The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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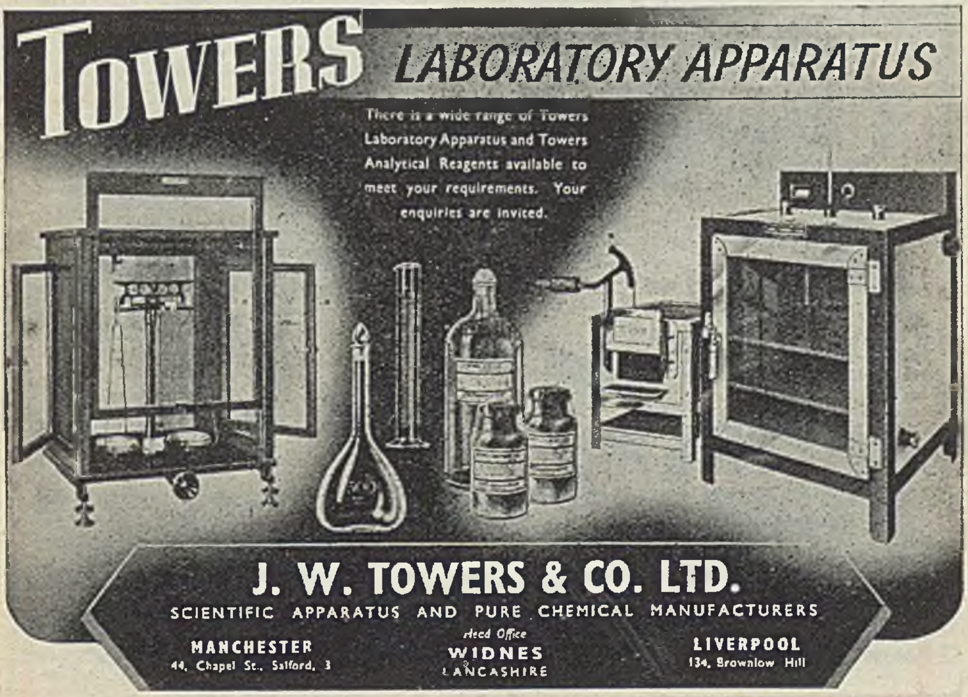
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The Chemical Age

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An Export Policy

INFORMED opinion is no doubt about the necessity for greatly increasing our exports over the pre-war figures. Whether the need is as widely acknowledged as it should be, however, there is room for doubt. We may take it that here we are preaching to the converted on that particular issue, and agree that as the basis of our effort to restore and maintain our pre-war volume of imports, we must increase the volume of visible exports by 50 per cent. over the pre-war level. Nor can we avoid this issue by restricting imports, even if such a course were desirable. By banning all imports but the barest necessities during the war, we succeeded in reducing our imports (excluding munitions, and revalued at 1935 prices) by only 21 per cent. That does not mean that that is the absolute limit of what can be done in that direction; the reduction in our standard of living during the war reached a level intolerable, indeed dangerous, under normal conditions, but there are directions in which we have not yet made the most of our own natural resources. On balance, however, we cannot expect to avoid the necessity for importing (and therefore for exporting) by making ourselves self-sufficient to a greater degree.

Our immediate task must be to recover the markets lost as the result of the war. If we take advantage of the easy and remunerative home markets, we may have a burst of temporary prosperity, but we shall find it all the more difficult later to gain entry to the export markets, since other nations will have stepped in where we have stood aside. One of the greatest difficulties of the export problem is that if firms are left to themselves, they will naturally take the easy path; they will choose quick and easy sales at home in preference to the more complicated and less attractive markets abroad. It does not lie with everyone to be a Merchant Adventurer. How to overcome this difficulty is one of the chief problems facing any Government.

It has been often said, and we have said it ourselves in these columns, that the way to prosperity is to raise the world's standards of living. That is still to be regarded as true, but world standards of living will not be raised unless someone shows the backward nations, the less highly industrialised nations, how to do it. We must be ready to send our

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technical men to work abroad, and we must train and educate overseas students in this country. That in itself will build up goodwill, since those who are educated in a country tend, *ceteris paribus*, to buy from that country. The British have always been renowned for their love of adventure, for their willingness to become explorers, and to travel abroad in foreign parts. Under certain conditions this is true, particularly when a man goes abroad in his youth. But the British reputation has not been well earned: the adventurousness of the few has been attributed to the many. That at least must be the deduction to be made from the ineffective way we dealt with export trade before the war. Some of our young men, like ambassadors, lay abroad for the good of their country. But when a man is asked to go abroad to-day he thinks it over very carefully—and often decides to remain at home.

Why is this? The reason is clear, and it is one which can be removed. Once a man has gone abroad, it is very difficult for him to become re-established in this country. It is difficult to get a suitable position, and it is always necessary to come home to a period of unemployment before a suitable post is found. Does not the remedy lie with the firms on whose behalf he has been working? It may be that a man goes as an engineer to a concern in a foreign land, such as a railway, a mine, or a manufacturing undertaking, owned by citizens of the foreign country. He has severed his connections with his own land. But when he wishes to come home, there is no place for him. One would have thought that he would have been specially valuable to concerns in this country that do business abroad. It would seem to be a matter for British industry, perhaps for Trade Associations, to provide against this handicap.

What should we export? That, again, is one of the stumbling-blocks of business men and politicians alike. All too often it is assumed that because we exported such and such a manufactured product or raw material in the 19th century—or even 20 years ago—we should aim to export that same commodity again in equally large quantities. Nothing could be more Rip-van-Winkle-ish than such a conclusion. The needs of the world change just as fashions change, though with more logical reason. Australia once was entirely agricultural and therefore we exported to Australia iron and steel and goods made from iron and steel, because that was what Australia wanted. Now Australia has built up her own iron and steel industry with our help and no longer wants iron and steel. It is no use sighing because our friends do not want to buy what we once sold them; we must supply them with what they want to buy.

So it is the world over; as the industrialisation of a country proceeds, as the world standards of living improve, so the primary products once imported are made within each country. The goods needed in a country are those for which there are no indigenous raw materials, which cannot be grown, or which require greater skill or more intricate plant and technique than are available there. Thus the export problem of this country, being both a world problem and a national problem, requires for its solution two conditions (*cf. P.E.P. Broadsheet* No. 229, p. 4):

1. On the world level: the attainment of a high and rising level of world prosperity, resulting in a sustained expansion of trade and a lowering of trade barriers.

2. On the national level: the cultivation by British industry of a high degree of efficiency, flexibility, and inventiveness, to foster existing export demands and to meet and create new demands.

"The only course open to us *is to live on our brains, which means intensive scientific and industrial research and constantly increasing efficiency.*"

Statistics show that the goods in which our export trade diminished between 1913 and 1937 comprised coal, iron and steel, and iron and steel goods, cotton and other textiles, clothing, and footwear. It is useless to sigh for the return of the good old days in these industries. We shall supply our own needs from them, and we must find other countries which are beginning to enjoy a higher standard of living and which will therefore desire to buy from us. The more promising goods for export, those in which there was an increase between 1913 and 1937, included:

spirits, pottery and glass, non-ferrous metals, electrical goods, machinery, artificial silks, chemicals and drugs, dyes and colours, paper, vehicles, radio and other newer discoveries and inventions. For success in the export markets, therefore, we must employ our inventiveness and research to the full to find new products and merchandise that will be needed by the world, and to maintain and improve the quality of whatever goods we produce. In addition, attention must be paid to productivity—to the maximum production per man employed—for only in that way can we keep our costs down to a reasonable figure competitive in world markets.

But all this does not solve the problem with which we opened this discussion. How shall we encourage manufacturers to make for the export market in preference to the easy and remunerative home market? How shall we enable the necessary flow of export orders to be maintained? P.E.P. has recently examined this problem and has issued a broadsheet on it entitled *First Aid for Exports*, in which is set forth a policy for the encouragement of exports. It is considered (a) that persuasion exercised on the manufacturer to look to the export market rather than to the home market will be ineffective; (b) that compulsion is by no means free from objections and difficulties; and (c) that it would involve the retention of controls which in time must become anti-social and would fail to operate. Some form of positive inducement must, therefore, be devised which will not incur the opprobrium of an export subsidy. The solution proposed is that the Government should charge a lower rate of taxation on profits directly attributable to export sales. This would avoid flooding foreign markets with cheap goods by putting the reward only on exports which yield a profit. It is considered that this method should be examined by experts. Its particular merit is held to be that it makes a clear and direct appeal to the average business man, especially while the domestic level of taxation remains high. But wherein, we would ask, is it distinguished from a subsidy?

In addition, it is considered that a Public Trading Corporation should be set up to obtain export orders and fill them either by direct approach to manufacturers or through merchants. Many smaller firms who could make for export have no means of obtaining orders abroad, and many of those who might do so do not maintain foreign contacts either by their own branch offices or by occasional visits of principals. A Public Trading Corporation could guarantee orders and payment, and could secure economies in costs for bulk orders. Naturally it would not operate in those countries or industries in which there was already adequate direct British representation. We confess to a good deal of sympathy with the views of this broadsheet. Certainly some direct means of representation of British industry abroad must be found; will industry do this for itself, or shall the Government do the work for us?

NOTES AND COMMENTS

For Business Men Abroad

ANOTHER batch of the "Hints to Business Men" visiting overseas countries has been issued by the Department of Overseas Trade. In the present instance, with the exception of Persia, the countries covered are all Latin-American: Argentina, Paraguay, and Uruguay (1 vol.); Bolivia and Chile (1 vol.); Brazil, Ecuador and Peru (1 vol.); and Mexico. In the case of Brazil it is noted that the language of the country is Portuguese, and that a sympathetic understanding of the customs of the country is desirable. Business men corresponding with Brazil would do well to fit their typewriters with the few accents used in the Portuguese language, a service which the D.O.T. does not appear to have required from their printers. The same might be said for the pamphlets dealing with the Spanish-speaking countries. In other respects, too, the editing might have been more consistent. For example, the dates of the Paraguayan public holidays are given, but not those of Argentina or Uruguay. The strictly business information, however, has been admirably compiled and the details brought right up to date, even to the inclusion of "stop press" notes where necessary. Business men can rely, we feel, on the purely practical side of the information: consular invoices, customs regulations, etc. For the more psychological side of their work, these official pronunciamentos should be treated with caution.

Atomic Energy in Fiction

IN view of the recently released information about the actual and projected uses of atomic energy, readers may be interested in a small item of literary history which has some bearing on the event. In the latest edition of Stewart and Wilson's *Recent Advances in Physical and Inorganic Chemistry*, lately reviewed in our columns, there was a summary of published information on atomic energy. This was not, however, Professor Stewart's first treatment of this topic. Reference to *The Writers' and Artists' Yearbook* will disclose to those not already aware of it that J. J. Connington is the pen-name of Professor Stewart in the guise of a writer of detective novels. But many even of J. J. Connington's "constant readers" are not familiar with his novel *Nordenholt's Million*, first published in 1923, and now, unfortunately, out of print. That the book, which has every right to be placed high in the list of Connington's best work, is not better known may be due to the fact that it is not a detective novel, but one of those often referred to by the rather denigratory term of "pseudo-scientific." The qualification is as mistaken in the present instance as it was in its application to Jules Verne's *Twenty Thousand Leagues Under the Sea*.

