The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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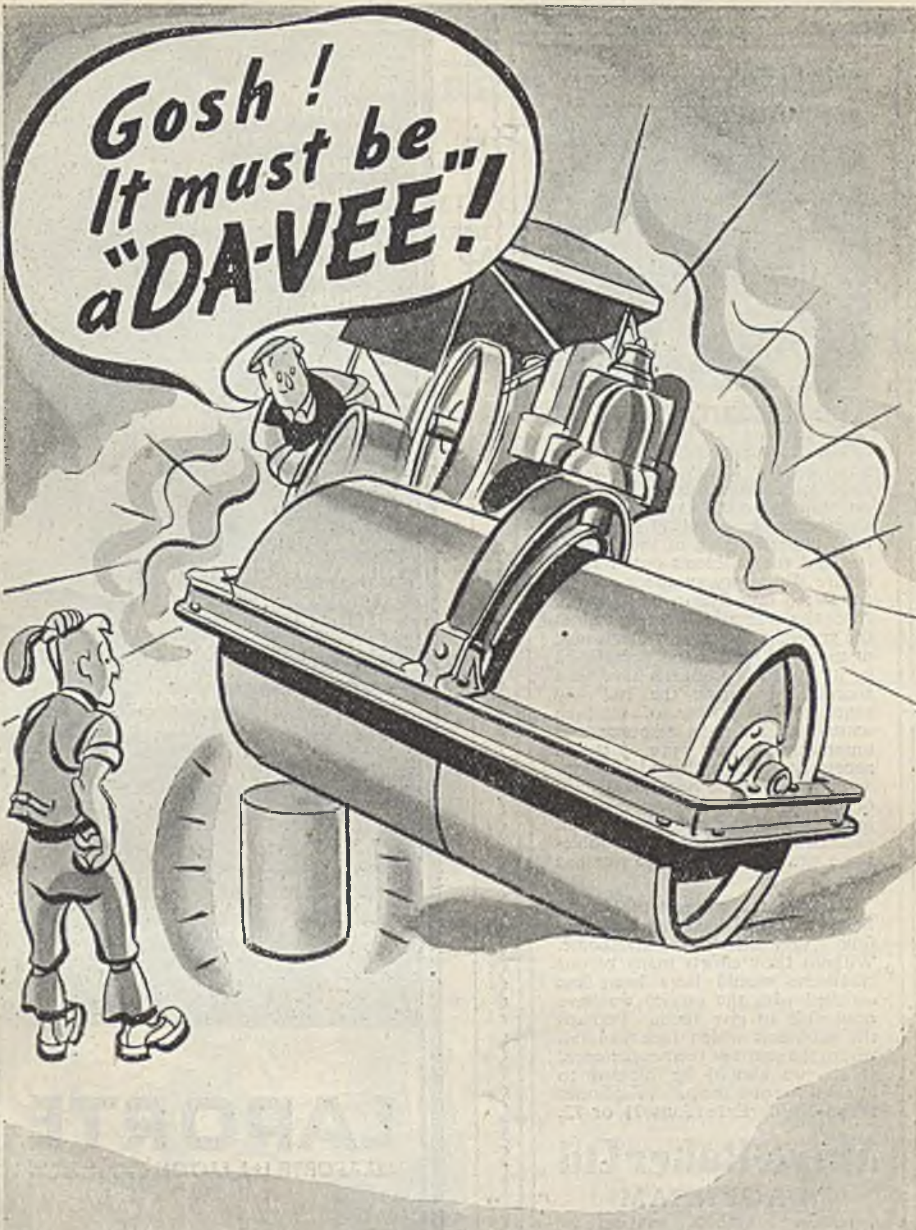
Gosh! It must be a "DA-VEE"!

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World Supply of Raw Materials

SOME considerable time ago we called attention to the very rapid rate at which ores and fuels are being used, a rate which is increasing in spite of every effort made to salvage used materials and make them available for re-use. We are not alone in this anxiety. To-day, many students of world mineral resources are expressing alarm over the rapid depletion of ores and other natural deposits that yield vital metals and mineral fuels. They foresee an acute shortage in 25 or 30 years; and this opinion is voiced by writers in newspapers and magazines to such an extent that the intelligently curious layman is becoming disturbed. He reads that the huge and rich iron ore deposits of the Lake Superior region are being exhausted rapidly; that, with the exception of Texas, all the leading oil-producing States of the U.S.A. have passed the peak of potential production. The persistent discussion in the Press of the "shortage" of petroleum and motor spirit, of steel and copper, of nickel and chromium (albeit caused by war demands), accentuates this apprehension.

The geological processes by which minerals are deposited in the ground are operative to-day, but the cycle of these processes covers millions of years, so that, from a practical standpoint, there is no current replenishment of supply. Within limits, metals can be and are salvaged for repeated use; but fuels, when once burned, are gone. On the other hand, there is a whole range of raw materials, such as rubber, timber, jute, cotton, wool, leather, which can be replenished year by year by natural growth.

