Government scientists is not assessed at its real value, nor are these investigators given the recognition which their distinguished attainments so richly merit. In the present emergency, the Government laboratories naturally are overwhelmed by demands made upon them from so many different directions, and our Chemistry Committee is in the position to mobilize the additional help required. When peace returns to our land, and aid of this kind is no longer needed, the Committee can then devote itself to those other activities described in its previous report.

In the second place, many of the problems referred to our Committee during the past few months immediately following our entrance into the war were not research problems at all, in the sense in which we understand the word "research," but related to the adequacy of our supplies of raw materials and chemical products. At the outset, and failing any other civilian organization to handle such questions, we did what we could to secure the desired information through our own men and by cooperation with the appropriate Government officials and with the Advisory Commission to the Council of National Defense. Since the organization of the Committee on Chemicals already noted, all such questions are referred to them.

Further, there is nothing strange about a Government accustomed only to peace conditions and up to within a few months apparently convinced of the impossibility of our ever becoming embroiled in a world-wide war, learning rather slowly the tremendous rôle of science in modern warfare and the many research problems which inevitably follow in its train and which must be studied in connection therewith.

It is to be hoped that these general remarks will furnish some explanation as to why there are now more volunteer investigators than can be supplied with problems whose study the Government has requested. The inability of the Committee to supply to all applicants important Government problems has been a cause of much disappointment and complaint on the part of our research men for the reason that they have not fully comprehended the situation. In fact, some university officers have specified that problems sent them should be of such a nature as to provide appropriate work for their full chemical staff, an order which would be an exceedingly difficult one for the Committee to fill.

FINANCIAL NEEDS OF CHEMISTRY COMMITTEE

The greatest and most urgent single need of the Chemistry Committee at the present time is financial assistance to enable it to do properly and effectively the work for which it is organized and which it alone is in a position to accomplish for our Country. Without money, it can do but little. One way of meeting this situation would be for Congress to make an appropriation for the benefit of the National Research Council. Is it too much to expect that the combined intelligence of our investigators would bring the war to a close one day sooner? In such matters it is not the money which should be considered although we are now expending about \$40,000,000 a day for war purposes but the human lives sacrificed every twenty-four hours with all the accompanying train of sorrow and suffering. How much would it be worth in dollars if such a strife could be shortened even a single hour?

In the absence of Governmental aid, the National Research Council has been enabled to conduct its work partly because certain of its active members are university officers, and the universities concerned have granted leaves of absence to these men and generously have carried them at part or full salary. This, of course, the universities cannot continue to do for any length of time, as they themselves are facing serious financial straits due to rapidly diminishing revenues, nor is it fair that

those endeavoring to serve the Government should have to do so at the expense of our universities.

When members of the Council, now partly or wholly supported by their universities, are cut off from this, one of two things must happen in the absence of Governmental aid:

(1) The work of the Council will have to be abandoned.

(2) The men concerned may accept officers' commissions in the Army or Navy or positions in some other Government Department. If the latter policy is followed by any considerable portion of the membership, the Council at once loses its civilian character and individuality by adsorption into the various Government Departments. While there is doubtless much to be said in favor of such a merger, it would be, from the writer's point of view, foreign to the original intent of the organization and a handicap to much of its work. As civilians, we enjoy a freedom of thought and action, and a privilege of conferring on a basis of equality with Government officials of all ranks which might not be accorded us as subordinate officials in a Government Department. Further, while all Government Departments have no objection to using a neutral civilian body as a central clearing house, they might not be so ready to do this where the Council Committee concerned was recognized as under the control of some single Department.

This brings me to another matter, namely the great desirability of the Government making more extensive use of our organization, getting the habit of turning to it for the aid it is so well qualified to render, and recognizing it as the central clearing house for chemical research.