The Wheel Turns

IT is, indeed, a pity that *Nordenholt's Million* is not more readily come by, for a comparison of the events there described, in the light of recent years, would undoubtedly be instructive. For the benefit of those unfamiliar with the plot, we may briefly say that a world-wide catastrophe (not, it is true, war, but one with equally unpleasant and very similar consequences) was combated by Nordenholt, who staked everything on the production, by a team of scientists, of atomic energy in an available and controllable form. In passing, there are some descriptions of London during the "last days" in which the masterly portrayal of the anarchy and chaos must often have borne grim comparison in the minds of those who know the book with the scenes of destruction, both actual and potential, with which we are now, through Press, news-reel, and experience, only too familiar. Nordenholt's team is finally successful, and catastrophe is averted, if we remember rightly, at the relatively minor cost of the destruction of part of the "new" chemistry building at Glasgow University. (That the new chemistry buildings at Glasgow University did not keep pace with the author's imagination must be accounted to their debit rather than to his!) For a thought-provoking—and, indeed, entertaining—illustration of the imaginative use of accurate scientific information, we can recommend *Nordenholt's Million* (if it can be found) to chemists who are sufficiently catholic in their tastes to find an interest in the by-paths of their subject. In 1923 the book might well have been dismissed as "far-fetched." But the wheel turns. Professor Stewart's *alter ego* may not have been the first to envisage many of the possible uses of the energy stored in the atom and impressed on the scientist through radioactive phenomena. He must surely, however, have been the first to introduce it to the notice of the lay reader.

SUPPLIES FOR THE CHANNEL ISLANDS

Under the Export of Goods (Control) (No. 6) Order, 1945 (S.R. & O. 1945, No. 953), which came into operation on August 7, the only goods for which export licences to the Channel Islands are now necessary are fertilisers: and arms, ammunition, explosives, etc. (Group 17 of the Export Control List).

The discontinuance of export licensing does not mean that normal trading in foodstuffs and soap with the Channel Islands can yet be resumed. These are at present being obtained in bulk and ordinary commercial import is prohibited under Channel Islands legislation.

Synthetic Fibres for Textiles

Raw Material Supplies in Britain

by D. D. HOWAT, B.Sc., Ph.D., F.R.I.C., A.M.I.Chem.E.

PRIMITIVE man obtained his clothing practically ready-made in the skins of wild animals slain in the chase, such materials being still widely employed and in certain respects possessing high value. With the progress of civilisation other textile materials were discovered, being woven into cloth following the very early but unrecorded invention of crude weaving plant. From the very beginning of written history until nearly the end of last century practically the entire world requirements of textiles were obtained from three natural raw materials—silk, wool, and cotton—together with smaller quantities of fibres from jute, hemp, and flax.

The Natural Textiles

The history of the utilisation of silk as a textile material goes far back into antiquity, becoming known first to the Chinese in 2700 B.C. Silk is closely connected with the rise of the earliest civilisations but remained practically a Chinese monopoly for 3000 years. In fact, it has been suggested that the development of the early civilisations followed the trading routes along which the silk was exported from China to the wealthy members of nations culturally less advanced. Always identified with power and wealth, silk continued to be the mark of kings, princes, and courtiers down even to the heyday of the East India Company.

Of the three natural fibres, cotton alone is obtainable directly from the soil, the others being produced through the intermediary of living organisms. Cotton is, therefore, available in much larger quantities and in consequence is very much cheaper. The weaving of cotton into textile materials was first introduced in India about 800 B.C. From India the employment of cotton spread, first to China and then westward, the material being mentioned by Herodotus in 445 B.C. In Britain, the earliest mention of the word occurs about A.D. 1641, although the West Indian natives were using cotton fabrics in the time of Columbus in 1492. Modern cotton cultivation began in Carolina about 1733, the first consignment arriving in this country from Georgia in 1734.

Wool, the third most widely distributed natural fibre, has from the earliest times been closely associated with the development of civilised communities. In this country the use of wool is recorded in the 8th century. Until the time of the Industrial Revolution wool played a very large if not indeed the predominant part in the trade and commerce of Britain. Evidence of the key importance of this material is furnished by the presence of the time-honoured "Woolsack," the seat of the Lord Chancellor, in the House of Lords.

Although these fibres comprised the raw materials for the manufacture of the greater part of the world's textile requirements for 5000 years, the idea of manufacturing fibres other than the natural materials has existed in germ at least for several hundred years. Such an idea was stimulated chiefly by the desire to obtain a material approximating as closely as possible to silk, the highly prized and expensive material, the symbol of wealth and power for thousands of years. As a result of studies of silkworms and spiders, Robert Hooke in 1664 and Réaumur in 1734 both suggested the spinning of fibres by methods similar to those employed by the insects, Réaumur, in fact, proposing the use of natural gums and resins for the purpose. About 1840, Schwabe, a silk manufacturer in Manchester, experimented with machines for producing filaments by drawing various substances through fine holes. Unfortunately none of the materials then available—gelatin, egg albumin, agar-agar, and carrageen moss—gave products nearly so satisfactory as the mercerised cotton originated by Mercer, also in Lancashire, in 1844. Search for methods of producing synthetic fibres continued, an important advance being made by Hilaire de Chardonnet, at one time a pupil of Pasteur in Paris. Chardonnet exhibited at the Paris Exposition in 1889 synthetic fibres made from nitro-cellulose, causing a decided sensation and stimulating further research.

The First Rayon Patents

Two British chemists, Charles Cross and Ernest Bevan, made possible the most revolutionary advance in the production of synthetic fibres by their work on artificial silk or rayon, their first patents being granted in 1895. Development of the three separate processes of rayon production—viscose, acetate, and cuprammonium—constitutes one of the most interesting chapters of industrial chemistry. Essentially a British invention, the process of rayon manufacture became firmly established here after a fairly long struggle against technical difficulties and the opposition of the old-established cotton and woollen industries. Reaching the stage of industrial production in Britain in 1900, the process of viscose rayon manufacture spread to France, Germany and Switzerland, and arrived in the U.S.A. in 1910.

Although rayon production has been the

most far-reaching development in the textile industry up to the present, other synthetic or semi-synthetic fibres have been introduced during the past 10 years. Early in the present century Todtenhampt investigated the manufacture of casein fibres, using milk as the raw material. Although these initial experiments met with no commercial success, the Italian investigator, Ferretti, continued the work on casein fibres for a period of over 20 years. In 1935 success was achieved with the production of the textile "Lanital." Further investigation has improved the properties and texture of these casein fibres which are now marketed successfully in the U.S.A. and in this country.

Nylon, the first of the truly synthetic fibres, was patented in the U.S.A. by E. I. du Pont de Nemours, the first commercial production being undertaken late in 1939 in a factory at Seaford, Delaware. By May 1940, production of fully-fashioned hosiery was at the rate of 64 million pairs per annum, a figure which was later increased to over 100 millions a year. Since then the demands of war have absorbed by far the greater part of the nylon production.

The Newest Fibres

More recent developments, although not as yet on a commercial scale in this country, have been the manufacture of fibres from soya beans and ground-nuts. In this field some very useful work has been reported on a new textile material—Ardil—produced by I.C.I. in sufficient quantities to allow adequate trials of its wearing and weaving properties to be made.

All the indications are that the manufacture of synthetic and semi-synthetic fibres will continue to play an increasingly important part in the supply of the world's textile requirements. Even at the height of the war in 1942 rayon production amounted to 18 per cent. of the total world production of textile materials. In the U.S.A., which produced 42 per cent. of the world production of 27.3 million bales of cotton in 1939, rayon is furnishing a steadily increasing percentage of textile requirements. From a fraction of one per cent. in 1920, rayon consumption amounted to 10 per cent. of textile requirements in 1941, while it has been predicted that this figure will rise to 25 or 30 per cent. within the next decade. Replacement of cotton by rayon cord in heavy-duty rubber tyres, particularly with synthetic rubber, has lengthened the life of the tyres and ensured a greatly widened field of application. In view of these facts, the rational policy here in Britain should, obviously, be to ensure an expanding production of the synthetic and semi-synthetic fibres. Such a policy is rendered more imperative by the necessities of our post-war export trade. Cotton exports have been made exceedingly difficult by the competition of the Indian mills and (in pre-war years) of the Japanese mills. A study of the Platt report reveals that the difficulties in competition did not arise only from easier access to the raw materials but in a large degree from the old-fashioned and inefficient plant and machinery only too prevalent in Britain's cotton mills. If these sources of export trade are closed then the question arises as to whether the chemical industry in Britain is capable of taking up the challenge to produce for export synthetic or semi-synthetic fibres in quantity and price enabling them to compete in the world's markets.

Before attempting to assess the position for the British chemical industry a number of relevant factors must be considered. Broadly speaking, these factors may be listed as follows: (1) the advantages gained by the development of synthetic fibres; (2) the nature of the fibres to be produced; (3) the comparison of synthetic and semi-synthetic fibres with the natural fibres; (4) the fields of application and use; and (5) the availability of the necessary raw materials.

Advantages of Synthetic Fibres

That there are decided advantages in the production of semi-synthetic and synthetic fibres cannot be doubted. Production of these new fibres marks the beginning of a new era in textile manufacture and in the world's textile requirements. This new textile era will be furnished with raw materials whose production is not directly dependent on climatic conditions, temperature, rainfall, and other variable natural factors, nor will the quantities produced be affected by the presence or absence of plant diseases or pests. In this way such factors as the drastic effects of the boll weevil on the cotton crop of the U.S.A. in 1938/1939 would no longer profoundly influence world raw material supplies. In addition, the quality and physical properties of the fibres produced may be standardised by the greater degree of scientific control possible; for example, long continuous filaments of perfectly uniform diameter may be mass-produced. Further, some particular property may be developed to meet certain specific conditions; *e.g.*, nylon is rot-proof and, therefore, capable of employment under conditions which render very uncertain the use of natural silk.

Finally, certain of the substitute materials possess a price advantage over the natural raw materials. This has definitely proved the case with rayon as opposed to natural silk and will almost certainly prove true with nylon. In other instances where a price advantage cannot be obtained the existence of certain distinct properties such as resistance to rot or attack by moths may prove sufficiently valuable under certain conditions to justify the more expensive product.

Natural fibres fall into two main groups: (1) vegetable or cellulose fibres, of which cotton, flax and hemp are representative; and (2) animal or protein fibres, of which wool and silk are the best examples. Cellulose and protein type fibres differ in many respects: silk is noted for strength, fine filament diameter, lustre, and handle, while wool is characterised by warmth, elasticity, moisture absorption, and felting properties. Cellulose fibres are stronger and less susceptible to shrinkage, but deficient in warmth, handle, and moisture absorption. On the other hand, the cellulose fibres are much more abundant, therefore cheaper and more widely employed.