Nor can chemical synthesis help very much, so far as is known at present. Synthetic processes can build up organic materials that will simulate or replace, or even be superior to, those natural products which are grown from the soil and which can therefore be replenished in any event. But with the single exception of plastics, it does not appear that chemical synthesis can help very much in replacing materials of construction. A good many of our technological advances of the present century are due to alloy steels which are given special properties by reason of their content of the less common metals. While the war-time development of the steel industry has shown that many metals can be replaced by others which are in easier supply, it still remains

On Other Pages

true that if we use up our natural resources of many of the elements we shall find it difficult to replace them, and in any event they cannot be replaced by chemical synthesis. Whether at some far distant date they will be recoverable by the synthesis or degradation of atoms is a matter upon which at the moment it is not wise to speculate. Atomic chemistry is in its infancy and it is always possible that the ultimate development may be the transmutation of any element into any other element on a commercial scale. This conjures up a world of which we cannot as yet perceive, even dimly, the possibilities.

An interesting address by Mr. A. B. Parsons, the secretary of the American Institute of Mining and Metallurgical Engineers (reproduced in the June issue of the *Journal of the Franklin Institute*), gives a more optimistic picture. It is true that with the war-time rate of exploitation, the life of known reserves of certain metals in the U.S.A. is very small. It is believed that there is only 3 years' supply of bauxite, 5 years' supply of tungsten, mercury, lead, and zinc, 10 years' supply of copper, 15 of petroleum and 20 of iron ore. Mr. Parsons points out that normally the U.S.A. consumes roughly half the world's output of industrial minerals; but, on the other hand, with the possible exception of Russia, it is the country most richly endowed with mineral resources. Various foreign countries have extremely large proved resources of some important minerals. Examples are copper in Rhodesia and Chile, manganese in Russia and India, iron in Brazil and Sweden, and petroleum in Venezuela, Iran, Irak, and Arabia. In some regions, hitherto only partly prospected, highly productive new deposits will doubtless be found.

Although the gloomier estimates are not controverted by known facts, Mr. Parsons points out that they refer primarily to the rich deposits and that in the crust of the earth, defined as a layer 10 miles thick including both ocean and land to which it may be assumed that man will ultimately gain access, there are enormous supplies of raw materials. He gives a table of the composition of the crust of the earth which we reproduce on page 622. Although the amount of gold in the crust of the earth is only 0.0000001 per cent. this is actually equivalent to 24,500,000,000 tons of gold. On this basis, therefore, we have in the crust of the earth enormous quantities of raw materials which are likely to keep the world going for indefinite millions of years if it and the human race should last for that length of time. It is true that economic production of any metal depends upon finding in the ground—or in the ocean—concentrations of sufficient extent and richness to warrant exploitation. A large aggregate amount in the crust does not necessarily assure the existence of hign-grade deposits. However, when and if the industrial utility of any metal becomes established, the chances are good that deposits will be found and that practical methods of exploitation will be devised. Costs may be relatively high; but, if demand is insistent, they will not be prohibitive.

Exhaustion of supplies would not take place suddenly but gradually, and would be accompanied by a gradual increase in the price of the element that began to be in short supply. This in turn would lead to its replacement by other elements through the agency of scientific research. "What," Mr. Parsons asks, "will happen when resources become depleted of the ferro-alloying metals?" He answers that the mining of deposits of progressively lower grade gives promise of a period of adequate supply much longer than many think. More significant, however, is the fact that each of these can be replaced, sometimes entirely and always in part, by one of the others or by one of the less commonly known alloying elements. Among the alloying materials that the metallurgist has introduced recently are beryllium, columbium, titanium, boron, tellurium, indium, selenium, lithium, zirconium, and tantalum—elements of which the average person has scarcely heard: these have contributed much to the steels that have gone into materials of war. Like iron, aluminium and magnesium are available in inexhaustible supply. Ores are widely distributed, readily accessible, and sufficiently rich to keep the cost of production within practical limits. Sea water to-day yields metallic magnesium at a remarkably low cost. Fifty years ago the production of aluminium was negligible; only ten years ago magnesium, as an industrial metal, was practically unknown. In 1943, the world's production of aluminium was of the order of 2,000,000 tons; and of magnesium, 500,000 tons. These figures are relatively insignificant compared with an annual world output of 175,000,000 tons of steel; and the cost per ton is five to ten times that of low-alloy steels. However, the trend unquestionably will be to reduce this differential in cost. Moreover, the lighter materials give more utility, pound for pound; and for a great many uses, such as shapes for fabricating mobile structures, the light metals will encroach to an increasing extent on steel. Without doubt metallurgists will devise alloys of both metals that will satisfy a wide range of requirements not only as alternatives to steel but also to copper, lead and zinc.

Mr. Parsons looks to technological research to solve the problem. The first method would be by making use of progressively lower grades of ore. We have already seen this taking place in regard to iron ore and to the mining of gold and in this way quite a large proportion of the immense amount of materials that are contained in the earth's crust will be made available. Secondly, if an element becomes in such short supply that it can only be obtained by costly processes, it will be used only for those purposes for which the high cost is justified.

Furthermore, it is considered that new technological processes may avoid the use of certain materials in short supply. Mr. Parsons points out that the major use for copper to-day is the manufacture of machines and equipment for the generation, distribution, and utilisation of electric energy. The essential virtue of the metal is high electrical conductivity. For some purposes in the electrical industry aluminium can be substituted for copper; and silver is an excellent conductor of electricity. However, aluminium is bulky and silver is scarce; and for the moment copper is preeminent. Yet it is not impossible that some of the "newer" metals or new alloys might be developed for use as electrical conductors. Speculating still further, it is conceivable that, by the time copper becomes really scarce, scientists will have found ways to generate and utilise electric energy with the minimum use of metallic conductors of any kind.

