by the decomposition of the pyroxylin would have a much greater weakening effect on the fabric than would a similar amount of acetic acid, even if the rate of decomposition of the two cellulose esters were the same. In one instance the tensile strength of cotton fabric doped with a nitrate dope after 3 weeks' exposure was reduced to 48.5 per cent of the original, while linen coated with the same dope was reduced to 68 per cent. With an acetate dope under similar conditions, the tensile strength of the cotton was reduced to only 87.2 per cent and the linen to 84.8 per cent. All of these were taken in the direction of the warp.

In order to give a more waterproof surface, it is the general practice with some companies to apply one or two coats of spar varnish over the usual dope. The use of spar varnish has one disadvantage, however, and that is in the matter of patching. As a rule, a hole in a wing can be patched with a piece of fabric by using dope as a glue. On spar varnish, however, most dopes do not stick, so that in order to make a repair, the varnish first has to be removed.

There is one bane of the dope room which might be mentioned here, and that is the formation of white spots during the drying of the dope. They are due to moisture condensation during the drying and show up as a rule only on humid or rainy days. They can be removed by going over them with a little solvent, or better by applying a cellulose acetate dope designed for the purpose. Of course, the white spots can be prevented, even on damp days, by regulating the amount of moisture in the air of the dope room, but this, as a rule, requires a rather elaborate ventilating system.

Of Mr. Cammen's ideal properties, we have now considered all but the last two, *viz.*, that of being non-poisonous and that of low visibility. The biggest bone of contention as regards poisoning has been tetrachlorethane. Tetrachlorethane is one of the best solvents for cellulose acetate. Unfortunately, however, its vapors when inhaled affect the liver, and before its poisonous character was recognized, a few deaths had resulted abroad. These were the result of inadequate ventilation. As soon as suitable ventilation was provided, the trouble almost entirely ceased. Some argue for the total exclusion of tetrachlorethane as a solvent in cellulose acetate airplane dopes, but it gives the finished wing a certain resilience which nothing else does. Some of the British experts are very strong in their assertions that it is indispensable as a constituent of dopes for scout machines. However, the report is that for some months the use of tetrachlorethane has been forbidden in England. The policy for this country has not as yet been absolutely established, but should it prove desirable to use tetrachlorethane, it would seem possible to do this, if ample ventilation of the proper type were provided.

As regards low visibility, the dopes, being transparent and almost colorless, do not make the fabric appreciably more visible than if it were not doped, except possibly when the sun might be temporarily reflected from a glossy wing. The use of a dull surface would obviously remedy this. Should it be found that some color other than that of natural linen would blend better with the color of the sky background, either the dope or the fabric could be dyed. The goal of low visibility, however, is a transparent wing. Doubtless many of you saw a newspaper account a little over a year ago of a foreign airplane that did not have transparent wings. That no further reports of such machines have appeared would seem to indicate that as yet, at least, they are not very common. The wings of the machine in question were made of transparent cellulose acetate sheets, and it was claimed that at a height of a few thousand feet, the machine was almost invisible. It had the further advantage that the field of vision of the operator was much increased. Cellulose acetate sheets in a thickness of $10/1000$ of an inch, which thickness has the necessary strength,

weigh about nine ounces per sq. yd., which is a little heavier than most doped fabric. The chief difficulty in using them is the fact that a tear once started spreads very rapidly. A patent has been taken out for remedying this difficulty by reinforcing the transparent sheet by means of a fabric such as silk woven rather loosely. As is readily seen, a wing of this sort would be waterproof, air-proof and non-inflammable, would have low visibility, would not affect the workmen applying it, and would give no trouble from stripping or peeling. In other words, there seems no doubt that if it can be obtained of the proper weight and strength, it will prove to be the ideal wing covering.

CHEMICAL PRODUCTS COMPANY
BOSTON, MASS.