While artificial fibres are sometimes classed broadly as synthetic, this is not strictly accurate, as rayon is primarily a cellulose fibre, obtained from spruce wood or cotton linters, the final product being substantially of the same chemical composition as the starting materials. Such fibres, which have merely undergone a chemical processing treatment, may be better defined as semi-synthetic. Similarly, fibres may be produced from vegetable protein, such as the protein fraction of ground nuts or soya beans, but again the finished product closely approximates to that of the raw material, having merely undergone an extraction, precipitation, and purification treatment.

In contrast, nylon is a true synthetic, in that the final complex molecule comprising the fibre is built up from simpler constituents, the most important of which is phenol or benzene. So far as chemical constitution is concerned nylon approximates neither to the natural cellulose nor to the proteins.

Comparison with Natural Fibres

Probably the most obvious difference between the two types of fibre is in the length of the individual filaments. With the exception of silk, spun by the silkworms in lengths up to 1200 metres, all natural fibres are short. In contrast, synthetic and semi-synthetic fibres may be made in continuous lengths, absolutely uniform in diameter and substantially free from any structural weaknesses. In certain circumstances, *e.g.*, the production of staple fibre for weaving, it is necessary to cut very fine diameter fibres into short lengths or staples adapted for use on the various types of textile machinery already developed for natural fibres.

The dry and wet tensile strengths of fibres are most important properties so far as manufacturing, weaving, and washing are concerned. Natural silk, with a dry strength of over 5 gm. per denier, is almost one-third as strong as a corresponding steel wire. Wet strength of silk is very good, being about 4.0 gm. per denier. Cotton is lower in strength, varying from 2 up almost to 5 gm. per denier. Viscose rayon comes still lower in the scale, being 1.8 to 2.3 gm. per denier when wet. Nevertheless the rayons have adequate strength for handling and processing.

With an average tensile strength up to 15 kg./sq. mm., wool has exceptionally high extensibility, good-quality fibres possessing the power of extending elastically up to one-third of their original length. Moisture absorption is the other notable feature of wool, which can absorb 35 per cent. of water without appearing to be wet. In contrast, casein fibres, with a dry and wet tensile strength of 0.9 gm. and 0.47 gm. per denier respectively, are inferior to wool in this respect and also in elasticity and moisture absorption. A recent report states that fibres only 18 microns in diameter were obtained from the protein fraction of peanuts, the wet and dry tensile strength being 0.94 and 0.55 gm. per denier respectively.

Considerable publicity has been given to a vegetable protein fibre produced from ground-nuts by I.C.I. and named "Ardil." With a tensile strength of 10 kg./sq. mm. and elongation at the break of 50 to 100 per cent., this protein fibre compares closely with wool. While the water-absorptive capacity of this new fibre is of the same order as that of wool, but rather higher, the material does not felt in the manner common to wool and fur. According to Traill's work[1], tests on the thermal insulation values suggest that woven fabric made entirely from the new fibre, or from a mixture of wool and the new fibre, will give the same thermal insulation as an all-wool fabric of the same thickness and structure. The only unsatisfactory feature of this new protein fibre was revealed by a series of empirical wear tests. These tests showed that the new protein fibre alone has a poor resistance to abrasion as compared with wool; nevertheless, when mixed with other fabrics the new fibre does not reduce the wear of the other fibres as much as might be expected.

The True Synthetic

Nylon, the true synthetic, has a closer similarity to silk both in constitution and in properties than has any other fibre, whether natural or artificial. This synthetic has the appearance and lustre of silk, although the degree of lustre may be modified as desired by the use of a delustrant. Nylon is superior to silk in uniformity of denier, while filaments of any desired size may be spun. High tenacity and elasticity make nylon particularly suitable for hosiery. Figures for the tensile strength of nylon are 5 gm. per denier dry and 4.5 gm. per denier wet, while for silk the corresponding figures are over 5 gm. and 4 gm. per denier. Claims have been made that nylon will elongate up to 20 per cent. before breaking and will recover completely after being stretched 4 per cent. for 100 seconds. Recovery under similar conditions is only 50 per cent. for silk and 30 per cent. for viscose rayon. Loop strength, the common measure of toughness, is about the same for nylon and silk, and is almost three times higher than that of viscose rayon.

Fields of Application

Although a study of the figures quoted above shows that considerable improvements are possible in certain properties of the synthetic and semi-synthetic fibres, there is not the slightest doubt of the great and rapidly increasing field of application for these fibres. Only within the past 45 years have these artificial fibres been produced on a scale enabling them to compete with the natural fibres, yet the following table shows that rayon furnished 18 per cent. of the textile requirements of the world in 1942.

Textile material	*World production (million lb.)*	*Percentage of total*
Cotton	12,700	68
Wool	2,440	13
Silk	100	1
Rayon	3,473	18
Total ...	18,713	100

No one has ever suggested that the world's population is adequately clothed, and it is obvious that the manufacture on a large scale of attractive and colourful fabrics suited to a wide variety of uses and at keen prices will command a steadily expanding market. Even without reducing the output of cotton, wool, and silk, a great expansion in the production of rayon and other artificial fibres could be absorbed in Europe and in Asia, if modern mass-production methods enable the prices to be cut keenly.

The Rayon Industry in Britain

In the manufacture of synthetic or semi-synthetic fibres the question of the supplies of raw materials is crucial. For rayon, the most securely established of the semi-synthetic fibres, the essential raw materials include spruce wood for the viscose rayon process and cotton linters for the cellulose acetate process. German practice has recently shown that beech wood may also be employed, especially for the production of rayon staple fibre. Although supplies of spruce and beech wood are plentiful and widely distributed over the world's surface, to a much greater degree than cotton, yet Britain is somewhat at a disadvantage so far as raw materials are concerned when compared with the U.S.A., Germany, and France, where supplies of home-grown wood are more or less easily obtainable.

Although questions of raw material supplies have undoubtedly played a part, they are not the only reason for the present unsatisfactory state of the rayon industry in Britain. In discussing developments in the rayon industry throughout the world, Levinstein[2] comments on the unsatisfactory position in Britain, stating that while production in Germany, Japan, and the U.S.A. has shown tremendous increases, in Britain production has diminished. Production of rayon fibre in 1938 is shown in the following table:—

Country	*Production (lb.)*
U.S.A.	343,600,000
Germany	143,280,000
Italy	114,700,000
Britain	110,230,000
France	77,140,000

In the U.S.A. manufacture of rayon fibre did not begin until 1910, ten years later than its introduction in Britain, but the following table shows the rapid expansion of the industry in that country.

U.S. Production of Rayon Fibre

Year	*Output (lb.)*
1911	330,000
1915	1,000,000
1925	50,000,000
1935	250,000,000
1938	343,000,000
1941	451,000,000
1943	660,000,000

Even more disquieting features, so far as British industry is concerned, are revealed by the study of the development of rayon staple fibre. Rayon staple fibre was developed in response to the need for a semi-synthetic fibre capable of being spun into yarn and woven into fabrics closely approximating to wool in general properties. Thermal insulation, or, in subjective terms, the warmth afforded by a fabric, has been shown to be due mainly to the layer of air immobilised, and is largely determined by the thickness of the layer of immobilised air. A greater quantity of heat is conducted through the fibres than through the immobilised air layer and there is, therefore, little difference between the solid parts of various textile fabrics. Basically the warmth of woollen fabrics arises from the high degree of crimp in the individual fibres, which when spun into yarn and subsequently woven immobilise an infinitely large number of minute air pockets.

Extensive research and development work eventually made possible the commercial production of very fine crimped rayon fibres which could be cut into suitable lengths and woven into wool-like fabrics. Commercial production began in the late 'twenties and in 1929 total world production of rayon staple fibre was only just over 7 million lb. Since then production of staple fibre has increased on an extraordinary scale until in 1942 the production of about 2025 million lb. practically equalled the world production of natural wool. Outstanding among the reasons for this development of rayon staple fibre was uniform fibre length for spinning, special characteristics in dyeing, and the improved feel of the fabrics produced. In Germany, Italy, and Japan the greatest application of rayon staple fibre has been found in blending with wool to permit the production of woollen- or worsted-type fabrics. In the U.S.A., where production has also increased at a remarkable rate in spite of the abundance of indigenous supplies of cotton, rayon staple fibre is used chiefly in cotton-type fabrics for draperies, sports wear, light fabrics and suits. In the following table some figures of the production of rayon staple fibre in the main producing countries are given (in lb.).

	Staple Fibre Production			Total Rayon Production
Country	1929	1937	1939	1942
Germany	2,385,000	220,000,000	496,000,000	1,100,000,000
Japan	—	174,755,000	309,500,000	700,000,000
U.S.A.	500,000	20,000,000	100,000,000	630,000,000
Italy	1,700,000	156,350,000	189,200,000	Not available
Britain	2,600,000	32,720,000	60,000,000	Not available
World Production ...	7,185,000	603,825,000	1,154,700,000	3,473,000,000
			Staple fibre only	2,024,750,000

have a salutary effect in expanding production and reducing prices. To quote a telling phrase by Levinstein[2]: "the interests of the community are not adequately served by an industry which relies for profits on a small production sold at high prices mostly in the home market. It must be willing, able, and substantially free to compete in the export markets on equal terms."

Production of vegetable protein fibres on a commercial scale has already begun in the U.S.A. in a new factory at Cincinnati, Ohio, soya beans being employed as the raw material. Claims are made that the new fibre is as warm as wool, resilient, strong, and durable. These fibres have already been made experimentally into blankets, underwear, hosiery and upholstery materials.[3] The synthetic fibre branch of the chemical industry must make its contribution to the export trade. In the modern world there is no large market for the products of our heavy industries, the field in which our export trade originally flourished. Even backward industrial countries like India and China are building or have already established their own iron and steel industry.

These figures reveal a regrettable decline in progress in Britain in this very important new industry. From the leading position in 1929, with a production equal to 36.6 per cent. of the world total, Britain sank ten years later to fifth place, with a production equal to only 5.2 per cent. of the world total. Figures for the years succeeding 1939 are not available for Britain, but in view of the further tremendous increases up to 1942, when world staple fibre production was almost double that of 1939, the position of Britain has almost certainly worsened.

This tremendous world development indicates that these new fabrics obviously fulfil the requirements of a vast number of consumers, to many of whom a keen price is a first consideration in a purchase. Why has a 100- to 300-fold increase in production been experienced in U.S.A., Germany, Italy, and Japan against a bare 20-fold increase in Britain in the same period? While the question of supplies of raw materials undoubtedly affects the development of the industry in Britain, the existence of a monopoly control of production may also be an important contributory factor. So far as viscose rayon is concerned, one large combine dominates the industry in Britain. Over the past four years profits of between £3,291,000 and £4,287,000 have been made by this concern, representing 10 to 13 per cent. of the issued share capital of £32 million. Is it a reasonable deduction that monopoly control of this industry in Britain has resulted in relatively restricted output with very substantial profits for the operating combine?