The general impression from this paper is one of encouragement for scientific research. We shall have difficulties as the years pass in finding sufficiently high-grade ores to enable us to produce materials at low cost, this applying particularly to metals. The solution of our difficulties can only come about through intensive research in industrial science. It is clear that the longer civilisation goes on the more will its future be in the hands of science.

NOTES AND COMMENTS

Science and Nutrition

NUTRITION, like other branches of chemistry, has evolved from an empirical procedure to an exact science. For a few of the more fortunate it used also to be an art, but nowadays it has become a pretty sordid business for most of us. This is all the greater reason for enjoying the perusal of Mr. A. L. Bacharach's new edition of his book, *Science and Nutrition* (Watts; 5s.), an excellent five-shillingsworth, if ever there was one. It is, we suppose, intended primarily for the layman, but the man of science cannot fail to appreciate the excellent work that the author has done, not merely in stating the facts as clearly as possible on an extremely intricate subject, but also in conducting a forthright campaign against humbug, cant, and slovenly work. Too much of these last, from the point of view of the man-in-the-street, has got mixed up—in irresponsible books and newspapers—with the real hard and logical thinking which genuine scientists have put into the study of nutritional problems. We have said that the book is primarily for the layman, but at least an appreciation of the principles of chemistry is advisable if the book is to be enjoyed to the full.

Still, whatever the status of the reader, he will be enabled to forget, for a few moments at any rate, the eternal scrabbling and queueing for rations, and be reminded instead that even if we cannot *enjoy* our food, we can at all events legitimately expect a fair share of such nutriment as is necessary to our well-being. That this is so is due largely to the work of Mr. Bacharach and his colleagues in food chemistry, and to the work of Lord Woolton, Sir Jack Drummond, and their assistants at the war-time Ministry of Food.

A Policy for the Ruhr

THE strong appeals made in recent weeks, both by a number of economists and by the more serious British newspapers, that the Government should declare its policy on the future of the Ruhr, have been successful. The coal mines and steel plants of the Ruhr, that over-industrialised area which has been such a powerful war-making factor in the history of the last hundred years, are soon to be expropriated. Direction and ownership will pass from the German industrial groups (one of the main props of the Nazi régime) to the British authorities, to be held in trust until final decisions have been made. Far too many highly important decisions have already been made by the easy method of following the line of least resistance, sometimes euphemistically called "the realistic approach." It is therefore essential that a final settlement should be arrived at as speedily as possible. the interests of France, the country which knows to the full the dangers of leaving the Ruhr in the hands of a centralised Germany, must, in any settlement that is to work, be given the greatest consideration. The interests of all the smaller countries in western and north-western Europe must also be made to dovetail into this scheme.

The Coal Board

ALMOST at the same time as the news about the Ruhr comes the detailed information of the scheme for nationalising the chief raw material of the British chemical industry—Coal. The Coal Industry Nationalisation Bill has been in the headlines of the Press during past weeks, and the main provision of it consists in the appointment of a National Coal Board. This comprises nine members, including a chairman and a deputy-chairman, appointed by the Minister of Fuel and Power, who, incidentally, is empowered to give the Board "general directions as to the exercise and performance of their functions." The Board is to consist of persons with appropriate industrial and mining qualifications, and their salaries are to be on a commercial rather than a Civil Service scale. The functions of the Board are such as to enable it to do "the same kind of things as a colliery company can generally do," and this provision is of the first importance to the chemical industry, as it covers the further treatment of the coal produced, and the production of such goods as manufactured fuel and by-products. The Board also has power to provide facilities for training, education, and research. One of the two Consumers' Councils which the Minister is bound to establish will deal with industrial supplies, and will pass to the Minister its conclusions on any disputed matter. The national Press has been concerned largely with the question of compensation, and in this section it will be interesting to see the "value for subsidiary purposes" which is assigned to coke ovens, manufactured fuel plants, and the like. At this stage it is idle to do more than comment; a tremendous amount will depend on the constitution of the Board, and during the turnover period the chemical industry will have to maintain a careful watching brief.

Paper for Containers

BEFORE consigning to the flames all the wrappings, greeting cards, letters, etc., that have accumulated during the Christmas season, everybody should recall the nation-wide need in many industries for paper-board, plaster-board, and fibre-board. There is still a great shortage of these commodities, which are required not only in the building trade, but also in every business that uses cardboard containers. There is even likely to be a serious dearth in the near future; and this may lead to an amount of quite futile unemployment. So please use only dirty or greasy paper for lighting fires.

The Evaluation of Resins

Symposium in London

THE London Section of the Oil & Colour Chemists' Association held a symposium on the evaluation of resins at its meeting on December 14, at Manson House, Portland Place, with Mr. R. J. Ledwith (chairman of the section) presiding.

The proceedings were divided into three parts, dealing with the evaluation of resins for paints and varnishes, for lacquers, and for printing inks respectively.

Resins for Paints and Varnishes

DR. H. G. RAINS, introducing the discussion, limited his remarks to certain oil-soluble resins of the synthetic type, which he regarded as the most difficult to evaluate. He supported a view expressed at the Harrogate conference in 1939, that maleic resins must be evaluated for the particular purpose for which they were required, and believed that that position still held for most other resins as well; so that in the evaluation of resins the main problem was to decide what tests to apply in order to make a selection. The resins with which he dealt were the 100 per cent. phenolics, the modified phenolics, and the maleic resins.