THE COLLABORATION OF SCIENCE AND INDUSTRY¹

By V. GRIGNARD

I am much honored that you have asked me to speak before you, but I must apologize for my ignorance of the English language which prevents my speaking at length without abusing your courteous attention.

I appreciate deeply the great honor done me in making me honorary member of the Mellon Institute and I wish to express my deep gratitude to the corps of professors and especially to the Director, Mr. R. Bacon.

My collaborator, Monsieur Engel, who speaks English fluently, will tell you better than I of the excellent impressions we have received in the course of our visit in your beautiful country; but I wish to emphasize myself all the gratitude which I feel toward your great industrial establishments and scientific institutions for the uniform kindness which we have received from them, for the courtesy with which they have facilitated our visits and have furnished us with literature.

I wish to express to you also all the admiration which I feel for the remarkable scope of your industry. You have made magnificent use of your immense natural resources, thanks to your will, your initiative, your faith in the future. These valuable traits the American race owes to the very conditions under which it has evolved: the first colonists, a small group of enterprising men constituting an élite because of their aptitude and their scientific knowledge which two centuries ago (and even less) was the lot only of the privileged few, found themselves struggling in a nearly virgin land with the many difficulties which social life has imposed upon humanity. They acquitted themselves with honor and if they did not always find the most scientific solutions, those which they did bring forward were marked for their daring and practical character.

And it happened sometimes that some of these solutions, obtained uniquely in the experimental way, proved superior to those of the European engineers; this was the case, for example, with the turbine.

But life becomes more and more difficult even for the most prosperous nations such as yours and the problem becomes singularly complicated when it is no longer simply a question of supplying a national market, largely open, but of entering into commercial competition, from within and from without, with new industries strongly organized. It becomes necessary then to reduce the net cost to the minimum, searching out the most rapid and most economical processes, allowing no loss of anything which represents any value.

Furthermore, the terrible war which has been imposed upon us and in which we are fighting side by side for the triumph of justice and of liberty, this terrible war has demonstrated that there exists for each large nation a certain number of vital industries which it cannot neglect without exposing itself to the danger of some day being at the mercy of its enemies. The nature of the problem changes. Scientific and technical in-

¹ Translation of address delivered in French at Mellon Institute on December 8, 1917.

struction become necessary and in this your universities succeed wonderfully.

But this again does not suffice; it is necessary that the manufacturer should not allow himself to be elated by his earlier success and should understand the necessity of commencing, or rather, of continuing the contest, without waiting for this prosperity to be menaced by better-informed competitors. And that still is not all; when the manufacturer has comprehended his real concern it is not always possible for him to erect suitable laboratories, to endow them with the necessary equipment, and above all, with a specially trained personnel.

It is then that institutions like the Mellon Institute come into play, a production of genius which has solved in a manner truly American a problem already old but without satisfactory solution in Europe—that of direct collaboration between science and industry. In visiting it the day before yesterday I took account of its strong organization and of the incalculable service which it can render.

Between the too naïve disinterestedness of the majority of the French investigators and the German form, fruitful without doubt, but too materialistic, which has made of too many German scientific schools veritable industrial laboratories, for the glory and above all the profit of their directors, there was room for a solution considering the rights of the manufacturer but also considering the dignity of the university. This solution you have found and the success of Mellon Institute since

its foundation proves that the way in which you have been doing it is the proper one.

Without doubt it will be necessary to struggle for a long time yet against acquired habits, as we say, against the routine, but further it will be necessary that the manufacturer have well impressed on his mind this truth: in the period of beginning the improvements to be realized are numerous, researches give results rapidly, but little by little the framework contracts, investigations require more and more specialized work, more time, and more money. And it will not be necessary that the manufacturer's interest should clash with that of research, the more difficult it becomes the more *raison d'être* will it have in the midst of the great economic struggle which, after the war, will array, on a new account, one part of the world against the other.