Time will show whether I.C.I. is going to enter into competition, with the production of the vegetable protein "Ardil" for woollen and worsted fabrics. Some competition among the different types of synthetic fibres now in production in Britain might

In Britain some attempt must be made to establish new branches of our export trade by the sale of finished commodities of high intrinsic value. Manufacture of commodities of this type will cause increased employment in this country, both directly in the man-hours absorbed in the actual manufacture, and indirectly in the manufacture of the precision plant and gear required for the processes. Recent estimates indicate that in Britain only 5 per cent. of the national income is expended in capital equipment, tools, and plant, while in the U.S.S.R. the figure is about 25 per cent. Among the most urgent needs in the textile industry in Britain is the provision of modern highly efficient plant. To expand the manufacture of synthetic fibres will call for the provision of new capital equipment, but this capital should in turn yield reasonable dividends, particularly if a genuine effort is made to capture our fair and equitable share of the overseas market. With the defeat of Germany and Japan a drastic reduction in the output of synthetic textile fibres will almost certainly occur, but this recession may not be unduly prolonged. Against this will be the competition of the U.S.A. with its modern, efficiently organised, rayon industry. One fact is certain: if the British chemical industry is going to capture any appreciable share of the overseas trade in synthetic and semi-synthetic fibres it must set about the task forthwith.

The Raw Material Problem

As already indicated, there are three types of synthetic or semi-synthetic fibre. Rayon manufacture necessitates supplies of cellulose —wood or cotton linters. Protein fibres such as "Ardil" require adequate sources of vegetable protein, soya beans and ground nuts being the most promising sources hitherto investigated. For nylon, the best known of the true synthetics, the essential raw material is benzene. That Britain is unfavourably situated for supplies of raw materials for the cellulosic and protein semi-synthetic fibres is quite obvious, a largely preponderant percentage of the requirements of these materials having to be imported. In the case of benzene for nylon the position is rather more favourable, as supplies of this chemical are available from indigenous sources.

Is it possible in the post-war era to find new sources of cellulosic raw materials on a basis mutually profitable to buyer and seller? It is not stretching imagination too far to suggest that our tropical West African Colonies might be made to furnish these supplies of cellulosic materials required in Britain. If in Germany it was found possible within a few years to change the basis of rayon production from spruce to beech wood there is no very obvious reason why other cellulose materials should not prove equally successful. Again, the tropical Colonies enter into the picture, as in these areas luxuriant growth of many sources of cellulose should be possible. Undoubtedly, extensive research and development work will be required to find the suitable material and to discover the best methods of cultivation. The vast acreage of "bush" in the West African Colonies offers a perpetual challenge to the chemist and agriculturist to make this district a useful source of raw materials, with resulting benefits to the native population and to the industrial potential of Britain. Such an investigation would come within the province of the Colonial Products Research Council under the chairmanship of Lord Hankey, established under the Colonial Development and Welfare Act of 1940 to conduct research into the possibility of finding new uses for colonial products which were or might be in surplus supply.[4]

At the same time the production of acetate rayon must be considered. This, the most recently developed of the rayons, is the most expensive to produce, but possesses many properties distinctly superior to those of viscose rayon. When cotton linters are used as the raw material, the cellulose is dissolved by the chemical action of acetic acid and acetic anhydride. The spun fibres possess a higher wet strength and are less affected by moisture than the viscose rayon, while they closely approximate to real silk in handle and lustre. The woven fabrics may be washed and boiled as severely as cotton, while they permit solid or two-colour effects fast to light and washing to be obtained by dyeing. In the U.S.A. production of acetate rayon has increased from 7 per cent. of the total rayon production in 1929 to 36 per cent. in 1941. According to Snell[5] this increase in acetate rayon production is almost entirely due to the increased supplies of cheaper synthetic acetic anhydride. Cheap bulk supplies of acetic anhydride and acetic acid depend on the availability of acetylene. In Britain we must develop hydro-electric schemes for calcium carbide manufacture, or press forward urgently with investigation into the pyrolysis of methane, to yield acetylene in line with the remarkable results that have been obtained in the U.S.A. during the past two or three years. Only if cheap sources of acetylene are made available by the exploitation of our natural resources of water power or by more efficient utilisation of our town and coke-oven gas output will cheap acetate rayon be produced.

Sources of Vegetable Protein

Supplies of vegetable protein also constitute a serious problem, but one well worth pursuing, as the production of animal protein fibres is a very inefficient process from the scientific point of view. In wool production the animal ultimately derives its protein supply from vegetable sources—plants, seeds and seed-cake—which are hydrolysed to amino acids in the blood stream. These acids are then utilised as in all animals for the building-up and renewal of essential tissues. In consequence, only a very small percentage of the protein intake finds its way into the hair of the animal. According to a German estimate 4000 lb. of mulberry leaves are eaten by the silk-worm for the production of 1 to 1½ lb. of spun silk. With casein production efficiency is just as poor, 8000 gallons of milk (the annual milk output of ten cows) being required to furnish one ton of casein. Obviously, a much greater degree of efficiency is possible if satisfactory methods may be derived for spinning fibres from naturally occurring vegetable proteins. These vegetable proteins occur in large quantities in such seeds as castor, linseed, hemp, soya beans, and ground nuts. For many reasons it is believed that soya beans and ground nuts may prove to be the most suitable sources of vegetable protein so far as Britain is concerned.

World production of ground nuts is about 8 million tons annually, main areas of cultivation being India, China, and West Africa. With an oil content of about 50 per cent., protein 28 per cent., and carbohydrates 11 per cent., these nuts are obviously a useful source of protein. Two to three million tons of ground nuts are harvested annually in West Africa, with possibilities of considerable expansion. Here, again, it appears there is an attractive prospect of increasing the supplies of raw materials to Britain and increasing the area of land under cultivation in the West African Colonies by a programme aimed at combining land reclamation, cultivation, and improved nutrition of the native population. In an era when bulldozers may be employed en masse for clearing vast heaps of rubble much less amenable than the West African "bush," there should be little difficulty in clearing wide areas of this land and putting it to good use by combining crops of value both for human and animal nutrition and in furnishing raw materials.

Soya beans resemble ground nuts in general in chemical composition, but appear to be superior in some respects for nutrition. Vegetable protein fibres, similar to those obtained from ground nuts may also be produced from soya beans, but the existing data are rather scanty.

Phenol for Nylon

For nylon production, as in so many other branches of the synthetic chemical industry, phenol is the starting raw material. Nylon is produced from phenol which is converted into cyclohexanol and subsequently oxidised to adipic acid. Part of the adipic acid is converted to hexamethylene diamine by the action of ammonia, the two compounds being then allowed to react, with the formation of nylon salt. After purification and treatment in an autoclave the nylon salt is converted to the amide, the polymer being subsequently produced by the combination of a number of amide groups. At the end of the cycle the liquid polymer is extruded on to a casting wheel where it is rapidly chilled in the form of a long continuous ribbon. After the ribbon has been cut into small flakes it is fed to a pressure vessel, where it is melted down to a thick yellow liquid about the consistency of honey. From the pressure vessel the liquid is extruded at high temperatures through dies or spinnerets. The extruded filaments are cold-stretched to give improved properties and are subsequently twisted together and prepared for weaving or other industrial requirements.

Although phenol is the immediate raw material for nylon production, the basic substance is benzene. Supplies of natural phenol have always proved quite inadequate to world demands for this invaluable chemical, and even four years ago it was estimated that three-quarters of the phenol used was made from benzene. In contrast with the other synthetic or semi-synthetic fibres nylon is the only one for which raw materials are available in this country. In a recent article in this journal the question of benzene supplies was discussed. Existing data show that the maximum availability of benzene at present is about 280,000 tons annually, a quantity which would not be sufficient for the needs of an adequately organised synthetic chemical industry. In addition, present fiscal arrangements with regard to the duty levied on imported hydrocarbon oils force the chemical industry to pay what is in effect a subsidy of 9d. per gallon on its purchase of benzene. Even if these anomalies are corrected some measure of control over the distribution of the available supplies of benzene will be essential to ensure a reasonable allocation of this vital raw material. Further increased supplies of benzene are essential so that the output of the products of our synthetic chemical industry may be adequate. Only in this way will the output of nylon be sufficient for the demands of the home and overseas markets. This very valuable fibre, finding such an infinite variety of applications in hosiery, textiles, foundation garments, tooth-brushes, industrial brushes, fishing lines, surgical sutures, and film, is just the type of high-quality manufactured article our export trade will need so urgently in the immediate future.

Production of nylon in this country at present is confined to British Nylon Spinners, Ltd., a company formed in 1940. According to a statement made early this year by the President of the Board of Trade, a factory for the spinning and processing of nylon is to be established at Pontypool, Mon. With a floor area of a million sq. ft., the factory will employ 1700 people, with a possibility of further expansion. While this represents a good beginning, further expansion is absolutely imperative to supply the home market and to compete in overseas trade.

Conclusions

In the light of these facts, expanding production of synthetic fibres appears essential to the further development of the textile industry in Britain and to swell the volume of our overseas trade. Of the three types of artificial fibre, raw materials for two must be imported, while advances in the production of acetate rayon and of nylon are bound up with the production of important chemical raw materials—mainly acetylene and benzene—in this country. So far as supplies of cellulose and vegetable protein are concerned, mutually profitable development and land reclamation and clearing schemes should be arranged with the West African Colonies. Intensive research and investigation will be required to find the most suitable source of cellulose both for cultivation and for subsequent utilisation. A good case may be made for ensuring increased supplies of the vegetable proteins both as a means of improving nutrition standards among the Colonial races and of providing raw materials for the newly investigated protein fibres. That every effort should be made to increase the production of chemical intermediates in this country has been widely agreed. If calcium carbide proves to be the best source of acetylene in the future then a national scheme of hydro-electric development is even more imperative than ever. On the other hand, if the most recent work in the U.S.A. in acetylene production by the pyrolysis of methane proves a better method, then this will only provide an additional reason for developing more efficient methods of utilising our supplies of coke-oven gas. Increased production of benzene presents some more serious problems, but aromatisation of oils appears to offer the best hope of increasing supplies which are certain to prove inadequate in this country if the synthetic chemical industry develops as it should. The expansion of the synthetic chemical industry in this country must be conjoined with the removal of restrictions imposed by monopoly control if the production of synthetic and semi-synthetic fibres in Britain is to be on a scale comparable with our position as an industrial power.

REFERENCES

1 Traill, *Chem. & Ind.*, 1945 (Feb. 24), p. 58.
2 Levinstein, *Chem. & Ind.*, 1944 (June 17), p. 226.
3 *Idem, Chem. & Ind.*, 1944 (March 5), p. 95.
4 Cmd. 6514: Scientific Research and Development.
5 Snell, *Chem. & Ind.*, 1942 (Oct. 31), p. 450.

U.S. Control Council

Chemists and Metallurgists Appointed

SEVERAL American experts and business men have recently been appointed to serve on the staff of General Eisenhower's Control Council for Germany. The list includes Mr. W. O. Snelling, a well-known consulting chemist and leading expert on explosives; Mr. F. Gaethke, to be in charge of mines, minerals and fuels, a former executive of the Anaconda Copper Mining Co., who, before the war, had been in charge of the company's properties in Upper Silesia. The oil section will be in the hands of Mr. P. P. Clover, who formerly worked for the Standard Oil Co., and later on for the Vacuum Oil Co., and who had seen service as petroleum attaché. Another appointment is that of Mr. A. B. Newman, Dean of the School of Technology at the City College of New York, who has been associated with the Corn Products Refining Co., the National Zinc Co., the General Chemical Co., and the American Chemical Company.

