The capillary tube method was carried out as follows: Tubes about 1 mm. in diameter were prepared and sealed at one end. The rosin was pulverized between two pieces of paper. About 2 cm. of the tube were filled with the powder, and it was attached to the thermometer as in the other cases, being also immersed in cold water and heated as before.

A reading glass was used to observe the result and the point at which the particles coalesced was noted as the melting point. It was not found advisable to carry the heating until the whole of the rosin in the tube became clear as this increased the range of personal error. There was found to be a more definite

indication and closer agreement when the point of coalescence was noted.

The results obtained by the "Film" method are for practical purposes the same as those obtained by the "Capillary" method, but the tests are prepared more rapidly and with much less trouble, especially in the hands of unskilled assistants. The end-point is definitely established by the penetration of the water.

In all of these tests recently boiled water should be used, otherwise the rising bubbles of dissolved gases interfere in several ways.

43 SCOTT STREET
TORONTO, ONTARIO

ADDRESSES

THE FUTURE OF THE AMERICAN DYE INDUSTRY¹

By W. H. NICHOLS, President, American Chemical Society

When war was forced upon the world in 1914, the chemical industry of England, France, Russia, and Italy was quite unprepared for the tremendous demands made upon it, some of the most insistent being for materials hitherto unmade in any of those countries, due to the shrewd policy pursued by the Germans for many years in anticipation of the event. The chemical industry of the United States was in far better state of preparation and, as is well known, was able to fill the gaps. On our own entry into the war, it appeared to those in authority at Washington that large additions should be made to the chemical output. To accomplish this result, our Government thought best to construct largely, and to assist certain individuals and corporations in doing likewise. As the chemical industry was thoroughly prepared to take care of the requirements of our own country before the war, it is fair to assume that it is in position to do so when we return to lines of peace. It is therefore manifest that a number of works in which the Government is interested will not be needed, and it is hoped that the manufacturers who so bravely and liberally contributed to the increase in output, will not now find themselves in competition with governmental plants. While I am informed the Government will take careful account of this, and will do what it can to protect industry already organized when the war began, I believe the potential injury should be alluded to in order that the large gathering of manufacturers here might be in position to express itself should it so desire.

The fortunes of the chemical industry are naturally bound up with the fortunes of industry at large, and the same rules which apply to any other industry would apply in almost every case to the chemical. If the country returns to its pre-war state of manufacturing capacity, the chemical industry will be able to take care of itself and any demands that are made upon it. Therefore, its future will be identical with the future of all the great undertakings with which we are involved. I have not thought it best to take up your time with discussing general details, knowing that these will be considered in the ordinary course of events.

I have thought that with the limited time accorded me, I might be of some service in calling specific attention to an industry which is practically new in this country, which is vital, and which absolutely needs encouragement; in fact, all the encouragement which can be forthcoming from every source. I refer to the manufacture of coal-tar dyes and medicinal preparations which up to 1914 were produced almost exclusively either in whole or in part by the great German concerns. Owing

to the fact that for nearly forty years these concerns had earned and obtained a practical monopoly of the whole world, they were able to charge prices which made it possible to write off all or the greater part of their plants, so that to-day they are in the position of having plants, doubtless largely increased by war orders, which stand on the books at comparatively small sums. In addition to this, they have the further advantage of having works which are perfected to date, whereas other countries have had to invest in plant, and will still have to do so, with the certainty that much of its construction may be scrapped as knowledge advances. With a full appreciation of these difficulties, manufacturers of England, France, and Japan have received the strongest kind of encouragement from government coöperation, financial and otherwise, and Switzerland permits by its laws the combination of the chief color works, three in number, in such way that processes and patents may be pooled for the common good. In Germany, as is well known, a union of all the great color works has been effected, binding for fifty years, and while the various units composing the same do not lose their identity, or control over their works, etc., still their activities will be controlled by their ability to produce stated products at minimum costs. Profits will be pooled and divided as already agreed; losses likewise. These various facts leave the United States as practically the only great country this side of China frankly open to the German assault, which is sure to come and which should be nipped in the bud. Our present protective tariff is entirely inadequate. I understand that plans have been completed to ship goods already prepared in immense quantities from Sweden, Holland, Switzerland, etc., so that their German origin will be carefully camouflaged.