France, who has never considered herself behind in the march of progress, cannot fail to organize all her forces for this collaboration, too much neglected by her, of science and industry. She cannot be inspired by a better model than the Mellon Institute. Again, it will be necessary that our manufacturers accept the necessary sacrifices for the foundation of laboratories and of scholarships for research. But we can, I trust, have all confidence; the war has opened our eyes and demonstrated once again the truth of the proverb, "He who does not advance, falls behind."

I, therefore, salute with all my heart your magnificent Institute which I consider a wonderful instrument of scientific and industrial progress.

PERKIN MEDAL AWARD

The Perkin Medal for 1918 was conferred on Auguste J. Rossi, in recognition of his distinguished contributions to the metallurgy of titanium, at the meeting of the New York Section of the Society of Chemical Industry, held at the Chemists' Club, January 18, 1918. Introductory remarks by Mr. Jerome Alexander, Chairman of the Section, were followed by an address on "A. J. Rossi and His Work," by F. A. J. FitzGerald, Past President American Electrochemical Society. The presentation of the medal by Dr. William H. Nichols, Past President of the Society of Chemical Industry, was followed by an address of acknowledgment by Mr. Rossi. The addresses are printed in full herewith.

The usual informal dinner was held before the meeting in the dining hall of the Chemists' Club, giving the members the opportunity of meeting the recipient of the medal.—EDITOR.

INTRODUCTORY ADDRESS

By JEROME ALEXANDER

Nothing could be more illustrative of the cordial solidarity that unites us to our Allies, England and France, than this evening's meeting; for here before the New York Section of a British Society we are about to award the Perkin Medal to Auguste J. Rossi, a native of France.

France! How the heart of every true American, yes, of every true democrat throughout the world, leaps at the mention of that name! Fair are her fields and beautiful her cities; but France is much greater than all these—her artistic, literary, scientific and spiritual gifts to humanity and civilization have made us her debtors for all time; and to-day the civilized world is fighting under her slogan of "Liberty, equality, fraternity."

As a consequence of this dreadful war, and under the lash of its stern necessities, we have fortunately been brought in closer relationship with our French fellow chemists. For some months past we have been planning the formation of a New York Section of the French *Société de Chimie Industrielle*, the sister society of the British *Society of Chemical Industry*; and to-night, immediately following our meeting, it will be formally organized.

We will, therefore, proceed with our program, and hear an account of Mr. Rossi's life and work from a gentleman well known to you all, Mr. Francis A. J. FitzGerald, Past President of the American Electrochemical Society.

NATIONAL GUM AND MICA COMPANY
NEW YORK CITY

MR. A. J. ROSSI AND HIS WORK

By F. A. J. FITZGERALD

It was, I think, in the year 1899 that I first made Mr. Rossi's acquaintance. There was much speculation in Niagara Falls at that time as to what he was doing. In those days there was always much gossip whenever some new work was started at Niagara Falls for it was still in the early period of power development before the MacFarlands and politicians got busy and we were all watching eagerly the rapid electrochemical developments, —aluminum, carborundum, caustic soda and chlorine, calcium carbide, etc. Wonderful stories would float about as to what newcomers were doing. When the Oldbury Chemical Company started, the most astonishing stories were afloat, caused I think largely by the high brick wall which surrounded the factory. It was told with bated breath that this works was engaged in the manufacture of cordite by a new and secret process and that you could not get inside the brick wall except over the body of an armed guard.

I cannot recall now what various stories were told about some remarkable work in the Porter house and the old stone barn which stood where the Acheson Graphite Company's plant now is, but these were sufficiently startling, and all agreed that it was a French chemist named Rossi who was working on some new invention.

I soon made Rossi's acquaintance, for in the electrochemical work of those days there was a fine spirit of coöperation, which indeed has become to a great extent permanently characteristic of Niagara Falls, and before long I got to know him very well. During visits to him I learned a great deal about his researches on the smelting of titaniferous ores, about the experiments he was then making on the manufacture and use of ferrotitanium and