laboratory, men whose sympathies, already scientific, would be strengthened by association and make broad channels for the flow of science into practice.

Scientific men, we must admit, have often no conception of the real environment and problems of the industrialist; of the accumulated store of empirical knowledge from which he must select what is needed; of the skill and design with which he must apply it under the limitations imposed by men, material, and markets. They too often underrate the extent and importance of what may be called technological science and the new horizons that it opens. The technologist is often ignorantly set in the outer courts of learning; he is not quite of the elect, and antipathies arise. How much have we not sacrificed of the acceptance and efficacy of science in industry by offering young men trained in pure science and knowing nothing of manufacture, to employers trained in manufacture and knowing nothing of science, relying wholly on the manufacturer for a most difficult and precarious adjustment?

The management of our applied science has become one of the great problems of the day, and it brings with it great difficulties. Spurious technology is a hateful make-believe that has already wrought much mischief; a man, however scientific, wholly on the make—to use a concise vulgar term for a vulgar condition—is an unedifying spectacle. But it does not follow that because a man is preoccupied with industrial problems he shall lose his scientific virtue or that his achievements, however remunerative, should rank on a lower plane. It is not so difficult to distinguish the genuine from the base among scientific workers wherever they may be engaged.

We must strengthen the bonds between science and industry by something more than an appeal to the pocket. A real sympathy and interest must be created on both sides; we must open our arms wider. Even if we find difficulty in discovering, in this country, the type of railway president described by Lt.-Col. Barret, there are yet many men in our world of industry and in the service of the State who, without any list of scientific memoirs to their name, have yet been potent in the service of science, and would be more potent still if they were brought more into companionship with the scientific world. The Royal Society has the power of admitting to its ranks at the rate of one each year "persons, who in their opinion have either rendered conspicuous service to the cause of science or are such that their election would be of signal benefit to the Society." Here at least is a limited opportunity of doing something towards introducing into the circle of science the sort of men whose influence might help towards bringing about the reform to which we are bidden by a candid friend. In any of the new associations that are contemplated for giving science its right place in our national life we shall surely do well to cast our net widely and to extend our outlook beyond the conventional circumference of what have usually been deemed scientific circles.

SULPHURIC ACID IN AMERICA.[1]

IN what is known as a "professional paper," Mr. W. H. Waggaman, of the U.S. Department of Agriculture, has recently given an account of the modes of manufacture of sulphuric acid, both by the "chamber" and the "contact" process, with special reference to its production in the United States for the manufacture of fertiliser materials. As the paper contains some features of interest with respect to American practice, a short account of its contents may not be out of place at the present juncture.

The production of sulphuric acid of various strengths in the United States, according to the latest (1913) figures available is stated to be as follows:—

Grades	Quantity tons	Value dollars	Price per ton dollars
50° Baume	1,643,318 ...	9,212,917 ...	5.61
60° Baume	509,929 ...	3,202,528 ...	6.28
66° Baume	797,104 ...	9,282,422 ...	11.65
Other grades	63,158 ...	986,659 ...	15.62
Total and Average...	3,013,509 ...	22,684,526 ...	7.53
Total reduced to 50°B.	3,538,980*...	22,366,482 ...	6.32

* Exclusive of 22,947 short tons of fuming acid, not convertible, valued at 318,044 dollars.

On comparing these figures with those for the two preceding years it appears that there has been a considerable increase in production of each grade with the exception of those classed under "other grades," the decrease in which is probably accounted for by the item "fuming acid," which appears for the first time in the statistics. Presumably, therefore, the manufacture of this form of oil of vitriol has only been introduced into America within the last three or four years. If account is taken of the fuming acid it is obvious that the production of sulphuric acid has very largely increased in the United States within recent years. There can be little doubt that the disturbance in Continental production in consequence of the war, with its effect on the export trade of Germany and Austria in dyes, drugs, and fine chemicals, as well as on a variety of other finished products in which sulphuric acid plays a part, direct or indirect, has given a still greater impetus to American manufacture, and has tended to consolidate certain industries and to initiate others in the States, to the eventual loss of the belligerent nations. German manufacturers are now beginning to realise that the supremacy they have hitherto enjoyed in certain branches of chemical industry is threatened, and nowhere more seriously than in America.