Of the several branches of chemical industry, at the outbreak of the war, none bulked so large in the eye of the public as the coal-tar dyes and none so gripped public attention. The reason is now not difficult to determine. While the coal-tar dye and its directly related industries do not occupy a leading rank in the world's activities when measured by the customary and usual standards, such as those of labor employed, capital engaged, value of output, tonnage of output, power consumption, and the like, yet their products did perform almost, if not wholly, indispensable functions in very varied industrial operations of exceeding magnitude, importance, and ramification. It is this *functional* value, rather than any *intrinsic* direct money value, that now determines the importance in which the public holds these products. Out of this new viewpoint as applied to coal-tar dyes has grown an entirely new public conception of utility which the public has embodied in the now widely-current expression of "key" or "pivotal" industries by which emphasis is very decidedly placed upon functional importance, and other considerations are deliberately relegated far to the background.

¹ Address to the Chamber of Commerce of the United States, Atlantic City, December 6, 1918.

The public has decided to have all "key" industries firmly established at home.

Just before the war the world's total coal-tar dye production was under, rather than over, \$100,000,000 in value and approximately 250,000 short tons in weight, probably not in excess of 50,000 persons of all ages and positions engaged in their production from primary coal-tar products; in the United States just over 3,300 tons, valued at \$2,470,096, were produced, employing not over 530 persons but using almost entirely foreign-made "intermediates;" but these 530 persons produced other articles valued at \$1,126,699, tonnage not stated. Similarly, the above 50,000 persons produced other things such as medicinals, photographic developments, and the like of unknown value and tonnage, the world's average pound-value of dyes thus being 20 cents, and of the United States production 37.5 cents.

On account of the unavoidably mixed and therefore uncertain nature of all general statistical information on this subject, both in this country and abroad, it is hazardous to attempt great detail; the following is a very rough attempt to sketch the outline and a few of the details of this very complicated business.

With the above reservations in mind, it may be stated for the purpose of rough comparison only that in making dyes from primary coal-tar products, the world's pre-war labor per capita production in terms of dyes was not less than 5 tons per annum; in the United States just over 6 tons of dye for labor per capita were produced, but using foreign-made intermediates.

From a recent publication of the United States Tariff Commission, it appears that we had in this country in 1917, 81 establishments producing dyes, or dyes and intermediates, and 119 establishments making intermediates only; that 19,643 persons were so engaged, producing 23,000 tons of dyes or just over one ton of dye per person engaged per annum. If this be the proper interpretation of that publication, then it discloses an efficiency in tonnage production of about one-fifth of the pre-war efficiency in terms of persons engaged. Of the approximately 300 intermediates needed for our normal dye requirement, 134 were made here in 1917 as against but a very small number, perhaps five, made here in 1914. In 1917 we made no fewer than 180 chemically different dyes and all from intermediates of domestic manufacture. Of the variously estimated 500 or 600 chemically different dyes imported in the fiscal year 1913-14, 154 were made here in 1917 from domestic intermediates, in addition to 18 not then imported and 8 of not now known composition; our imports in that year totaled 23,000 tons; our 1917 production tonnage was a trifle higher; the tonnage imported in 1913-14 of the above 154 dyes amounted to 13,500 tons or 60 per cent of the total 1913-14 importation. Hence, our domestic dye industry in 1917 was directing its efforts very intelligently towards the production of those individual dyes of major importance to the industries requiring this class of products, and in producing substitutes for other dyes since much of its needed material had to be diverted to other uses for one or the other of the belligerent countries including, of course, our own country.

This whole business is made up of a host of different finished products calling for a multitude of semi-finished products representing an individual consumption of the widest conceivable range both as to tonnage or poundage as the case may be, and in values as are now set forth in sketchy outline.

For 383 presumably chemically different dyes imported in 1913-14 and for which values and poundages are known totaling 18,000 tons, the annual importation is 47 tons; of these 383 dyes only 67 are equal to or above this average tonnage, and 316 dyes are below it; the largest individual shipment amounts to 4,253 tons and the smallest to $\frac{1}{17}$ of a ton; 30 dyes are less than $\frac{1}{2}$ ton; the total value of these 18,000 tons was \$6,496,882, or an individual value of \$26,479; the individual annual values

range from \$1,090,773 to \$43. Some dyes (value not given) were imported in amounts even as small as 9 lbs. for the year.