Most manufacturers, he said, published information on certain physical properties of their resins, such as specific gravity, colour, melting point, acid value, and solubility in various oils and solvents. Many of them gave an indication of the nature of their resins, and he would like to see that practice become general.

Coming to the 100 per cent. phenolic resins, he dealt first with those specially recommended for use with tung oil, and said that valuable information could be obtained from tests on varnish consisting of 2 parts by weight of tung oil to 1 part by weight of 100 per cent. phenolic resin. The manufacturers of the resin generally recommended a temperature at which the resin, when cooked with tung oil, eliminated frosting, and he generally used that, at least in first tests.

Having given details of the method of preparation of the varnish, he said that after it had been made for 3 or 4 days, tests were conducted to determine its properties in regard to frosting, dry, volatile content, colour, light stability, alkali and water resistance, skinning, stability, smell, pigmentation, gloss, and durability. He gave details of the methods of conducting those tests.

Many 100 per cent. phenolic resins suitable for use with soft oils such as linseed were available. When cooked with varnish linseed oil, at temperatures often considerably lower than those employed in the manufacture of linseed oils, they reacted with the oil to give a highly bodied system, which could be thinned with a high percentage of solvent, generally white spirit. The main value of resins of that type was that they caused rapid bodying when cooked with linseed oil, and they gave coatings with very good water and corrosion resistance. Those properties were the important ones to examine, together with the incidental characteristics such as dry, smell, effect on stability, effect on skinning, and pigmentation. A suitable oil length for a test varnish was: Varnish linseed oil, 2 parts by weight; 100% phenolic resin, 1 part by weight.

If it were desired to use the 100 per cent. phenolic resin in a linseed stoving varnish, the varnish was applied to tinplate against the standard and stoved under the following conditions: (1) 250°F. for 1 hour; (2) 250°F. for ½ hour; (3) 200°F. for 1 hour. Scratch tests were made one hour after taking from the oven. After deciding conditions for satisfactory films, tests could be made for water resistance, alkali resistance, etc., if those were necessary.

The modified phenolic resins were a type involving very many possible variations in composition and physical properties, so that it was difficult to give a number of tests which would enable a proper selection of resin to be made. Many resins of that class were suitable for use either with tung oil or linseed oil or a mixture of both. In those cases it was advisable, therefore, to make up to varnishes consisting of:

(1)	Tung oil	4 parts by weight.
	Linseed stand oil	1 part by weight.
	Resin	2 parts by weight.
(2)	Linseed oil stand oil (15 poises at 25°C.)	2 parts by weight.
	Resin	1 part by weight.

Tests were made on those two varnishes for dry and adhesion, gloss, tendency to skin, stability on storage, smell, colour and tendency to yellow, water resistance, durability, and stability when pigmented with normal amounts of pigments to give a range of colours, including a white containing zinc oxide. In addition, a webbing or frosting test would be made with the first varnish to determine whether the resin inhibited the frosting of the tung oil.

Maleic Resins

The outstanding advantage of maleic resins was their freedom from tendency to yellow when exposed to light; that property, in conjunction with their initially pale colour, made them very suitable for stable white enamels. A suitable varnish on which to make a range of tests consisted of:

Pale linseed stand oil, 150 parts by weight; Resin, 100 parts by weight.

The tests already described for other varnishes were then applied, particular attention being paid to the test for resistance to yellowing. Further tests were made by pigmenting the varnish with titanium dioxide to produce an enamel which was tested for (a) drying at normal temperatures and by stoving; (b) gloss; (c) tendency to yellow.

Natural Resins

Mr. A. J. Gibson (past-president of the Association), a supporter of the natural resins, said that in 1937 the output of natural resins as compared with the synthetic was in the ratio of 3 : 1. Since the war began and we were cut off in part from our sources of natural resins, the ratio had become roughly 1 : 1. In America the production of synthetic resins had increased roughly fivefold. He asked whether Dr. Rains would be willing to consider a natural resin if it could approximate in performance to the synthetic, to which question Dr. Rains replied in the affirmative.

It was a question, therefore, Mr. Gibson continued, of comparative prices and performance. In order to maintain a sense of proportion, we should consider the enormous progress made in research in the natural resins. A great deal of work on Congo copal had been done in Holland, work on rosin and its many derivatives had been done in America, and work on shellac had been done in India and in this country. It was well to realise that work was being conducted on parallel lines, if not on a larger scale, in natural resins than in the synthetic.

Mr. Eric Bevan said that in 90 per cent. of cases a resin was evaluated for a specific purpose; the resin producer, however, evaluated a synthetic resin, not from the point of view of one application, but in comparison with some standard of synthetic resin. He emphasised that the right way in which to evaluate a synthetic resin, at any rate in its initial stages, was to compare it with a standard synthetic resin. Commenting on Mr. Gibson's remarks, he said there was no sharp line of demarcation between a natural and a synthetic resin; there was a much sharper and finer line of demarcation between certain types of synthetic resin, particularly when considered in relation to the use to which they were to be put. The first task in evaluating a synthetic resin, after it was classified as an oil-soluble or a lacquer-soluble type, was to put it into relation with some well-known standard, and give it points. The evaluation of resins for specific purposes resulted in building up a mass of knowledge which was entirely uncorrelated.