THE TARIFF COMMISSION AND OUR CHEMICAL INDUSTRIES

By WILLIAM S. CULBERTSON

Member of the United States Tariff Commission

I am grateful to you for affording me this opportunity to discuss some of the broader aspects of our investigation of the chemical industries. It was clear from the time of the organization of our Commission in April that the chemical tariff presented complex problems of immediate importance which will become more important as the War progresses and as peace again comes. When we began work, we had before us the legislation Congress passed at the same time as the act creating our Commission which recognized the need of a new policy toward the coal-tar dye industry; we saw how vitally the chemical industries are related to the successful prosecution of the War; we saw that the very existence of many industries depends upon their maintenance; we saw the War revolutionizing these industries—financially, technically, and industrially; we foresaw some of the competitive difficulties which they will have to face when normal times return. And seeing these things we determined to make—as it has never been made before—not a partial and inadequate, but a comprehensive study of our chemical industries in their relation to the tariff.

We recognize frankly the difficulties of our task. The expert chemist and manufacturer no doubt realizes, more even than the layman, the diversity of problems presented by the chemical schedule of the tariff law. Schedule A, coming first in the tariff act, is, like the preface of a book, usually passed over by the average tariff student. If industrial chemistry has been a closed book to the public, and to most economists, we hope with your coöperation to make it less so by our investigation. While we have employed some of the ablest experts in the country and while neither time nor labor will be spared in exhausting published sources of information, we must have help from those directly in touch with our chemical problems. *We are looking for coöperation from the chemists in our universities and in our industries, from those experienced in the importation of chemicals, from those who use the*

products of the chemical industry, and, above all, from the manufacturers actively engaged in developing our chemical industries. We, therefore, ask you, the progressive industrial leaders in this field, to give us your confidence and assistance in our work.

A GLANCE AT THE CHEMICAL SCHEDULE

Time does not permit even the mention of all the important questions raised by the chemical products enumerated in the tariff act. It may be of interest, however, to recall some of the difficulties which confront certain of our industries. War conditions have cut off the raw material of the sulfuric acid industry—iron pyrites—which in normal times is imported in large quantities from Spain. A new kelp industry has developed since the War and produces as a by-product iodine. The War has stimulated the mining of magnesite in California and the manufacture of metallic magnesium, tending to make this country independent of foreign supplies. The securing of an adequate supply of manganese is a serious war problem. Before the War monazite was shipped from Brazil to Germany where thorium nitrate and cerium nitrate were made from it: those two substances were then shipped to the United States where they were used in making gas mantles. Now the monazite comes direct to the United States and the entire process is performed here.

Because of the removal of the duty, the imports of wood alcohol have been greatly increased under the present tariff law. Acetone, also produced by the wood distillation industry, is used in making explosives and its production has increased rapidly under the war demand. Before the War oxalic acid came in large quantities from abroad, chiefly from Germany: the cutting off of this supply has stimulated domestic production.

Bleaching powder, ammonia and ammonia salts, the cyanides, sodium phosphate, the chromates, the nickel compounds, pigments—these and other products deserve more than enumeration, but I must pass on to several other problems in the chemical field.

ELECTROCHEMICAL INDUSTRIES

I am very deeply impressed with the progress made in the electrochemical industries of this country. The ferro-alloys, made possible by the electric furnace, have revolutionized the steel industry; ferro-silicon, for example, is indispensable in munition manufacture; the efficiency of metal cutting tools is due to tungsten, while the addition of chromium, nickel, vanadium or molybdenum confers special properties to steel, making it peculiarly suited to many special uses, including armor plate. The production of aluminum is one of the greatest achievements of the electrochemical industries. They have also produced carborundum and alundum, which have almost eliminated from the market such natural abrasives as emery. These new abrasives are important factors in the metal working industries, such as the shoe machinery industry, where mechanical perfection is necessary in the making of interchangeable parts. Calcium carbide and artificial graphite are also achievements of the electric furnace, and the separation of common salt by electrolysis into caustic soda and chlorine gas is marvelous enough to excite the admiration of the most indifferent. To visit these industries at Niagara Falls is to visit the frontier of industrial research. In America, we should be proud of them. A number of them are peculiarly American in origin. To-day, however, they are confronted with a serious problem of obtaining sufficient water power—so necessary for their operation. Unless this problem is handled in a statesmanlike way, our electrochemical industries will continue the migration already begun to Canada and Norway—both of which offer adequate, cheap water power.