In considering the future of our domestic dye industry it must not be lost sight of that with proper combination of physical plant and proper elimination of duplicated effort the German dye industry could reduce the total number of persons engaged; maintain, if not even increase, the output tonnage, and increase the annual tonnage output for labor per capita. It seems not unreasonable to expect that this might ultimately be one and one-half times the pre-war figure or say approximately eight tons per person engaged per annum.

In any event, the foregoing annual production of one ton of dye per person engaged in our domestic industry for 1917 must be considerably improved if our industry is to be permanently on a sound competitive footing. This apparently poor showing of efficiency must not be construed unfavorably to American effort; it is an unavoidable and wholly to be expected result of the conditions under which our chemists have been compelled to work by circumstances wholly out of their control, or the control of the public.

Our pressing and paramount problem has been to get these goods; matters of cost, labor-efficiency, and the like were wholly secondary; the goods had to be made. In the synthetic organic chemical industry, of which the coal-tar dye business is the largest factor, many ways of making one and the same thing are generally open and it calls for much experience, which can be gained only through time-consuming manufacturing effort, to decide which is the most efficient and the cheapest way. Our chemists did not have time or opportunity to enter into these refinements, they had to begin at the very beginning, and having found one way that would give them commercially usable products they bent their energies towards making that way, no matter how defective it might be, produce the greatest weight of goods in the shortest possible time, regardless of refinements as to efficiency and wastes. That was not a mistaken policy under the circumstances. Time and the goods were the essence of the problem; everything else was supremely secondary; the large domestic industries and needs dependent thereon had to be helped out of an emergency and they were effectively helped. This is not an apology: our chemists are in no sense under any obligation whatever to apologize; it is merely an explanation.

Having made this most important contribution toward winning the war, toward keeping our domestic industries going even though knowing all the time that from the point of view of efficiency his then manufacturing methods were woefully defective and wholly inconsistent with professional standards, should not the American chemist now be given an opportunity to improve the efficiency of the methods heretofore employed, or to devise new and better ways so that we can have this key industry firmly established at home? He must have these opportunities if he is successfully to weather the stress of foreign competition. It is not a question of raw or basic chemicals; we have all of these, except Chilean nitrate, in domestic abundance, and to spare, and at prices as low as anywhere. There is no magic in attaining the highest efficiency but it requires slow, painstaking, and voluminous investigation and testing to arrive at this maximum. Our chemists have the necessary training, skill, ingenuity, and resourcefulness to accomplish this. What they need is proper opportunity, and to be relieved from this production pressure, in order that they may improve their methods. Such a procedure is very costly. Who will foot the bills and how? These are not matters that can be successfully solved in a laboratory; they require try-out on manufacturing dimensions and under manufacturing conditions and hence are inseparable from actual manufacturing plants operating for commercial ends. For that reason our governmental research agencies cannot effectively aid in the solution of the problems

confronting our dye manufacturers. This work, therefore, devolves wholly upon the manufacturers themselves. Since the normal pre-war competitive manufacturer's value of our total annual dye consumption is not over \$10,000,000 for several hundred, possibly one thousand, widely different products, including intermediates and dyes, most of them of small individual value and tonnage, it is clear from our past experience that our manufacturers cannot themselves finance this expensive undertaking of refining and improving all needful manufacturing processes so as to have this key industry in its substantial entirety firmly established here. Our Federal legislators must find effective ways and means of lifting this financial burden and production-pressure from our dye makers while they are perfecting their processes and increasing the variety of their output.

We, of course, have a protective tariff. In my opinion this alone will not accomplish the purpose, nor do I think that it will do so even in connection with the anti-dumping law now in force. As stated before, in England, Japan, France, and Italy, the respective governments have taken more direct action ranging from direct government financial participation to guarantee of dividends. Yet these measures seem in the opinion of some not to promise success. Additional help in the way of complete prohibition of imports of all dyes or that device modified by permitted importations of limited amounts of specified dyes not then made at home, under government license, all for a limited number of years, have been seriously proposed abroad. This problem is rendered the more difficult by the very practical and important consideration that dyes enter commerce not only as such and in packages like kegs, casks, and barrels, but also on finished commodities such as textiles, leathers and leather goods, printed and painted articles, and an uncounted host of other things. It might even be necessary to prohibit the importation not only of dyes and the like as such, but also all articles, like textiles, which are dyes or colored with such dyes except where we have domestic sources of all the dyes involved in any shipment.