Dr. Rains agreed that one should use a standard against which to compare a new resin, and said that in all the tests a standard varnish was made with a resin whose behaviour was known. But in view of the fact that the resins could vary so much in their physical properties as the result of different methods of manufacture, one particular manufacturer's resin might be more suitable for a particular job than that of another manufacturer, and the user had to find out which manufacturer's resin was the best for his purpose.

Dr. H. W. Keenan (president of the Association) said he often wondered what was a "100 per cent. anything" resin. The paint chemist could not expect the manufacturer to write to him and give him the whole of the dope as to how he arrived at his resin; nor could the paint chemist expect the resin manufacturer in all cases to say that the resin he supplied was not really 100 per cent. phenolic, but that something else was added. Therefore, while agreeing with the sense of Mr. Bevan's remarks, he felt that Dr. Rains' method was the one which, in the paint chemists' predicament, would separate the good, the bad, and the indifferent.

It would be interesting if synthetic resin manufacturers would say whether, if a real combination were effected between a natural and a synthetic resin, experience had shown that the life of the natural part of it had been materially affected. From his own experience he would say that that was so; in some cases where he had examined such resins his impression—and it was only his impression—had been that the natural component had improved the resin as a whole. After all, was it not the object to bring both the natural and the synthetic fields together, so that both might play a useful part in the future development of resins?

Mr. H. Taylor said the synthetic resin industry was highly specialised, and the time had come when we could lay down certain resins which could be used for all types of purpose to suit the paint and varnish industry. There should be definite standards for resins. If the users of synthetic resins would be guided by the producers who had had many years of experience in the industry, they would not be led astray.

Mr. Newman suggested there was room for consideration of two classes of test for resins; there might be tests to classify resins in respect of the types of use to which they were applicable, and also a service test which a particular user might apply to ascertain whether a particular resin would meet his particular problem.

Resins for Nitro-Cellulose Lacquers

Mr. J. B. G. Lewin, B.Sc., A.R.I.C., said the formulation of nitro-cellulose lacquers consisted essentially of the balancing up of properties, with emphasis on those determined by the use to which the lacquer was ultimately to be put. There were three stages, therefore, in the evaluation of resin in nitro-cellulose:

(i) Preliminary physical and chemical tests to determine the probable effect in a lacquer film and its likely use.

(ii) Its incorporation in a basic formula for which its use was well defined.

(iii) Modification of that basic formula to suit the resin under examination.

Most of the data on physical and chemical tests were, or should be, supplied by the resin manufacturer. The desirable information included solubilities in various proportions in a wide range of solvents; compatibility with nitro-cellulose in various proportions; viscosity in solution; fastness to colour and to light; hardness; refractive index as a guide to gloss; and chemical composition.

Coming to stage (ii), the incorporation of the resin in a basic formula, Mr. Lewin gave a list of several main types of clear and pigmented lacquers. There was not time to describe the technique involved in all types; but he gave a fairly detailed description of one, with a brief description of the features which were given priority in the other types. The one chosen was a glossy exterior, durable pigmented lacquer, because it was a case in which the inherent characteristics of the synthetic and natural resins were to a certain extent opposed, and a careful weighing up of properties became necessary. The points which would be given priority in such lacquers were gloss, durability, hardness and flexibility. Other considerations were flow, viscosity, toughness, and cost.

Glass from spray suggested the use of the maximum resin content, limited only by requirements of durability and hardness, also the necessity for fine pigment dispersion and, therefore, the probable use of a roller mill paste. The grinding medium was generally the plasticiser combination or a semi-resinous plasticiser. A typical basic formulation for the non-volatiles, therefore, might be: ½ sec. N/C 25 per cent.; resin 50 per cent.; plasticising grinding medium 25 per cent. The last was maintained at a sufficiently high ratio to allow for adjustment with different pigment pastes.

Preliminary Considerations

Resins which would probably suggest themselves from preliminary tests might be:

(i) Non-drying alkyds of various oil lengths.

(ii) Certain drying oil alkyds, though at that nitro-cellulose/resin ratio the danger of lifting on re-coating was very evident.

(iii) Maleics, phenolics, dammar or ester gum in proportions determined by their durability limitations.

The basic formulations as first prepared would consist of an average pigment paste, *e.g.*, chrome green, dispersed in vehicles compounded in the ratios described. The solvent mixture used would be of good quality, rich in solvent power, and added in such proportions as to obtain a constant viscosity throughout the series.

Those preliminary formulations would then be rated for various properties, which he listed. Sufficient would be gauged from the tests to suggest modifications in the basic formula to deal with any idiosyncrasies of the particular resins being evaluated. Mr. Lewin dealt briefly with typical modifications to overcome excessive softness, poor gloss, excessive viscosity, slow drying, re-coating difficulties, and excessive hardness. All such modifications, he added, were re-tested for hardness, gloss, flexibility, etc., and when judged satisfactory they were tested on the roof for durability, with particular emphasis on lacquers containing straight, *i.e.*, unblended, resins.

A Matter of Compromise

After giving some examples of the different priority points which were given to different types of lacquers containing different resin/nitro-cellulose ratios, he said his remarks indicated that the evaluation of a resin in nitro-cellulose was essentially a matter of compromise. Time did not permit of the preparation of innumerable combinations designed to find the optimum concentrations or conditions of use of a particular resin, *e.g.*, at different temperature conditions or with numerous plasticisers; if that were the case, each and every resin would be the subject of a lengthy research programme. Experience and common sense probably led to a better approach to the problem of resin evaluation than considerations of a fundamental chemical nature.