We have in addition to the water power of Niagara great undeveloped powers in the south and west. According to recent statistics the maximum potential water horsepower in this country exceeds 60,000,000 and only 8.8 per cent of it is developed. We have here not merely a problem of statesmanship for members of Congress but a real task for the statesmen of business.

THE POTASH SITUATION

Before August, 1914, practically all the potash used in this country was purchased from the German Potash Syndicate. Geological conditions gave Germany a monopolistic control of this product. In 1910, the German Government by law limited the sales of the potash works up to the end of 1925 and fixed maximum domestic prices and minimum foreign prices.

After the outbreak of the War, Germany added to the restrictions on ocean trade by placing an embargo on the export of potash. In this country the need of potash is to-day acute. Many efforts have been made to discover new sources of supply which can be developed commercially and production has been greatly stimulated; but it is still far short of the demand. The most promising sources of supply are brine lakes in Utah, Nebraska, and California. High-grade potash is no longer available except in very limited amounts and the refining of low-grade potash presents many difficulties. When the German product again seeks a market in this country, the new domestic projects will face severe competition. The Geological Survey of the Government is keeping in close touch with this problem and it will also have our most careful consideration.

EXPLOSIVES AND NITRATES

The control which Germany had over potash has its parallels in other raw materials used not only by the chemical but by other industries. Platinum, for example, is a Russian monopoly. In our search for war materials we have had emphasized again our dependence on Chile for sodium nitrate, which has been the chief raw material in the production of nitric acid. The fear that this supply might be cut off and this country be left almost helpless in the production of explosives, has turned our attention to the fixation of atmospheric nitrogen. Congress appropriated \$20,000,000 for this new development. After an investigation, the committee recommended that nitric acid be obtained from the oxidation of ammonia and that a plant be erected.

This action is not only wise as a war measure but it is also a peace measure. As soon as the demand for explosives declines, nitrogenous fertilizer can be produced. We have here an example—there are many others in the field of industrial chemistry—of an industry whose development may be viewed either as a measure of military or economic preparedness.

COAL-TAR DYES

Such, in fact, is the way in which Germany views her coal-tar dye industry. This industry was regarded by the German Government as an important factor in national defense and when war broke out in 1914, it was almost without change transferred from the production of dyes to the production of munitions.

No problem connected with the chemical tariff is more complex and important than the problem of coal-tar dyes. *Of the total consumption of artificial dyestuffs in the world in 1913, it is said that Germany produced 74 per cent and the remainder was produced only with Germany's permission, because she controlled the raw materials known as "intermediates."* Under the shelter of war conditions a new industry has sprung up among us as if by magic and it is destined to contest and overthrow the monopoly which the Germans have had of the world trade in dyes.

As is well known, the organization of Cartels is encouraged in Germany and has been a leading factor in the advance of German industry. It has been particularly effective in the chemical industries. Because of the interrelation of products and the utilization of by-products, close organization has effected large economies. It has made the protection of patent rights easier; it has made it possible to purchase raw materials at a greater advantage; and it has enabled the industries to meet competition abroad more effectively.

In the dye industry organization has been important and powerful. Unquestionably a large part of its success was due

to the painstaking research of German chemists and the patents which they took out by the thousand. But financial control and business organization were also large factors in its supremacy. Before the War it was controlled by two communities of interests—the one known as the Badische group, the other as the Höchst-Cassella group. These two groups were closely coördinated and it was reported not long ago that a closer union had been entered into for the purpose of meeting effectively the conditions created by the War, which have led to the establishment of competing industries in other countries, particularly the United States.

The dividends of four of the large German dye concerns from 1902 to 1911 ranged, it is reported, from 196 to 300 per cent. This financial strength must be kept in mind when we are considering the competition which our industries will be called upon to face after the War.