Metallurgy and Heavy Industry

The following metallurgists are to work under Mr. R. J. Wysor on the metallurgical branch of the Control Council in the U.S. zone of Germany. Mr. J. Hyland, deputy chief, a veteran steel man, got his education through the International Correspondence Schools. Most recently, he has been manager of the Cleveland district office of the Republic Steel Co. Mr. T. Parke, chief of the castings section, has an engineering degree from Cornell, and was employed, after 1926, by American Steel Foundry Co. During the war, he has been deputy chief of the War Production Board. Mr. P. Martin, chief of the coke plant and blast furnace section, has served since 1923 with Carnegie Illinois Steel Company, most recently as director of industrial relations. Co-chiefs of the copper and brass facilities of Germany are O. Klopsch and T. J. Little. Mr. Klopsch, a metallurgical engineer, was with National Hall and Steel Casting Co., and Calumet and Hecla Copper Company, Mr. Little with Anaconda Wire and Cable.

Borax Companies Fined

U.S. Anti-Trust Suit

THE U.S. Federal Court on August 16, fined seven borax companies and officers a total of $150,000 for alleged world monopoly on mining production and distribution of borax. The companies fined $10,000 each included Borax Consolidated, Ltd., England, and subsidiaries, the United States Borax Company and the Pacific Borax Company, both of Los Angeles, also the American Potash and Chemical Corporation, New York, and its subsidiaries, Borax and Chemicals, London, and the Elephant Corporation.

The directors of Borax Consolidated announce that they have agreed to accept a "Consent Decree," *i.e.*, a settlement out of court, which involved waiving a claim to a location which they had never established, and the disposal of three properties, two of which they were not exploiting, and the other of minor importance, the proceeds to be credited to the company. In addition, the company and its co-defendants had to pay the usual fines, amounting to a total of $80,000. Under the circumstances, the directors consider this settlement satisfactory.

ARGENTINE ALKALI IMPORTS

Argentina's seaborne imports of most soda compounds decreased in 1944 from the preceding year, according to preliminary estimates, says *Foreign Commerce Weekly*. Imports of soda ash dropped from 62,051 gross tons in 1943 to 15,144 in 1944, while imports of sodium hyposulphite declined from 181,154 kg. to 1,122, of sodium sulphite from 469,476 kg. to 253,901, and of sodium phosphate from 202,887 kg. to 136,165. Sodium bichromate imports showed an increase—from 236,987 kg. to 312,798.

Imports of potassium nitrate showed a substantial increase, rising from 797,272 kg. in 1943 to 1,796,744 in 1944. Potassium chlorate imports dropped from 251,786 kg. to 187,970 in 1944, while imports of potassium cyanide declined from 92,305 to 17,206 kg. in 1944.

South African Chemicals

The Problem of Sales Agencies

(From our South African Correspondent)

A SUGGESTION by the United Kingdom Department of Overseas Trade that, in order to expand sales, British firms should establish their own selling organisations in overseas countries—by large firms individually and by smaller firms through a channel such as a chemical export group—is not supported by South African representatives of chemical and other manufacturers. The Department expressed the opinion that among the disadvantages of the agency system the main ones were that an exporter working through a commission agent usually could not exercise sufficient control over the way in which his chemicals were presented and could not build up goodwill for his products, or ensure constructive sales policies. In regard to this, South African representatives of British chemical manufacturers point out that the remedy is in their own hands. If they are satisfied that there is a good demand for their chemicals, but that sales are poor owing to lack of ability of representatives, business can always be transferred to other agents.

Market for British Chemicals

During the war it was difficult for South Africa to obtain any but the most essential chemicals and those needed in connection with the munitions industry and for the army from Great Britain, and as a consequence there was a much larger import of chemicals and drugs from the United States. It remains to be seen whether this will result in any preference for American chemicals. Even now certain South African importers are interested in the possibilities of entering into contracts with British suppliers for such requirements in the near future. Generally, it is hoped that British industry will soon be able to supply a wide range of industrial and other chemicals, for there is still plenty of scope in South Africa for the British chemical manufacturer.

Salt Stocks

Salt stocks in South Africa are better than they were some time ago, but it is still necessary to use them with the utmost care. In fact, present supplies are only sufficient to see industrial users through to the beginning of the next salt-producing season. For this reason it has been impossible to allow the issue of permits for the export of salt from South Africa, and no such permits are likely to be issued until it is possible to assess the salt prospects of next season. As a rule the season opens in September, but it is feared that it may be delayed this year.

Graphite can now be imported into South Africa from Madagascar and Réunion through normal trade channels, but local importers have been advised to assure themselves that export permits will be granted by the authorities in these islands and that shipping space is available before they approach the Director-General of Supplies for import permission.

Naphthalene is produced in South Africa by the Iron and Steel Corporation in Pretoria as a by-product and much of this compressed naphthalene has been used to protect local wool, hides, and skins. There is a fairly large local market for this product, but unless the industrial use of it widens it is not likely all to be absorbed in the country. In the past much of it has been sent to the U.S. for the manufacture of artificial resins, but during the war certain difficulties rather impeded this traffic. It is now hoped when the shipping position improves to export large quantities for this purpose. The Iscor works has also been a source of much of the tar used on South African roads. In the very near future the demand for such tar will increase enormously, as it is planned shortly to initiate a vigorous policy of road building.

South Africa is still exporting the Cape herb, buchu, largely to America. This herb is generally in strong demand during the war periods, when the prices for it are really satisfactory. It is an old-established remedy for indigestion, colds and stomach troubles. Smaller quantities are being sent to England, where the prices are usually higher than those paid in America, but the greater quantities taken by the latter country compensate for this. Small consignments of buchu have also been sent to Australia and New Zealand.

Adoption of Standards

The chairman of the Transvaal Chemical Manufacturers' Association has said that the principle of protection of the consumer envisaged in the Standards Bill was welcomed by his association, but there were potential dangers in the manner in which the bill could be applied. It was agreed that in some cases standards to protect consumers were essential, but such standards should be minimum standards only. Manufacturers should be free to improve on any standardised product. Compulsory standards, particularly when applied to the chemical industry, would retard the development of the industry, and would lead indirectly to its stagnation, as they would discourage scientific research.

Alcohol and Fuel from Sulphite Liquor

New Field for the Pulp Industry

DEVELOPMENT of a process for the production of butyl alcohol by fermentation of waste sulphite liquor was announced in Seattle in April by Dr. Bror L. Grondal, professor of forestry, University of Washington, and Major Henry W. Berger, research chemist and fermentologist, formerly with the Bureau of Chemistry, U.S. Department of Agriculture.*

The discovery, a result of two years of research, may open up vast new fields for the pulp industries of the north-west United States, which, for lack of practical use for the sulphite liquor, have been forced to dispose of it as waste. Not only would the process provide a means of utilising almost 100 per cent. of the wood, but it would eliminate the source of a long and bitter battle between the pulp interests and the fisheries, who complain that the discharge of such liquors kills fish and oysters.

If given practical application, the process will provide a new source of butyl alcohol for the plastics and other industries. Waste sulphite liquor contains about 2 per cent. of fermentable sugar. From 100 lb. of this sugar, the process will produce about 22-23 lb. of butyl alcohol, 10-12 lb. of acetone, and about 3 lb. of ethyl alcohol. Explaining the findings, Major Berger stated that the key to the entire process probably hinges on being able to get rid of inhibiting materials while retaining the growth elements necessary for normal development of the Weissman bacillus or *Clostridium acetobutylicum*.

Former Practice

Hitherto it has been known that to produce butyl alcohol in quantity from sulphite liquor, the presence of certain growth factors, including biotin and another unidentified factor, perhaps a vitamin that is present in molasses, was necessary. In all previous attempts to produce the alcohol from this source, it was found necessary to add molasses in order to supply this growth factor. This made the process as expensive as using pure molasses. In the new process, however, yeast is produced without the introduction of molasses, thus making the production of butyl alcohol and acetone from sulphite liquor relatively inexpensive.

A New Fuel

Also from the liquor will come a new type of fuel, extracted by adding certain chemicals to the liquor to produce " a very heavily insoluble fuel precipitate which must be removed as a part of the first step." This precipitate which, when dried, forms crystals about the size of a split pea and appears somewhat like coke, is rated as having about 6000 B.Th.U./lb. as compared with about 5000 to 8000 in wood and about 12,000 in coal. Recovery of this substance from the liquor would supply about 75 per cent. of the fuel used in the actual production of the pulp and the liquor at the pulp mill digesters. By weight it comprises about 12 per cent. of the total volume of liquor now being dumped into Puget Sound alone at the rate of about 1600 tons daily. This would mean that a usable fuel is being discarded at the rate of 192 tons daily.

The new fuel, which burns like coal, gives off a sulphurous odour which may render it undesirable for domestic use. However, it can be used either in its original form for stokers, powdered for blowing into furnaces under air pressures, or pressed into lumps or logs.

In addition, the process would make available large quantities of yeast fodder for livestock. The yeast, high in nutritional value and vitamin content, is described as chemically pure and suitable for use in the home and by commercial bakers (*see* THE CHEMICAL AGE, 1945, *52*, 397).

* *Chem. Met. Eng.*, 1945, *52*, 6, 101.

Petroleum Products Cheaper

Cost of Imports Lower

THE Minister of Fuel and Power announces that after consultation with the Petroleum Board he has reviewed the current prices of petroleum products. As a result of the decreased cost of imported petroleum products following the end of the war in Europe and the cessation of convoys in the Atlantic, he has approved the following decreases, which are effective from August 21:

Motor spirit: decrease of 2d. per gallon, making the ex-pump price of pool motor spirit 1s. 11½d. per gallon and the wholesale price 1s. 8d. per gallon in the England and Wales and South Scotland zone.

Diesel oil for road vehicles: Decrease of 1d. per gallon.

Burning oil (paraffin): Decrease of 1¼d. per gallon.

Vaporising oil: Decrease of 1d. per gallon.

White spirit: Decrease of 1¾d. per gallon.

Gas oil, diesel oil (other than for road vehicles), fuel oil and heavy fuel oil (inland trade schedule): Decrease of ¾d. per gallon.

Creosote-pitch mixture: Decrease of 12s. per ton.

Bitumen: Decrease of 18s. per ton.

Water Purification by Activated Carbon

With Special Reference to the Textile Industries

by A. E. WILLIAMS, F.C.S.

THE effect of various impurities in the water used by the textile trades presents a problem which is never completely solved because the water supply cannot practicably be of constant composition. Whether the water be obtained from wells, streams, or canals, the proportion of undesirable matter in the water invariably increases with the diminution of the supply. In some cases the regular source of water fails entirely, and it then becomes necessary to consider possible alternative supplies which perhaps hitherto have not been regarded as serviceable.