MR. W. GARVIE commented that much was being done to convert natural resins into synthetic resins, and it seemed that before long there would not be any natural resins as such used in industry. He disagreed with any suggestion that, if one knew the chemical constitution of a substance, one knew how it would function; he emphasised that, no matter how much information the manufacturer gave concerning the chemical constitution of a substance, it would tell the user very little about its functional properties.

MR. GOODCHILD agreed with Mr. Lewin that, in order to evaluate a resin for cellulose, it was necessary to make numerous trial-and-error tests. If a knowledge of the chemical composition of the resins were denied to the user, then they had nothing to fall back on but a long series of trial-and-error experiments. A knowledge of the chemical and physical properties was helpful in indicating the sort of compositions to use in the tests, thus eliminating probably 80 per cent. of the thousands or millions of mixtures that could be made.

Mr. Eric Bevan suggested that Mr. Lewin had merely put forward a method of formulating a particular type of lacquer. He believed that, if we went the right way about it, we could arrive at a more or less scientific system of evaluating resins. As a yardstick we wanted some useful function such as, for example, flexibility, and fix the amount of, say, plasticiser to give a definite property of flexibility. He would like to see a body such as the O. & C.C.A. or a committee get down to the problem.

Mr. E. R. Wells asked why Mr. Bevan should expect the users to evaluate his resins for him; life was just too short for the users to do the resin manufacturer's work as well as their own.

Mr. Bevan replied that that was his point, that if they could arrive at a systematic method of evaluation, which he believed was possible, they would save much time; with the aid of fundamental information they would be able to formulate their lacquers in a very much shorter time than at present.

Dr. Gidvani agreed that more attention should be paid to chemical constitution, and suggested that probably X-rays might help.

Mr. Schollick pointed out that the purpose of the lacquer manufacturer was to produce a finish, and as a result of that it was not possible to adhere rigidly to one series of tests. If the manufacturer adhered firmly to a standard formulation, he did not get the best results; it was all dependent on producing a finish ultimately. It seemed to be suggested that the user was required to take any particular resin that was offered to him and evaluate every possible use for it. But it was quite impossible to do that in any given time. One must be bound to a limited number of possible uses for a particular product. The composition gave an indication of the sort of product for which the resin might be suitable.

Mr. Bache suggested that one of the governing factors in the evaluation of resin was whether its cost was such that it was possible to use it.

Resins for Printing Inks

Mr. H. A. Idle said that in evaluating resins for printing ink there were four possible methods of approach. When evaluating a resin for use in a particular printing ink, a proper understanding of the properties required of the printing ink were demanded, backed with a knowledge of the properties that could be expected from a resin, natural or synthetic. When one was given a resin and the problem was to find its uses in printing inks, a perfect testing and filing organisation that could index the results of some hundred or so tests on each resin was required.

A clearly organised set of standard tests based on the properties required of a resin was sufficient to cover the evaluation of resins or repeat deliveries of the same resin for use in a particular type of ink. The last method was one which had had to be used during the war years; given a totally unsuitable resin, how could it be made usable?

Mr. Idle then examined some twenty resin properties required by a typical ink, stressing the difficulties of applying simple laboratory tests that would be equivalent to the requirements demanded by actual printing; those tests did not include such tests as melting point, acid value, etc., but were all practical tests. Next, he examined in more detail some resin properties that were peculiar to printing ink.

The solubility of resins had to be considered in a much wider range of solvents —many non-volatile—than with the paints or lacquers. Flow requirements were often difficult to satisfy, due to high pigment concentrations. The advent of odour-free inks, from which drying oils were eliminated, made differences in the odour of the films from various resins very apparent.

Manufacturers' Troubles

Adhesion and flexibility were often a headache for the printing ink maker, who had to overcome such troubles as the grease film present on metallic foils, the varying surfaces of cellophane, P.V.C. sheeting, and other plastics. Even the comparison of the effect of resins in quick-drying inks was not simple, as it was difficult to reproduce in the laboratory the conditions of the pressrooms, where the prints were piled to a considerable weight, making it difficult for oxygen to reach the centre of the stack, where heating due to oxidation released moisture from the board or paper.

Pigment/resin reactions, stability of the ink in storage, weathering and soap resistance imparted by resins were discussed, in addition to the property of rapid film resolubility required by gravure or aniline type inks. In conclusion, Mr. Idle said the high standard achieved in printing-ink manufacture was a compliment to the resin makers; but it would be of considerable assistance in the selection of resins if a common language could be used in describing simple resin properties.

Mr. Hawkey commented that if he were a resin manufacturer he would be worried about the number of resins discarded by the printing-ink chemists in trying to fit resins to a certain job; he was glad, therefore, that Mr. Idle had mentioned the reverse case of fitting the jobs to the resins.

Dr. R. F. Bowles supported the point of view that in the long run the quickest way of evaluating a resin was the slow and fundamental way, though he appreciated that that was an entirely different picture from that given by Mr. Idle. It was true that the things the chemists wanted to measure were difficult to measure; but he urged that, by getting down to it, most of the essential properties could be measured. It meant setting out really to measure those properties and not, as most of them were doing at the moment, taking the line of least resistance and measuring the melting point, which was easy, irrespective of whether the information meant anything or nothing.