When the War broke out in August, 1914, we were using some 60,000,000 lbs. of dyestuffs and 80 per cent of them were imported. Not only that, but 80 per cent of the "intermediates" used by the four or five domestic concerns making the remaining 20 per cent of dyes were imported. The country was practically dependent on Germany for color. The War brought almost a panic among the users of dyes. Prices mounted to unprecedented heights and dire prophecies were made.

The American business man and chemist, however, attacked the situation in a truly American fashion. Within three years after we were cut off from the German supply, we had invested huge sums in plants for making crudes, intermediates, and finished dyes. We were producing as large a quantity of dyes as were consumed here when the War started. We were receiving from abroad more money for exports of dyestuffs than we had normally paid out for dyestuffs imported. We still do not make a few such highly manufactured lines as the alizarines and indanthrenes and only a portion of our requirements of indigo, but in most lines of large consumption we are now able to meet all demands and we shall soon be producing the remaining lines of color. We have a right to be proud of our achievement in this field. When it is recalled that over 900 distinct chemical products are made from some 300 intermediates, which themselves have first to be chemically produced from 10 crude products distilled from coal tar, the vastness of the problem set before this youngest of our industries is apparent. The rapidity of its progress has amazed the world. The record of its achievement reads like a fairy tale and will prove an imperishable monument to American chemists and business men.

COMPETITION AFTER THE WAR

New conditions have been brought about by the War in industry as well as in all the other phases of our national life. Thoughtful students of industry are looking ahead to peace times and asking what competitive conditions will then prevail. What I have said makes it clear, I think, that this question is particularly pertinent in industrial chemistry. In the law of September 8, 1916, Congress has already said that the tariff is to be one of the means of preventing any attempt by a foreign competitor to destroy the new American dyestuffs industry. In revising the law of 1913, the plan was carried out, with a few exceptions, of raising the duty on intermediates from 10 per cent ad valorem to 15 per cent ad valorem plus a special duty of $2\frac{1}{2}$ ¢ per lb. and on finished dyes from either the free list to 30 per cent ad valorem or from 30 per cent ad valorem to 30 per cent plus 5¢ per lb. The duty of $2\frac{1}{2}$ ¢ per lb. on intermediates and the duty of 5¢ per lb. on dyes are referred to as "special duties" and after five years are either to be abolished or reduced gradually over a subsequent period of five years. The law provides for a census which may be taken by our Commission for the purpose of enabling the President to determine which of these alternatives shall govern. If the census shows that after five years from the passage of the act 60 per cent of the domestic consumption in intermediates and dyes is not produced in this

country, the law provides that the special duties shall be abolished by Presidential proclamation.

As you know, the Tariff Commission has no power to fix tariff rates or even to recommend them upon its own initiative. We are, however, vested with power to investigate all phases of the tariff problem and our report will be laid before Congress in ample time so that it may consider, in the light of our investigation, whether or not the new conditions created by the War require any further changes in our tariff laws.

PREVENTION OF "DUMPING"

Unfair competition was one of the methods employed by the German coal-tar dye industry to maintain its international supremacy. Unfair acts in this and other lines were no doubt in the minds of the members of Congress when they enacted the unfair competition section of the law of September 8, 1916. By this law it is a criminal act to import any article systematically into the United States at a price substantially less than the actual market value abroad plus certain charges with the intention of destroying, injuring, or preventing the establishment of an industry in the United States or of restraining or monopolizing the trade in the imported article.

In addition to this prohibition of unfair price cutting, the law makes provision against the practice known as "full line forcing." Articles will be assessed with a double duty which are imported into this country under an agreement that any person shall not use, purchase, or deal in or shall be restricted in his using, purchasing, or dealing in the articles of any other person. If, for example, after the War, the German dye industry controls by patent a color needed in this country, it cannot use the necessity of the American consumer as a means of forcing him to purchase his full line of dyes from abroad when all the colors except the one controlled by the patent can be purchased in this country.

