

scale of prices fixed for milk and the efforts being made to secure reduced prices for feeding-stuffs and a preferential call upon supplies, the dairy farmer was being fairly treated, and should endeavour to surmount his difficulties by securing greater economy in the use of food and an increased average milk output per cow.

On the subject of beef production Mr. Prothero did not conceal his apprehension that the scale of prices fixed by the Food Controller for the winter would not only gravely imperil our meat supplies, but would even operate adversely against corn production. From his practical experience he was convinced that current prices left little margin of profit, if any, for the arable farmer, who feeds and fattens cattle for the winter market. A price of 60s. per cwt. live weight for stall-fed cattle puts a premium on grass as the cheapest form of cattle-feeding, and thus renders the farmer more reluctant than ever to plough up grass; it penalises stall-feeding on arable farms, and so tends to diminish the supply of manure for the needed corn crops. We are glad to see, therefore, the announcement in Wednesday's *Times* that the War Cabinet has conceded the appeal of the farmers for a revision of the scale of maximum prices fixed some months ago for home-killed beef for the Army. Under the sliding-scale of prices for live cattle, as originally announced, the price for home-killed beef fell from 74s. per live cwt. in September to 72s. in October, 67s. in November and December, and 60s. from January 1, 1918. It has now been decided that the November and December price of 67s. shall continue until July 1, 1918, and that the 60s. maximum shall then come into force for the rest of the year.

At the best, with the reduced supplies of feeding-stuffs, it will be difficult to avoid a serious shortage of meat in May and June next year. We must not be driven to slaughter more cows or veal calves; we cannot depend upon an increased import of meat; the only safeguard within our control is a reduction in our consumption of meat, and this must be pressed for more and more insistently. The eloquent appeal to farmers in the closing part of Mr. Prothero's speech will assuredly not fall on deaf ears, but it is equally necessary that the public shall realise their difficulties and extend to them the sympathy which no section of the community more rightly deserves.

#### CHEMICAL LABORATORY PORCELAIN.<sup>1</sup>

THE first attempts to make porcelain in Europe were undoubtedly in imitation of the Chinese porcelain imported into Europe by the Dutch, English, and French East India Companies about 1673.

Its beautiful whiteness, its thinness, its translucency, its close vitreous fracture, apart from, and also in conjunction with, its decoration, at once appealed to and obtained the admiration and emulation of the Europeans.

The story of the struggle in the attempt to reproduce it is not within the scope of this paper, but suffice it to say that it was accomplished in Germany by Bottcher about 1706-18, and in England by Cookworthy, of Plymouth, about 1767.

The one factory continued for the reason that not only were the products excellent, but the financial success was not the main object, while the other had to bear its own losses, and though there was considerable promise of success, the financial aspect of the undertaking was a complete failure. It is well, then, at the outset to note that we do not owe the origin of the porcelain to the Continental potters, but to the Chinese.

<sup>1</sup> Abridged from a paper read at the annual meeting of the Society of Chemical Industry, July 18-20, by Mr. Henry Watkin.

Chinese porcelain being at that time the only translucent pottery in existence, there can be no wonder about the admiration it called forth.

It cannot be surprising, then, that the English potters were very anxious to produce such a body, and if that object could be attained, the means by which it was achieved were secondary matters, and we find that instead of continuing the manufacture of hard-paste porcelain, they produced, about the end of the eighteenth century, (1) a beautiful white earthenware which for generations secured the market of the world, and made it possible to replace almost all other pottery for domestic purposes; (2) a translucent white porcelain similar to the Chinese, by the use of other materials and methods, equally beautiful, which for more than a century has held its own amongst all other porcelain productions, and is generally known as bone china.

The ceramic productions of the world as regards their bodies or paste, apart altogether from decorative effects, vary from goods made from the coarsest to the finest clays, through almost every variety of texture, by admixture of the natural clay with other materials, such as sand, flint, barytes, felspathic rock, etc. From these materials were produced at one end of the scale the cinerary urns of our great ancestors, and, at the other end, the excellent hard-paste porcelain which we are considering to-day.

The marvellous difference in the productions of the various peoples of the world may probably be explained by the general assertion that the potters have from the very earliest times worked with the materials they had at hand. The cinerary urns of the ancient Britons were made from natural clays.

The Staffordshire potters used, at first, natural clays, found cropping up simultaneously with the coal, and afterwards improved the colour and texture of the product by the addition of, first, fireclay, then Devon and Cornish clay, and calcined flint. Messrs. Eler Bros. used the red marl of the Burslem district for their fine red ware. Bottcher, of Germany, at first made red ware from local clays, etc., and afterwards porcelain from the white clays or kaolin, and pegmatite.

The Chinese for centuries had been working with their natural materials, kaolin and petuntze, and from these produced their fine porcelain. Some of these various clays naturally required a much greater heat than others to produce hard vitreous bodies.

These varying conditions with regard to materials to the hand of the potter, when means of communication were so restricted, necessarily involved very varied methods of manufacture. The materials differing so essentially from each other naturally required very varying degrees of heat necessary to bring to maturity.

The kaolin and petuntze used by the Chinese would require a much higher temperature to mature than the clays, etc., used in other countries at the time. The exact temperature would not be found at once, and in working out the same an observant potter could not fail to notice the changes taking place in the fired material in regard to vitrification, translucency, and finally distortion at the various temperatures. Thus in all probability, without any more scientific knowledge whatever than careful observation, the fine product of that time would be produced which even now (centuries later) is the object of our research.

While the Chinese were for centuries making the most suitable material in the world for chemical laboratory ware, they had no use for such, and consequently did not make it. It was only with the advance of scientific chemical knowledge in Europe that the need was felt for the various porcelain accessories that were then called into use.