The Essential Information

Indicating what he would use in its place, he said that first one should try to learn from the manufacturer as precisely as possible what the material was and, if possible, how it was made; then the solubility in one or two solvents, a good and a poor solvent; the the viscosity in the two solvents, which gave some idea of the molecular complexity of the material. Then, having made it up into a standard medium which, of course, would bear some relation to the printing process in which the product was to be used, one should measure the dispersibility for pigments of the medium containing the resin which was under examination. All those properties could easily be measured, and from them one obtained a tremendous amount of fundamental information as to what the resin would and would not do.

Further, properties such as adhesion, chemical resistance, film hardness, and durability could be measured, though not by such means as scratch tests. That meant devising means of measuring the development of the structure of a film, and possibly its decay in the case of durability. There, again, we must do something more fundamental than examining paints or printing inks. It was difficult, but not impossible.

Co-operative Investigations

Mr. D. E. Roe said that co-operative investigations were just starting in the Association, and it was a good thing to take one step at a time. If we could measure properties such as acid value and melting point, etc., perhaps we should make more sense of such matters as the evaluation of resins. When we came down to brass tacks, such evaluations were based on our being able to do simple things, and to do them well.

Mr. Garvie pointed out that, when many people concerned with the paint and varnish industry were asked to suggest suitable subjects for research, 80 per cent. had mentioned melting point. There had been since a tremendous correspondence about it, showing the need for more information and a more standardised method. While he agreed with Dr. Bowles that our trouble was the lack of fundamental knowledge, his comment was that if we were to do thoroughly the work he had suggested, we should have to stop making resins for the next ten years, because the amount of work would be immense. However, work would go on, in which there must be collaboration between resin manufacturers and users. He added that very few resin manufacturers kept any secrets about the chemical constitution of their products.

Mr. Healey pointed out that freshly printed sheets were passed over heated rollers to evaporate quickly the solvent used in the ink, and the sheets were stacked. If the resins used in the ink had a low melting point, there was considerable danger that the sheets would stick together. In that connection a knowledge of the melting point, combined with the solvent retention of the resin, was of very definite practical value.

Air Pollution Discussed

Local Authorities in Action

REPRESENTATIVES of 48 local authorities and others co-operating with the D.S.I.R. in the study of atmospheric pollution (*see* The Chemical Age, December 22, p. 599) conferred last week with officers of the Department at the County Hall, Westminster, under the chairmanship of Dr. J. A. Gillison of the L.C.C. In a message to the conference, Mr. Herbert Morrison stressed the importance of collaboration between local authorities and the D.S.I.R. in maintaining records of pollution up and down the country.

The conference learnt with satisfaction that 30 additional recording instruments had been brought into use during the year and that a number of authorities had started to take observations for the first time. The conference recorded the view that it was only by maintaining continuous records at a large number of sites and by statistical treatment of the data so obtained that exact knowledge can be acquired of the amount and the trends of pollution. This knowledge is to-day more important than ever when so many replanning schemes are under consideration.

Dr. G. M. B. Dobson, F.R.S., said that the standardisation of measurement, the co-ordinating of local observations and fundamental research on problems of atmospheric pollution previously carried out on the advice of the Atmospheric Pollution Research Committee would in future form part of the work of the Department's Fuel Research Station, where it would be effectively linked with practical work already in hand there aiming at the prevention of pollution. The conference warmly welcomed this development.

Parliamentary Topics

Fertilisers

IN the House of Commons, in the week preceding the Christmas recess, Mr. De la Bère asked the Minister of Agriculture whether he would give an assurance that during the year 1946 there would be available adequate supplies of fertilisers, especially of potash and superphosphate.

Mr. T. Williams: Supplies of nitrogenous and of phosphatic fertilisers, including superphosphate, for use during the first half of 1946, will be adequate to meet farmers' requirements for arable crops, but only a limited quantity of phosphate will be available for use on grassland, and there will continue to be a shortage of potash. In the second half of that year, the supply position of nitrogenous and phosphatic fertilisers should be satisfactory, but I can give no assurance that the potash supply will by then have materially improved.

Asked by Mr. Turton whether anything was done to get more potash from Germany, the Minister said that we got our main supplies from Germany and France, and there was little or no possibility of increasing supplies immediately.

German Scientists

Captain Peart asked the President of the Board of Trade whether it was proposed to offer employment in this country to German scientists and technicians; and if he would give any indication of the numbers to be employed and the conditions of their engagements.

Sir S. Cripps: It is the Government's policy to secure from Germany a knowledge of scientific end technical developments that will be of benefit to this country and to make such knowledge available to those who can use it. Although we were generally ahead, there are certain fields in which the Germans held a temporary lead. It is proposed to recruit, on the recommendation of the responsible Department, a strictly limited number of German scientists and technicians of the highest grade for service in this country. Any Germans brought in must be politically unobjectionable and they will be subject to strict supervision.

In general, these experts should work in Government establishments, or for research associations sponsored by the D.S.I.R., but, in approved cases, their services may be made available to individual firms. They will be servants of the State, and in no case will a German be brought in to undertake work that could equally well be performed by a British subject. I have set up an interdepartmental panel under the chairmanship of Sir Charles Darwin to examine the requirements of British industry in this matter and to scrutinise the credentials of those whose names are put forward. Our American and Russian allies are pursuing a similar policy.