On account of the present abnormal conditions in international trade, neither the Department of Justice nor the Treasury Department have been called upon to act upon any cases under these provisions of the law, but they will become valued means of protecting the American chemical industries, particularly the dye industry, from the determined trade aggressions of foreign competitors. They might be made more effective by giving the Tariff Commission power to issue an order against persons who after investigation are found violating the law, requiring them to cease and desist from the unfair acts. In other words, the Tariff Commission, which now is vested by law with the duty of investigating "dumping" cases, could be given in addition a jurisdiction over these cases such as the Federal Trade Commission has today over unfair methods of competition. Many cases could be reached in this way in which the evidence would not be sufficient to warrant criminal prosecution.

ORGANIZATION AND RESEARCH

Tariff laws and "dumping" legislation will not alone protect our chemical industries. The German industry attained success by years of research, by conservative financing, and by industrial coördination. In American industry these, too, must be important, in fact, dominant factors.

The chemical industry "is one of the industries in which export coöperation might be expected to prove highly beneficial." While tariff and unfair competition laws will afford some protection in the domestic market, they afford no protection in export trade. After all, the best security for industry is in research laboratories, in the standardization of processes and products, and in efficient management and organization. In these, your genius as industrial leaders has its widest opportunity for not only business success but national service.

I say "national service" because of our dependence on our chemical industries. Their products are in most cases basic. They are indispensable in processes and products of other industries. The metal working industries are dependent on the

products of the electric furnace. The textiles must have dyes. We must have chemicals for the refining of sugar and petroleum, for the manufacture of glass, pottery, paper, paints, and varnishes, rubber, and cement. The tanning industry leans heavily on the chemical industries. Agriculture gets from these industries its fertilizers. Medicinal and pharmaceutical products, toilet preparations, photographic materials, motion picture films, cleaning compounds, baking powder—to mention these among the many which suggest themselves reveals how close chemistry comes to our daily life. In the problem of national defense it is a controlling factor. The factories that produce nitrogenous fertilizer in time of peace will yield us nitric acid in time of war; those producing intermediates and dyes can turn their machinery and workers to making explosives. Hard steels for shells and armor-plate are achievements of the electrochemists. *I might go on enumerating cases illustrating the close relationship which exists between our chemical industries and our national interests. I have said enough, however, to indicate my feeling. The healthy development of our chemical industries is a matter of national concern. It is the duty of the Government to study its needs sympathetically. In turn, it is not only your duty but your privilege to be business statesmen in solving your problems of production and distribution—to plan not merely for profits but also for a national industrial system serviceable to the capitalist who invests, the worker who toils and the public that consumes.*

WAR AND THE FUTURE OF INDUSTRY

I have spoken of some things this evening which, at first glance, seem to have no bearing on the tariff problem. But our tariff problems, in so far as they touch production, are also industrial problems. They must be considered as a part of the more comprehensive task of the progressive development of our national life. The War in which we are now engaged will inevitably affect radically American industry. More than ever before conditions demand a constructive program, not merely for war but for peace. Modern war is in methods an economic as well as a military struggle. It is teaching us the value of coöperation. Society is learning its obligations to industry; industry is learning its obligations to society. We are relearning the old lesson that we can not under modern social conditions live to ourselves. Things which once were private matters are now admitted by all to be matters of public concern. It is not strange that many men are now wondering whether or not social coöperation, if it is good for national defense, is not equally good for the progressive development of our economic life after the War. Let us face these new problems with an open mind. Let us look forward not backward. Let us coöperate together in bringing from the fire of sacrifice, through which the world is passing to-day, more efficient methods of production, juster means of distribution, and a nation rededicated to righteousness and international fair dealing.