It is not surprising, therefore, that Germany and France, having continued making the Chinese type of

porcelain, should have applied themselves to this particular demand, and while the English porcelain manufacturers were busy on their own particular class of porcelains they should have almost entirely secured the trade of the world in this branch.

With the cessation of the importation of Continental porcelain into this country came the call to the English potter, and, as might have been expected, it was not every manufacturer that would listen to the call; neither was it needful that he should.

There was no very tempting offer of any lucrative opening in the new business, and a potter must be more tempted by patriotism to his country, and a desire to meet its needs, than by immediate prospective financial success.

It is almost impossible to give a definition of chemical porcelain which could generally be regarded as entirely satisfactory. When first porcelain was introduced into Europe, its translucency was sufficient to differentiate it from all other ceramic productions of that period.

We have seen that in the attempts to produce a similar porcelain in Great Britain and on the Continent other kinds of translucent pottery were discovered, which are known under other names, such as bone china, soft-paste porcelain, etc., the first of which for more than a century has held its own amongst the finest productions of the world.

It is quite clear, then, that what was once the predominant and characteristic definition of Chinese and Continental hard-paste porcelain is so no longer, and translucency alone could never be regarded as the guarantee of chemical porcelain. Translucency is only one of the properties of porcelain, and that rather of beauty than utility, as evidenced by the fact that so much of the beautiful translucent porcelain of England has been found useless for the purposes we have in our minds at the moment.

More than 150 years' experience of the manufacture of hard-paste porcelain at the State-supported Royal Factory of Berlin, the experience of which was placed at the disposal of the porcelain trade of Germany, gave it a tremendous advantage over the English manufacturer. It was therefore no light task for an English manufacturer, *minus* that experience, under entirely different conditions, with all the models and moulds to prepare, to attempt the task. Some three or four English manufacturers, however, have attempted the same with very considerable success.

While I cannot speak with any degree of confidence in relation to the manufacture or supply of other factories than our own, I think I may safely say that there is now no very serious occasion to go abroad for any of the chemical porcelain accessories needed in this country.

In spite of all the difficulties surrounding the problem, English samples were in the hands of the dealers for testing purposes in November, 1914. On January 20, 1915, deliveries were commenced. The permanent success of the venture for all the firms concerned will depend upon the behaviour in use.

Doubtless demand will be made upon our manufacturers, from time to time, for very special articles, such as the condensing worms as shown in the Royal Berlin Catalogue, p. 107, but if our Government will behave towards British potters as Continental countries have done to theirs, such articles will be made by special assistance.

We cannot refrain from expressing a sense of satisfaction that something has already been done by making a grant of 10,000*l.* to the North Staffs. Technical School, Stoke-on-Trent, for experimental work in connection with hard-paste porcelain, and extensive scientific research work in that direction is being carried out under the superintendence of Dr. Mellor.

With regard to the future of the trade, it may be well to repeat that the English potters for two years now have supplied Great Britain with nearly all that has been needed for scientific work, as also for chemical processes in connection with the war. The cry, therefore, that it cannot be done is no longer admissible.

We may not at present have succeeded in making anything superior to the German production, but I venture to say that in much less time than chemical hard-paste porcelain has been manufactured our country will be making something superior.

Much will depend on conditions prevailing after the war as to the permanent success of the undertaking. That there will be a keen fight for the trade need scarcely be said. The Germans will not very willingly relinquish their hold upon a trade they have held so long. Other countries also will compete. France, Denmark, Japan, and Russia have already commenced to supply, and the *Engineer* says:—"Like this country, America, prior to the war, depended upon Germany for porcelain articles used in chemical work, and especially for laboratory work. Since the war the German supply has ceased, and much inconvenience was caused to chemists across the Atlantic. To-day, however, we learn that American pottery manufacturers are producing porcelain equal to any produced in Germany."

The aim of the English potter in relation to this matter should be not slavishly to copy the hard-paste porcelain, but rather to follow the method pursued in the past, viz. to produce his own particular type of porcelain; but in this case it should be a porcelain suited to the particular requirements. The occasion is ripe for the introduction of something better than anything yet produced, and whatever the slight difference as to the colour and the degree of translucency, the main endeavour should be to produce a porcelain that will fulfil the requirements demanded of it.

#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Rev. T. C. Fitzpatrick, president of Queens' College, who has held the office of Vice-Chancellor during the past two years, made, in accordance with the usual custom, an address to the Senate on vacating this office on the first day of the Michaelmas term. He referred to the loss which the University had sustained during the past academic year through the death of, amongst others, Mr. Charles Smith, master of Sidney Sussex College; Prof. T. McKenny Hughes, who had held the Woodwardian professorship since 1873; Dr. W. H. Besant, the oldest living Senior Wrangler; Dr. Keith Lucas, who lost his life by an aeroplane accident; and Mr. W. E. Hartley, first assistant at the Observatory, who was killed in the explosion on H.M.S. *Vanguard*. He reported that the work of all the departments of the University had been maintained during the past year, though the number of students had again decreased. There were in residence in the Michaelmas term of 1916 444 undergraduates, as against 825 in the Michaelmas term of 1915. The number of Cambridge men on service had increased to 14,450. The list of killed now numbered 1872, of wounded and missing 2622. The honours won numbered 2855, and included eight V.C.'s, 210 D.S.O.'s, and 729 M.C.'s. Besides those serving with the forces, many members of the electoral roll were engaged on war service of various kinds.

Among the reports approved by the Senate during the year was an amended report on degrees for research, including recommendations which were not in