American chemists have not talked to anything like the same extent as we have done about "capturing German trade." Nevertheless, as recent discussions in the American Section of the Society of Chemical Industry unmistakably indicate, aided by their elastic fiscal policy, they have quietly and deliberately set themselves to do it. And, curiously enough, the "hyphenated" Ameri-

[1] "The Production of Sulphuric Acid and a Proposed New Method of Manufacture." By W. H. Waggaman. U.S. Department of Agriculture. Bulletin No. 283. (Washington, 1915.)

can has not been the slowest to move. It may be that our people are too busy making the things required for munitions to be able to give the matter adequate attention, but we could wish to see the same signs of intelligent and organised effort on the part of the general body of chemical manufacturers in this country as we are now witnessing on the other side of the Atlantic. There can be no doubt whatever that with the fierce industrial struggle that will certainly follow the cessation of hostilities, a very serious time, fraught with the greatest peril, is in store for us, and in particular for our chemical industries. With powerful rivals on either side of us, nothing but the application of the same means, the same enlightened skill and intelligence that in the past have brought pre-eminence to Germany, and are now rapidly bringing it to America, can possibly save these industries from ultimate extinction.

It is not our purpose to follow Mr. Waggaman in his account of the methods of manufacture of sulphuric acid except in so far as they throw light on their comparative advantages in special circumstances, or deal with questions peculiar to America. As regards the contact process, his remarks as to its excellences and its commercial limitations are judicious and to the point. It is admittedly a process which demands skilled and intelligent supervision, and in which there is no room for the rule of thumb type of procedure which characterises much of the foreman management in this country. Doubtless the last word has not yet been said on "catalysers" and "poisons," and there is still room for the ingenuity of chemical engineers in the improvement of plant. But, as matters stand at present, for certain grades of oil of vitriol, and especially for those used generally in the manufacture of fertilisers—one of the most important of the outlets of production—chamber acid will probably hold its own for many years to come, especially in view of the important improvements and simplifications in plant and procedure which have been introduced within recent years.

Of the various methods which have been proposed from time to time for accelerating the chamber reactions, those which seem to have found most favour in the States are Pratt's, Meyer's, and Falding's.

In Pratt's process (U.S. patents Nos. 546, 596, 652, 687), which appears to be much used in the southern States, the gases are drawn through the first chamber by a fan, then through a tower packed with quartz, down which flows dilute sulphuric acid, when they are again introduced, by the same fan, into the first chamber. In a number of plants in which this circulatory system is employed less than nine cubic feet of chamber space are required per pound of sulphur burned in twenty-four hours.

In Meyer's arrangement, of which three installations are in use in the States, "tangential" chambers, designed so as simultaneously to mix and cool the reacting gases, are employed. These chambers are cylindrical in form; round the first run lead pipes conveying cold water. The gases are admitted at a tangent near the upper part of the chamber walls, and are discharged from outlets in the centre of the base, thereby acquiring a spiral motion which tends to mix them thoroughly.

In the Falding system the chambers are approximately one and a half times higher than their horizontal dimensions. The gases after passing through the Glover tower are introduced into the chamber near the top, where, being hot, partly from the fact that they have only recently issued from the burners, and partly because their temperature has been raised by the reactions between certain of their constituents, they collect in the upper part of the chamber and form an active layer, which gradually cools and settles down to the bottom of the chamber, where the spent gases are drawn off. It is claimed that this system requires much less chamber space in which to complete the reactions than the ordinary type. Each Falding chamber is a unit in itself, and is connected directly with the Glover tower, instead of in series as in ordinary chamber systems. Whatever doubts may exist as to the proper explanation of the mechanism of the process, it seems to be commercially successful, to judge from the number of plants in which it is in operation.

The new modification of the chamber process to which Mr. Waggaman refers consists of a method of more quickly effecting an admixture of the reacting gases by causing them to traverse a spiral tube of lead, kept at a determinate temperature. The arrangement has only been tried on a laboratory scale, but from the published results it promises well. Whether it will diminish the chamber space to the extent of 0·139 cubic foot for every pound of sulphur burned in twenty-four hours, as is claimed, seems too good to be true. Comparative experiments using glass and lead spirals appeared to indicate that the metal exerted a specific (catalytic) action. The construction of a sulphuric acid plant along the lines indicated by the author, if successful in working, would certainly greatly diminish the amount of ground space needed, and would presumably decrease the initial cost of construction. The practical man is apt to deride laboratory experiments, forgetting that all factory experience has its beginning in small scale trials. Perhaps he may think it significant that "if patent is allowed, it will be donated to the people of the United States."

NOTES.

EARLY in 1914 a committee representative of British geologists and friends of Sir Archibald Geikie was formed with the object of presenting to the Museum of Practical Geology a suitable memorial of his long association with that institution as director-general of the Geological Survey and Museum, and as a record of their appreciation of his brilliant labours in the cause of geology. It was decided that the memorial should take the form of a marble bust. On Tuesday, March 14, a number of Sir Archibald Geikie's friends