The coarser impurities and suspended matter can, of course, be removed by simply percolating the water through a bed of sand, but unfortunately this proceeding does not expel soluble matter and bacteria, both of which have an adverse effect on textile materials. Particularly is this the case with water used for the preparation of sizes and dressings; for the presence of acidity or inorganic salts acts as a catalytic agent on the starch or flour ingredient of the preparation, and ultimately converts this to soluble dextrin and sugar. So that what was perhaps intended to be a water-insoluble compound becomes a water-soluble compound, and so is expelled in the first washing of the fabric. Many such raw waters are also frequently loaded with bacteria, which in the presence of starch-containing materials set up fermentation and thus produce mildew on the fabric.

Apart from sizes and dressings, certain mineral constituents in water will often attack cotton material itself and partially convert this into hydrocellulose; which occurrence becomes obvious when a mechanical strength test is made of the fabric. Therefore, in general, the water coming into contact with textile materials, particularly those of a delicate nature, should be at least as free from foreign matter as the average potable water. Investigations show that activated carbon is capable of taking up from most raw waters all the bacteria and injurious inorganic matter, by a simple filtration of the water through a layer of the carbon.

Development

Activated carbon was probably first used in connection with water purification as an auxiliary agent to the continental Katadyn process. This process, the fundamentals of which were developed by Thiele and Wolf (*Archiv fur Hygiene*, 1899, 34), is based on the catalytic destructive action of minute traces of silver on micro-organisms and bacteria. It is carried out by simply passing the raw water through a vessel containing a relatively large internal surface area coated with finely dispersed silver, over which the water percolates. To preserve the catalytic surface of the silver a preliminary filtration of the water is necessary, to free it of the coarser impurities. Originally, the prefilter was of sand, later displaced by charcoal. Ultimately, activated carbon took the place of charcoal, and following upon advances made in enhancing the adsorptive properties of active carbon, it has been found that such carbon alone is capable of completely sterilising most raw waters.

During the first world war the treatment of water by activated carbon was developed by the Germans, both for drinking and for textile purposes; similar experiments also being carried out at about the same time in the U.S.A. German Pat. No. 44,128 of Aug. 23, 1918, a typical example, claims to remove organic matter, gases, and odoriferous substances, in addition to the coarser impurities, from an average raw water, by filtering the latter, by gravity, through a layer of activated carbon. Growths of algæ in water may be controlled by introducing to the water a small proportion of activated carbon, which may be as low as 0.25 per cent. by weight of the water. C. Stich (*Chem. Z.*, 1943, *67*, 349) frees water from micro-organisms by using 0.20 per cent. carbon; for this use talc was found to be ineffective.

Mineral and vegetable oils can be removed from water, when the oils are present in relatively small proportions, by filtering through activated carbon. The latter is used directly on water containing not more than about one gram of the oil per cu. ft.; when the oil exceeds this proportion it is customary to give a preliminary filtration through graded coke. According to U.S. Pat. Nos. 2,210,965-6 of August 13, 1940, fluorides may be removed from water by treatment with activated carbon, the latter having been treated with a highly concentrated aluminium salt, such as aluminium sulphate.

Most Suitable Carbon

Carbons for water purification should, in general, have a low ash content, preferably not more than 3 or 4 per cent.; and the percentage of water-soluble matter should also be small, since this is immediately dissolved by the water, to which it may impart undesirable properties. A carbon produced from a raw material which is initially of low carbon content, *e.g.*, waste wood, coconut shells, etc., usually gives the best results. The material is first partially carbonised at about 700°C., followed by activation at a temperature of 900-950°C. with superheated steam at a pressure of about 120 lb./sq. in. By means of a weak solution of hydrochloric acid, about 2 per cent. strength, the bulk of the ash in the activated material is next removed. This elimination of ash imparts to the carbon an interstitial surface, thus considerably increasing its surface area and simultaneously its adsorptive capacity. With a raw material such as coke, the bulk of which is, of course, already carbon in a non-activated state, it would not be possible to create a greatly enlarged surface area by hydrochloric acid treatment, owing to the relatively low ash content of coke.

The action of the acid in removing the ash also creates a structure in the carbon that induces good filtration, and also high retentivity of bacteria and other impurities in a raw water, so that frequent stoppages for cleaning and renewing the carbon filter are not necessary. A further advantage of a vegetable carbon is that it retains the original cellular structure of the raw material, so facilitating filtration. Investigations have shown that an alkaline carbon tends to hinder the adsorption of bacteria. Such an alkaline reaction—which is mostly present in vegetable carbons not acid-treated—cannot be expelled by merely washing the carbon with water. It is necessary to boil the carbon with weak hydrochloric acid for an hour or more, followed by repeated water-washing and drying.

Adsorption Processes

Two chief methods of procedure may be adopted in contacting the carbon and water. In the first the water is led by gravity, at a predetermined rate to give the desired degree of purification, through a layer of carbon, the depth of which depends on the extent of contamination in the water. The other method, which is suitable for handling relatively small quantities of water, consists in bringing a definite amount of raw water into intimate contact with a small proportion of active carbon, generally less than 1 per cent., in a mixing vessel, followed by filtration in a filter press.

The gravity process is the more economical, as it dispenses with the use of pumps and filter presses. Some idea of the low cost of the process may be gained from the fact that 1 cwt. of carbon, when used in a gravity filter, will treat 10 tons of contaminated water, containing 10,000 bacteria per c.c., per 24 hours. The filtered water contains not more than six bacteria per c.c., and is therefore practically sterile and incapable of any action on the most delicate fabric. About 20 days is the normal period of usefulness of the carbon, during which it treats 200 tons of raw water. Badly contaminated water, containing up to 300,000 bacteria per c.c. and heavily loaded with inorganic matter, may also be successfully treated. In this case either a deeper layer of carbon is used, or the rate of filtration is slowed down. When much suspended matter is present the water is led first through a prefilter of sand or similar material.

The Gesellschaft für chemische Produktion m.b.H. has protected a method (Ger. Pat. No. 417,254) for the removal of iron salts from waters by means of active carbon. This idea is based on the fact that iron compounds in aqueous solution may be completely and quantitatively removed by carbon. In addition to the iron salts, organic matter and suspended impurities are simultaneously removed. This method is carried out by a simple mixing of the water and carbon, either by mechanical agitation, or by a current of air, followed by filtration, whereby a completely iron-free water is obtained.

Sterilisation of Filters

Carbon filters used in water purification may be sterilised, according to U.S. Pat. No. 2,123,092, of July 5, 1938, by treatment with a solution of iodide and iodate, or of iodide and iodine, in which the ratio of potassium iodide to available iodine should be between 10 to 1 and 100 to 1. With iodate the carbon itself appears to have the property of liberating iodine without the addition of acid.

The utilisation of coal, specially treated, in water purification forms the subject of U.S. Pat. No. 2,137,932. In this, the coal is first reduced to a powder to form a convenient filtering medium. The powdered coal is then impregnated with chlorine at high temperatures; the chlorinated compounds are next either steamed or treated with hot water, and may be also treated with caustic alkali. Alternatively, the chlorinated coal may be treated with an alcohol, such as methyl alcohol, with, if desired, a caustic alkali, uncombined reaction products being recovered and the coal finally washed.

In a review of the United States Public Health Service, E. A. Sigworth (*J. Amer. Water Works Assoc.*, 1943, *35*, 1587) states that the average annual usage of activated carbon for water treatment is 10.6 lb. per million gallons of water, the actual amount used in each case varying with the type of water-treatment plant employed and the type of water handled.

Finland's Chemical Industry

Further Expansion Likely

IN view of the Anglo-Finnish agreement, announced on August 17, regarding the resumption of private trading and financial transactions between the two countries, and the reference made to British relations with Finland in the Foreign Secretary's speech in the House, the following chemical news is significant.

Before the war, Finland was entirely dependent on products of foreign origin for her chemical and pharmaceutical requirements. Roughly two-thirds of her imports under those heads were accounted for by raw materials and semi-manufactured products, the main items being sulphur, Glauber salt, common salt, chlorine, metal salts, etc., while the remainder was taken up by fine chemicals and pharmaceuticals.

At the end of 1942, Finland's chemical industry employed 3250 men in 161 industrial units, with a gross value of production aggregating 879,000,000 Finnish marks. The value of raw materials required is stated to have totalled 372,000,000 marks, of which materials worth 170,000,000 marks were of domestic origin.

Impetus of War

In Finland, as in many other countries, the war encouraged not only the expansion of existing branches of the chemical industry, but also the creation of new activities. It has to be borne in mind that owing to the peculiar circumstances in which Finland found herself during the last five years, this expansion has been on a limited scale; but the construction of sulphuric acid plants and of superphosphate factories by the State, together with recent investigations into the establishment of other branches of the chemical industry, have shown that relatively favourable conditions obtain in the country. For instance, occurrences of certain raw materials are said to be larger than was originally supposed; given the application of modern methods of exploitation and of industrial utilisation, these could form the basis for further expansion. It is hoped to raise the necessary capital from both private and Government sources. In fact, the State has already expressed its interest by favouring the construction of a large nitrogen plant in the northern part of the country, the power supply of which is to be derived from an expansion of existing power stations on the Ule River. This nitrogen plant is reported to have a key position in a chain of other new chemical plants, while there is no need to emphasise its importance to fertiliser supplies.

In May, 1942, the Finnish Government appointed a committee of experts to investigate the prospects of a domestic chemical industry. This committee has so far submitted 19 reports dealing with the major branches of the industry, the establishment of which might be feasible in the country. At the same time, the foundation of a number of research institutions has been proposed by the committee. Special attention is to be given to an increase in the production of tar, which during the last decade had fallen to about 1000 tons per annum, as compared with about 2000-3000 tons annually at the turn of the century. Plans are now in hand to increase tar output to about 10,000 tons yearly. Production of lubricating oils from tar in four plants is reported to total about 4000 tons per annum, and these supplies are helping to overcome the dire scarcity of lubricants.

The committee of experts has also examined the prospects for the establishment of a fine chemical industry, as well as for the production of solvents, and of biochemical and pharmaceutical products. It remains to be seen to what extent these plans will be influenced by a gradual resumption of Finland's trade with other countries, a trade in which deliveries of chemical products should assume an important position. It must not be forgotten, however, that Finland is heavily committed, not only as a result of the reparations agreement under the armistice with the Soviet Union, but also in return for assistance granted by Sweden during the war. While undoubtedly modifying her plans regarding the establishment of a chemical industry in the light of new conditions, Finland will most probably be anxious to manufacture a large proportion of her requirements at home.

FRENCH CHEMICAL PRICES

The Statistical Service of the French Ministry of National Economy has now resumed publication of index numbers of wholesale prices, suspended during the occupation. The latest figure published refers to December, 1944, when the wholesale price index for the chemical industry (1936=100), stood at 269, compared with 212 in 1943 and 108 in 1939. The index number for the metallurgical industries is given as 179, compared with 177 and 116 respectively, that for the rubber industry is 499, compared with 499 (unchanged) in 1943 and 129 in 1939, while the index for the paper industry rose to 434, compared with 371 and 91 respectively.

Personal Notes

DR. W. T. GRIFFITHS, F.R.I.C., F.Inst.P., has been appointed chairman of the Mond Nickel Company and of its subsidiary companies in succession to the late Mr. D. Owen Evans, M.P.

The London University Chair of Chemistry, to which DR. D. H. HEY was recently appointed, is tenable at King's College, not at the Imperial College of Science and Technology, as previously reported.