From this it is clear that this problem is not only complex, but exceedingly difficult; that the best minds in foreign friendly countries are not agreed as to the needful helps; that the more this phase of the subject is studied, both here and abroad, the more drastic the proposed measures become. It is also clear that half-way measures cannot promise success. Since we are really determined to have this particular key industry firmly established at home, we must be prepared to pay the full price and we ought to be prepared to pay rather more than "just enough" in order to make ultimate success not only certain but speedy of accomplishment.

If public measures are taken for the purpose of establishing this key-industry at home, it is perfectly clear that those who enter into or remain in it are in duty bound to make the country not merely seemingly but actually and intrinsically independent of all foreign competitors by producing not only the staples and the specialties in quality, quantity, and cost equal to anything offered from abroad, but also to lead or at least to keep abreast of the highest foreign developments by assiduous, intelligent and resourceful research, both scientific and technical, of the whole field and all its ramifications.

Just how this shall all be brought about, no man can with any confidence say to-day, but surely our dye-makers, our users of dyes, and our importers of dyes and materials into which dyes enter, can find by patriotic and clear-headed conference and coöperation ways and means that will commend themselves to our legislative and other government officials as being best designed to accomplish the will and desire of the American public which has been repeatedly and determinedly expressed and in a way that cannot be ignored.

Given a fair chance, with confidence that there will be no

outside interference for a certain period, it is my conviction that the American dye industry will not only stand alone, but that it will lead the world.

THE PROBLEMS OF THE DYESTUFF INDUSTRY¹

By F. W. TAUSSIG, Chairman, United States Tariff Commission

It is not necessary for me to rehearse the events of the last three years or the facts of the present situation. You are familiar with the history of the industry and with its problems. You know well the extraordinary story—the unique dominance of the German industry before the war, the passive acquiescence of most countries in that dominance, the virtual cessation of imports during the war, the rapid growth of the dyestuff manufactures in this country and in others. You know too that there is impending an equally sudden transition to new conditions. It is these new conditions that now demand our attention. I shall not weary you either with congratulations on the achievements of the past, or warnings about the possibilities of the future. Nor shall I undertake any discussion of general questions of industrial policy or general problems of reconstruction. I shall confine myself to the problem which is before the dyestuffs industry now and here.

Before considering, however, the possible lines of legislative action for the immediate future, I shall ask your attention to one general proposition, simple and unquestionable in itself, but of special relevancy at this time.

Stability is of the first importance for any industry and at all times. Business can accommodate itself to almost any conditions, provided they be steadily maintained. This is true as regards prices and wages, banking and monetary systems, income taxes and taxes on business, and, not least, as regards tariff duties. It is quite as important, probably more important, that duties should be settled as that they should be high or low, well- or ill-adjusted. It is imperative to know on what basis business calculations may be made.

Not only is this the case with regard to an individual business or a particular industry; it is true also as regards the prosperity of the country at large. Vacillation and uncertainty in tariff policy are probably more harmful than any extreme of high duties or of low duties. The good results which are obtainable through a protective system endure only if such a system is maintained consistently for a considerable period—if time is given for the development of domestic industries, for growth under assured conditions, for the introduction of improved methods through long-continued experiment. And similarly, the good results which are obtainable under a policy of free trade are dependent upon its maintenance over a long period. They can come only through steady competition among foreign producers and domestic distributors, and the adjustment of export trade as well as of import trade to larger volume. A consistent policy followed for a considerable stretch of time is in either case essential for the attainment of the desired results.

Let us now look at the situation which is to be expected in the immediate future in this country, and look at it frankly and openly. Let us not disguise the facts by vague generalities, by pleasant words, by rose-colored optimism. The truth, plainly stated, is that the outlook for stability is poor. Indeed, the prospects are of the slightest for anything in the nature of a settlement of the tariff. Consider the obvious facts of the political situation. We are at the beginning of the short session which closes the 65th Congress. In the 66th Congress, which will be in session from March 4, 1919, to March 4, 1921, there will be no unification of control and hence there can be no

¹ Address before American Dyestuffs Manufacturers Association, New York City, December 6, 1918.