THE TARIFF COMMISSION AND ITS OPERATION WITH REFERENCE TO THE CHEMICAL SCHEDULE

By GRINNELL JONES

Technical Expert, U. S. Tariff Commission

The structure of the Tariff Act as we have it to-day goes back to the Act of 1883, when the dutiable articles were for the first time divided into Schedules. Schedule A was assigned to Chemical Products, Schedule B to earthenware and glassware, Schedule C to metals; while wood, sugar, tobacco, foods, liquors, cotton, flax, hemp, and jute, wool, silk, paper and books, and sundries were classified under Schedules D to N. This same order is found in all the later Tariff Acts. The Schedules of dutiable articles are followed by the Free List, in which the articles admitted free of duty are arranged alphabetically with entire disregard of the classification by Schedules.

In the Act of 1890 we find for the first time the Schedule subdivided into numbered paragraphs, which proved such a great

convenience that it has persisted to the present time. There have been, however, frequent changes in the paragraph number assigned to any given article.

In subsequent Acts there have been considerable additions to the number of substances mentioned by name, but these additional substances have not always been added to the Schedule and paragraphs to which they would seem properly to belong. For example, articles made of carbon have been added to the Glassware Schedule; thorium nitrate has been added to the Metal Schedule; and saccharin has been classified with sugar rather than with coal-tar products; and we now find dried egg albumen in Schedule A, and liquid egg albumen in Schedule G. Schedule A, in 1883, was made to include not only chemicals proper but oils, drugs, pigments, dyes and extracts for tanning and dyeing, explosives and alcoholic preparations. This same grouping and a great deal of the phraseology has persisted to the present time in spite of the numerous revisions, and many of the things which seem strange in the present Act can be traced back to the Act of 1883. For example, we find sponges included in Schedule A in the present Act instead of among the sundries in Schedule N. This classification appeared in the Act of 1883 and has been copied in all later Acts.

The arrangement by paragraphs also leaves much to be desired, since the same paragraph includes such dissimilar articles as amber, dutiable at \$1.00 per lb., and dextrine, dutiable at $\frac{3}{4}$ c per lb. On the other hand different barium compounds are dutiable under five separate paragraphs. Asafetida quite properly gets a paragraph by itself, but "gunpowder and all explosive substances" are compressed into one paragraph, although further search discloses fulminates in a separate paragraph. Paragraph 5 reads, "Alkalies, alkaloids and all chemical and medicinal compounds, preparations, mixtures and salts, and combinations thereof, not specially provided for in this section, 15 per centum ad valorem." However, this close juxtaposition of alkalies and alkaloids is not quite so bad as it sounds because nearly all of the alkalies are elsewhere provided for by name and therefore not included here. Paragraph 5 is the basket clause which levies a duty on any chemical which may have been overlooked in drawing the Act or on any newly discovered substance which is not covered by any of the general descriptive or class names in other paragraphs.

The rates in the Act of 1883 were high, but the general tendency in the revision since has been downward. Chloroform was dutiable at 50c per lb. in 1883 and has been gradually reduced to 2c per lb. Refined glycerine which was dutiable at 5c per lb. in 1883 is now 2c per lb. Castor oil has come down from 80c to 12c per gal. and linseed oil from 25c to 10c per gal. Bicarbonate of soda has been reduced in the same time from $1\frac{1}{2}$ c to $\frac{1}{4}$ c per lb. and soda ash from $\frac{1}{4}$ c to nothing. Perhaps the most extreme case is the alkaloid strychnine which has come down from 50c per oz. to nothing. On the other hand cases where articles on the Free List in 1883 have been removed from it are rare, the most conspicuous examples being alizarine, indigo, the essential oils and balsams.

There has been a marked tendency to alternate from ad valorem to specific duties and back again, especially in the earlier tariffs under consideration.

The continual increase in the number of items mentioned by name has resulted in a corresponding increase in the detail of the import statistics published by the Government. If a substance is specified by name in the Tariff Act, all shipments of the article which came into the United States must necessarily be so described and invoiced and can, therefore, be entered in the published import statistics. In many cases, however, a substance not mentioned by name in the Act will be dutiable under some general class name and in such cases it is usually entered on the customs house records under that general class name, thus