MR. D. MCMILLAN and MR. J. R. FLEMING have been appointed to the board of Qualcast. Mr. McMillan is the managing director of the company's Manchester subsidiary, Follows & Bate. Mr. Fleming is general works manager of the Qualcast factories.

Following the relinquishment by Colonel Devereux of his position as chairman and managing director of High Duty Alloys, Ltd., MR. SPENCE SANDERS has now relinquished his position as deputy managing director. Mr. Sanders will retain his seat on the board of International Alloys, Ltd., and will be associated with Colonel Devereux in his future plans, which will be announced shortly.

Obituary

MR. PAUL ZECH-DUPONT, who died in Glasgow on August 18, aged 69, was managing director of Sandeman's Varnish, Ltd., Maryhill. A citizen of Antwerp, he had served as Belgian vice-consul in Glasgow for some years. In 1914 he was active in the siege of Antwerp, and later he succeeded in escaping to this country.

MR. JOHN SOMERVILLE HIGHFIELD, who died on August 15, aged 73, was chairman of the Fuller's Earth Union. His profession, however, was that of electrical engineer—he was senior partner in the consultant firm of Highfield and Roger Smith —and he was a past-president and honorary member of the Institution of Electrical Engineers.

SIR ALLAN CAMPBELL MACDIARMID, who died in London on August 14, within a few days of his 65th birthday, had been chairman and managing director of Stewarts & Lloyds, Ltd., since 1926, and was president of the British Iron and Steel Federation. By profession a chartered accountant, Sir Allan was appointed secretary of Stewarts & Lloyds in 1909 and was elected to the board in 1918. He was a director also of many iron and steel and engineering companies, and received the honour of knighthood last January.

MR. JOSEPH CLAYTON, who died on August 17, aged 74, at Moortown, Leeds, after an operation following several months' illness, was chairman and managing director of Clayton, Son & Co., Ltd., of Hunslet, Leeds. Educated at Askern College and Leeds University, in 1885 he joined the firm which his father, the late Laurence Clayton, had founded in 1862. Never seeking the limelight of publicity, Mr. Clayton did a great deal of valuable and unobtrusive work for the British engineering industry. His expert knowledge of gasholder construction and design has long been recognised by the gas industry, but his manufacturing interests were wide and varied and in many branches of engineering he was a leading authority. During the wars of 1914-18 and 1939-45 many important engines of war, very different from the productions of peace, were made at the works of the company under his supervision. Always keenly interested in overseas trade, Mr. Clayton travelled abroad many times in connection with the contracts undertaken by his firm. He was also chairman of Deighton's Patent Flue and Tube Co., Ltd., The Yorkshire Patent Steam Waggon Co., Goodall, Clayton, & Co., Ltd., and Rice & Co., Ltd., in addition to many other engineering interests.

New Control Orders

Silicon

THE Control of Silicon (No. 2) (Revocation) Order (S. R. & O. 1945, No. 971), made by the Minister of Aircraft Production, revokes Order No. 1 which regulated the acquisition, disposal, treatment, use, consumption, and price of silicon.

Pest Control

The Infestation Order, 1943 (S.R. & O. 1943, No. 680), provided for the licensing of pest control undertakings in order to ensure safety and efficiency in pest control, and the Minister of Food has now made an Order (S.R. & O. 1945, No. 847) nominating October 1 as the appointed day contemplated under Article 7 thereof. From that date the manufacture or preparation of pest control articles is subject to licence, and those concerned who have not yet applied should do so forthwith to the Ministry of Food (Infestation Division), University College, Gower Street, London, W.C.1. The provision of service for prevention or treatment of infestation does not require to be licensed, but will be the subject of a further announcement.

A new company, to be known as the B. F. Goodrich Chemical Co., Ltd., is to be established at 251 King Street West, Kitchener, Ontario, Canada. Responsibilities of the new company include the sale in raw material form of Geon polyvinyl resins, plastics, latices, and various rubber chemicals which, it is understood, will be manufactured in the new plant now under construction.

A CHEMIST'S BOOKSHELF

Fertilisers During and After the War. By E. M. Crowther, D.Sc., F.R.I.C., Bath and West Southern Counties Society, 3 Pierrepoint Street, Bath. Pp. 51. 2s. (post free).

The booklet under review is the 13th of a series of pamphlets issued under the general title "Article on War-time Agriculture," by the Bath and West Southern Counties Society. It was a happy thought to induce Dr. Crowther, the head of the chemistry department at Rothamsted, to describe the lessons learnt from the use of fertilisers during the war. At a time when fertilisers are in short supply and production must necessarily be maintained at the highest level, the correct use of fertilisers becomes a matter of life and death. Not unnaturally, important lessons were learnt and important differences of practice were observed between different parts of the country. All these have been summarised in the pamphlet under review.

It is obvious that farming is now becoming highly scientific, but it comes as almost a shock to observe that a work of this character, although not couched in *highly* scientific terms, can be considered suitable reading matter for the majority of farmers. This is a pamphlet which cannot be neglected by anyone who has anything to do with the manufacture, sale or use of fertilisers in Great Britain. It is written in a very lucid, if compressed, form and there is no doubt that Dr. Crowther has put on record experiences that will be of the greatest value to British agriculture in the future.

Rubber in Engineering (Services Rubber Investigations). London: H.M.S.O., for Ministry of Supply, Admiralty, and Ministry of Aircraft Production. Pp. xviii + 267.

Experiences gained from the Services Rubber Investigations are the background from which this book is written. The research work on which the publication is based has been carried out by I.C.I. (Dyestuffs Division) on behalf of the respective Ministries. Its main purpose, to furnish engineers with a general survey of the information available on the fundamental properties of rubber, is well achieved.

The opportunity that this presentation affords the production engineer to learn what has been proved effective in this special industry, and the fact that this is the first publication devoted entirely to experiences of the types of problems connected with both the manufacture of rubber articles and with their use enhances its value. Over 80 figures, 68 tables, more than 300 references, and a comprehensive index add to its value.

General News—From Week to Week

A reprint of Specification D.T.D.355: Silicon-Iron Bronze Castings (Dec., 1937), incorporating Amendment List No. 1, has been issued by the Ministry of Aircraft Production.

Sussex Engineers' and Manufacturers' Association has been registered as a company limited by guarantee without share capital, with registered offices at 62 Old Steine, Brighton.

An engineering exhibition, arranged by the Bristol Engineering Manufacturers' Association, comprising over 200 firms, will be held at the Victoria Rooms, Bristol, from September 7 to 15. Further particulars may be had from the association's office at 104 Filton Avenue, Bristol, 7.

An interesting point in connection with the development of Radar—that triumph of British research, the story of which has now been made public—lies in the use of polythene, the remarkable insulating material developed by I.C.I. The answer to certain insulation problems, hitherto insoluble, was provided by Metropolitan-Vickers engineers who, working with material supplied by I.C.I., evolved a method of moulding polythene which not only solved the problem, but also effected a considerable saving in money.

The Ministry of Supply announces that as from August 14 all restrictions on the release of copper from fully-manufactured goods for export are removed by the Non-Ferrous Metal Control.

An exhibition of apparatus for the measurement and testing of metallurgical equipment was opened on August 20 at Cutlers' Hall, Sheffield, and will remain open for a week. Among interesting precision instruments may be mentioned apparatus for the detection of flaws in steel by supersonic waves, and for testing the thickness of glass and internal strains when only the outside is accessible.

British owners of property in Germany should address all communications on the subject to the Trading with the Enemy Dept., 24 Kingsway, W.C. They should already have made a return of such property to this Department. As information becomes available, individual owners will be notified of the condition of their property; but at present no inquiries about the state of specific properties in Germany can be dealt with. Those who receive no news about their property can rest assured that their interests are being guarded as far as practicable by specialist officers of the Control Commission.

The Melchett Lecture of The Institute of Fuel, to be given in the hall of the Royal Geographical Society (by kind permission of the president and council) on October 17, at 6 p.m., by Professor C. H. Lander, the Melchett Medallist for 1945, will deal with the importance of team work in the acquisition of knowledge.

Foreign News

Compared with 1943, rock salt output in the United States increased 6 per cent. and brine 5 per cent.; but output of evaporated salt declined 1 per cent.

Control over non-ferrous metals will be gradually relaxed in Belgium. Copper and tin will be the first two metals in which free dealings will be resumed, as imports are now arriving regularly from the Congo.

Foreign-owned mining concessions in Yugoslavia will be terminated by a draft bill, accepted by the Yugoslav Parliament, which would also place the country's mineral resources under State control.

A more plentiful supply has allowed the Controller of Industrial Chemicals to dispense with the permit system for control in South Africa for shellac, states a bulletin of the Director-General of Supplies.

Production of calcium chloride and of calcium-magnesium chloride in the U.S. in 1944 was 200,964 short tons, valued at $1,621,227, a slight increase over the 1943 figure of 199,796 ($1,549,565).

The U.S. War Production Board has practically abandoned control of copper, steel and aluminium. Most allotments of these metals have been cancelled and nearly all preference ratings assigned to the armed services have been cancelled.

American magnesite production in 1944 was 561,540 short tons, higher than in any previous year except 1943. Curtailment of magnesium metal production, however, caused a reduction in the output of magnesium chloride, which is expected to be still smaller in 1945.

The U.S. Bureau of Mines reports natural sodium sulphate sales for 1944 at 168,923 short tons (value £1,577,982), and natural sodium carbonate sales at 184,826 short tons (£2,869,243). This is a record figure for the carbonate, but sulphate sales, though up on 1943, are slightly lower than in 1942.

In Palestine, a superphosphate fertiliser factory has up to now had an annual production of about 12-15,000 tons. To enable it to double its output for both local consumption and for export, and to meet an increased demand for sulphuric acid of all grades, the firm intends to erect a new plant in Haifa. The new factory will cost nearly £P250,000, and will have a capacity of about 15,000 tons of sulphuric acid per annum.

The Corning Glass Co., New York, has purchased a plant at Leaside, Ont., Canada, previously operated by Research Enterprises, Ltd., for the Dominion Government. Equipment for manufacture of Pyrex glass will be installed and facilities provided for large output. This will be the first Canadian activity of the Corning company, and a new Canadian subsidiary will be formed to carry out the development.

A new list of all American Standards and War Standards approved to date has just been published by the American Standards Association, 70 East 45th Street, New York 17, and is available free of charge. There are approximately 800 standards listed in the booklet, together with definitions of technical terms, procedures, etc., which should serve as valuable reference material to chemists and engineers.

Increasing demand for synthetic rubber compounding raised U.S. sales and production of carbon black to new records. Sales expanded by 49 per cent. over 1943, to 937,430,000 lb.; while production gained 35 per cent. over 1943 to 801,860,000 lb., or 207,795,000 lb. above the old record in 1941. Carbon-black plants burned 355,770 million cu. ft. of natural gas, a moderate increase (13 per cent.) compared with the output gain.

The East African Industrial Research Board has just published its *First Annual Report*, covering the period from the inception of a co-ordinating research organisation in 1941 to the end of 1943. Most of the items of interest to the chemical industry have already been published in our columns, but it is a great convenience to have the whole record in one booklet, which is obtainable (price 2s.) from the Secretary, E. A. Industrial Research Board, P.O. Box 1587, Nairobi.

Brazil's annual coal imports before the war amounted to from 1.5 to 2 million tons and, as current imports are about 600,000 tons per annum, the difference has to be made up by domestic output. The national mines of Rio Grande do Sul, Santa Catharina, and Paranà, are now capable of producing over 2 million tons yearly. After washing and treating, it yields a metallurgical coal, most of which is reserved for the Volta Redonda steel plant.

To assist industry in the post-war period to meet many problems of research, the New Zealand Manufacturers' Federation, in conjunction with the Dominion's Scientific and Industrial Research Department, has set up an organisation to be known as the Manufacturers' Research Committee. The major facilities of the D.S.I.R. to be made available to manufacturers through the committee are library and information service, chemical, physical, and engineering laboratories, and the results of studies in industrial psychology.

At the moment only half the story can be told. Not until the peace has been won can we tell you of the war developments which will be incorporated in the post-war design and manufacture of our Optical-Mechanical-Electrical Instruments and Aircraft Equipment.

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Three magnesium plants of the American Defense Plant Corporation are being returned to full production schedule at the request of the War Production Board. The plant at Velasco, Texas, operated by Dow Magnesium, has been standing by since last December; the Painesville, Ohio, plant, operated by Diamond Magnesium, and the plant at Luckey, Ohio, operated by the Magnesium Reduction Co., have been limited to 50 per cent. of capacity since the end of 1944.

Forthcoming Events

September 7. Society of Chemical Industry (Food Group). Members of the Group have been kindly invited by Roche Products, Ltd., to a semi-social summer meeting at their factories at Welwyn Garden City, Herts. The meeting, to which ladies are invited, starts at 11 a.m. with a visit to the Research and Pharmaceutical Departments. A lecture on the large-scale synthesis of certain vitamins and their use in enriching food will precede a visit to the factories in the afternoon. Luncheon will be available at 5s. each (payable at table) to members and their friends; tea will be provided by Roche Products, Ltd.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

TYNE CHEMICAL CO., LTD., South Shields. (M., 25/8/45.) July 25, charge, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; charged on contract moneys. *Nil. April 13, 1944.

Satisfaction

GRIFFIN & TATLOCK, LTD., London, W.C., philosophical and chemical instrument makers. (M.S., 25/8/45.) Satisfaction July 18, of charge registered November 7, 1929.

Company News

Boots Pure Drug Co., Ltd., announce a first interim dividend of 10 per cent. (same), payable September 30.

The United Glass Bottle Manufacturers' Co., Ltd., is paying an interim dividend of 3½ per cent. (same) on its ordinary stock.

British Oil and Cake Mills, Ltd., announce a net profit of £554,736 (£547,286) and are paying an unchanged ordinary dividend of 3 per cent.

Solignum, Ltd., reports a profit, for the year to March 31, of £19,055 (£16,102). The ordinary dividend is 5 per cent. (same, paid for 1940-41).

Metal Industries, Ltd., report a profit, for the year to March 31, of £123,477 (£119,738). A final ordinary dividend of 6 per cent. on "A" and "B" shares was declared, making a total distribution of 9 per cent. (8½ per cent.)

New Companies Registered

British Chemical Products & Colours, Ltd. (397,779).—Private company. Capital £1000 in £1 shares. Manufacturing, analytical and dispensing chemists, etc. Subscribers: D. Miller, D. R. Barton. Registered office: 6 Broad Street Place, London, E.C.2.

Plato Processes, Ltd. (397,719).—Private company. Capital £400 in £1 shares. Precision, electrical, chemical, and general engineers, etc. Directors: F. T. A. Hawkins; W. E. J. Hawkins; H. Allen; A. Rayner. Registered office: 9 Skelton Street, London, W.C.2.

Foamslag (Scottish Productions), Ltd. (23,426).—Private company, registered in Edinburgh. Capital £100 in £1 shares. Objects: To manufacture and treat (by physical and chemical processes) smelts, blast furnace slags, pumice, cements, etc. Subscribers: E. W. Roseir, 1 Greenhurst Road, London, S.E.27; C. H. Treble.

Chemical and Allied Stocks and Shares

STOCK markets were generally firm, although business in most sections was moderate, reflecting a tendency to await further indications of the Government's policy. British Funds maintained an upward trend, and this gave a feeling of confidence to markets generally. Home rails rallied well on the belief that nationalisation of the railways will take a long time to effect and that meanwhile the fixed rental agreement is likely to continue which would imply dividends at around current rates.

Shares of chemical and kindred companies maintained their recent rally and were slightly higher in some cases. Imperial Chemical were 38s. 3d., buyers being attracted by the yield of over 4 per cent. No change is being expected in the I.C.I. interim dividend, due to be announced next month, and there is general confidence that there are good prospects that the dividend total will be maintained at the 8 per cent.

level which has ruled for some years. British Aluminium firmed up to 43s. 9d., and Turner & Newall were 77s. 6d., but United Molasses at 42s. 3d. lost part of an earlier gain. The units of the Distillers Co. displayed firmness at 115s., and British Plaster Board were 36s. 9d.

B. Laporte showed firmness at 87s. and, in other directions, Greeff-Chemicals Holdings 5s. ordinary were 9s., while British Drug Houses rallied further to 39s. Shares of the last-named company are attracting attention on the belief that if E.P.T. were reduced or abolished there would be prospects of dividends at least returning to pre-war levels, while there is also market talk of the possibility of a share issue on favourable terms. Cellon 5s. ordinary were 26s. and firmness was maintained in British Glues 4s. ordinary at 11s. 3d. W. J. Bush were 75s., and Monsanto Chemicals 5½ per cent. preference have changed hands at 23s. Morgan Crucible 5½ per cent. preference marked 27s. 6d., and the 5 per cent. preference 24s. 9d. United Glass Bottle were held firmly and quoted at 72s. 6d. Dividend on the last named has been limited to 12 per cent. for some years, but earnings have been much in excess of this rate, and the assumption is that sooner or later increased payments will be forthcoming. Forster's Glass 10s. shares were again 38s. 9d., but Triplex Glass, after moving ahead, reacted to 41s. 10½d. on profit taking.

Iron and steel issues were generally little changed, and despite the Government's nationalisation statement, colliery shares have also been fairly well maintained. Prevailing view in the market is that, despite the difficulties of the transition to peacetime working, there seem reasonable prospects of the maintenance of dividends of leading iron and steel companies. Payments during the war period have been well below earnings on the shares, a good proportion of profits being added to reserve. Guest Keen at 38s. rallied after an earlier decline, as did Dorman Long at 24s. 6d., Davy Engineering at 31s. 9d., and Stewarts & Lloyds at 49s. 6d. Allied Ironfounders have been active around 49s., and Babcock & Wilcox were 54s. 6d. Amalgamated Metal showed steadiness at 18s. 9d. General Refractories were firm at 16s., while Murex strengthened to 97s. 6d. Among textiles, Bradford Dyers were active around 27s. with Calico Printers 20s. 6d., and Fine Spinners 25s. 7½d.

Boots Drug firmed up to 54s. 4½d. Timothy Whites were higher at 42s. 6d., and Sangers were 30s. 6d., with Beechams deferred 19s. 3d., and Griffiths Hughes 39s. 4½d. Elsewhere, Imperial Smelting have been steady at 15s. Oil shares failed to hold earlier gains, Burmah Oil easing to 85s., and Shell to 83s. 1½d.

British Chemical Prices

Market Reports

CONDITIONS in the London general chemicals market remain quiet, with the general tone steady. Contract deliveries are going forward on a normal scale, but there is little fresh business, chiefly on account of the shortage of supplies and the annual holiday period. It is expected that an improvement in the shipping position will result in a big increase in export trade. In the soda products section there has been a fair movement of supplies of caustic soda and bicarbonate of soda, while a moderate weight of business has been reported in hyposulphite of soda, nitrate of soda, and acetate of soda. The potash chemicals generally maintain a very strong undertone, with acid phosphate of potash a brisk market. Offers of yellow prussiate of potash remain on a restricted scale and both caustic potash and bichromate of potash are meeting with an active demand. In other directions crude and refined glycerine are very firm and the demand is active, while a steady inquiry for the various grades of sulphur is reported. There has been no change in the position of alum lump and sulphate of alumina, both of which are being absorbed in fair quantities. British-made formaldehyde meets with a steady inquiry and this also applies to peroxide of hydrogen and white powdered arsenic. Quiet conditions continue to operate in the coal-tar products section, where no fresh developments are reported.

MANCHESTER.—Trade in heavy chemicals on the Manchester market during the past week has been under the dual influence of the peace celebrations and of uncertainty as to the future course of business, especially in those classes of materials wanted for war purposes, and at the moment new business is on the quiet side, the textile and certain other descriptions of industrial chemicals continuing to find a steady outlet. Fertilisers remain in seasonally quiet demand in most departments. Among the tar products, creosote oil is in good demand and more activity is reported in the xylols and naphthas, but a falling off in the movement of supplies of the toluols as a direct consequence of the changed conditions has been reported.

GLASGOW.—Business in the Scottish heavy chemical trade improved during the earlier part of last week, but the two days' victory holiday restricted deliveries towards the end of the week. Prices remain firm and export business is unchanged.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.

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None of the situations advertised in these columns relates to a man between the ages of 18 *and* 50 *inclusive or a woman between the ages of* 18 *and* 40 *inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order,* 1945, *or the vacancy is for employment excepted from the provisions of that Order.*

ASSISTANT MANAGER, Chemical Section, wanted by Chemical Engineering firm (E.W.O.) in London. Applicants must hold Ph.D. degree Chemistry, wide knowledge of basic organic and inorganic chemical processes used in industry. Some chemical plant operational experience is essential. Special knowledge of physical chemistry is required. Previous experience of translating research results into practical schemes an advantage. Age preferred 30/40. The post is permanent and progressive. No application will be considered unless the following information is supplied in writing: Nationality at birth, age, education, particulars of past positions held and responsibility at present, availability under E.W.O. and Service regulations, salary required. Box No. 2231, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

THE BRITISH DRUG HOUSES LTD., require a man of sound education, under 35, as assistant manager of their Laboratory Chemical Sales department. Good English and the training and capacity to undertake responsible executive work are essential; chemical qualifications or experience of the chemical industry are desirable. Write fully stating age, education, qualifications and experience, and indicating salary required to The Secretary, The British Drug Houses Ltd., Graham Street, London, N.1.

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WORKING NOTICE

THE proprietors of British Patent No. 414,558 are prepared to sell the patent or to licence British Manufacturers to work thereunder. It relates to a process and apparatus for the continuous extraction of Liquids. Address: Boult Wade & Tennant, 112, Hatton Garden, London, E.C.1.

THE Proprietors of the Patents Nos. 463,437 and 507,040 for "Improvements in or Relating to Wood Pulp adapted for Chemical Use" are desirous of entering into arrangements by way of licence and otherwise on reasonable terms for the purpose of exploiting the same and ensuring their full development and practical working in this country. All communications should be addressed in the first instance to Haseltine Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

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