Rebuilding Potteries

Dr. Barnett Stross asked the President of the Board of Trade whether he was aware that the risk of lead poisoning in the potteries had been substantially eliminated, but that the risk from silicosis was still present; and whether he would give favourable consideration to the building of new factories and the rebuilding and improvement of as many such existing factories as merit a continued existence.

Sir S. Cripps: I am anxious to facilitate the rebuilding of potteries so far as the available building resources permit, not only to prevent industrial disease, but also to provide modern and efficient working conditions.

Percy Verses

Safety Through Laughter

PERCY VERE has won his own place in industry. His popularity is enormous and many must have wished to have some of his adventures in a more compact and permanent form than a series of posters. Here, in *Percy-Verses,* are reprinted some of Percy's more endearing exploits, and with them, to add point to the meaning behind the humour, are a dozen sets of verses by S. O. Shave.

Happily, the drawings lose nothing by their reduction in size and the whole booklet, to borrow a Hollywood phrase, is a "lavish production." So lavish, in fact, that at bookstall prices it would be reasonable to expect having to pay 2s. a copy. However, the fact remains that any management that buys 1000 copies will be paying rather less than 2½d. each.

Judging by the success of "*We Don't Want to Lose You* . . ." which was illustrated by the same artist—Mendoza—and which has already sold nearly a million copies, *Percy-Verses* should have an immediate appeal for distribution to workers. The instruction is deliberately indirect for there is a lot in the old principle of "Laugh and Learn"—it is learning made easy.

Prices (including postage): Single copy, 6d.; 50 copies, 12s. 6d.; 100 copies, 22s. 6d.; 500 copies, £5 5s.; 1000 copies, £10. The price for an intermediate quantity is in proportion to that for the next *lower* quantity. Orders (with remittance) should be sent to the Royal Society for the Prevention of Accidents, 52 Grosvenor Gardens, London, S.W.1.

The Foundation for Applied Sciences has recently been founded in S. Paulo, Brazil.

Lac-Glycol Esters

Their Preparation, Properties, and Use

THE third section of the study of ethers and ether-esters of lac and their polymerisation,* prepared by the London Shellac Research Bureau, deals with the optimum conditions for the preparation of the products obtained by the esterification of lac/ethylene-glycol compound with fatty acids of drying oils. The present study is restricted to the use of monobasic fatty acids, although rosin esters have been investigated to some extent.

The lac-glycol compound has on an average a hydroxyl value of 180-200, and can be easily esterified, and a process of esterification has been developed in which only equivalent quantities of fatty acids are employed to esterify practically all the hydroxyl groups of the compound. It is obvious that under these circumstances, a neutral ester cannot be obtained, but for many applications a material with an acid value of 20-30 is not only suitable but even to be preferred. This study, therefore, chiefly concerns the preparation of esters having an acidity of this order.

Optimum Conditions

The best conditions of esterification with equivalent quantities of lac-glycol compound and linseed-oil fatty acids have been found by experiment to be at 250°C. without any catalyst, but in an inert atmosphere. Satisfactory rates of esterification are also obtained under the following conditions: (a) at 200°C. with 0.2 per cent. acid catalysts and, (b) at 150°C. with 0.5 per cent. aryl sulphonic acids. The use of sulphuric acid at the lower temperature is not recommended as the greater part of it will remain in the product and may cause trouble, although addition of small quantities of metallic oxides, particularly those which form water-insoluble sulphates, may overcome this defect. The yields are practically quantitative at 150°C., about 97-98 per cent. at 200°C., and 90 per cent. at 250°C.

Fatty acids of dehydrated castor oil, castor oil, maize oil, cotton-seed oil, and palm-kernel oil have also been successfully used for the esterification of lac-glycol compound. The rates of reaction are of the same order as that with linseed-oil fatty acids, the only difference being in the time of gelation. With rosin esters of the compound the reaction is best carried out in an inert atmosphere, and preferably at temperatures of the order of 250°C.

It has been observed that, in the absence of any esterifying catalyst, skinning generally starts when the acid value of the reaction mixture has reached 50 and gelation occurs at the acid value of about 40, irrespective of the relative proportions of the reactants. But, if the rate of esterification is such that the acid value becomes less than 30 in about 90 minutes, the risk of gelation is considerably reduced and the product can be heated for a longer period. For example, when the esterification is carried out at 200°C. in the presence of sulphuric acid, a product with an acid value of 30 is obtained in 55 minutes; and this does not gel until after 10 hours' heating, the acid value at this stage being 14.

Properties of the Esters

The higher unsaturated fatty-acid esters of lac-glycol compound are dark red, viscous liquids (viscosity about 6-7 poises at 25°C.). They are miscible in all proportions with bodied and unbodied drying oils, and can be thinned with white spirit or other cheap hydrocarbon solvents. The films made from these esters show some similarity to the corresponding triglycerides. Thus they have poor water resistance and require a larger amount of drier to become non-tacky on exposure to air. They have also a tendency to pinhole on rapid baking. Film properties, however, can be improved by heat-bodying either alone or with a small quantity of a drying oil. Further improvement is obtained when the films are stoved, and the films can be made resistant to water by this means. The properties of unbaked films are, however, inferior, except those based on compositions which have been heat-treated.

The usual practice has been to heat the ester at 200°C. with hand stirring at frequent intervals until the product thickened considerably. Under such conditions both oxidation and polymerisation, would have taken place. It is to be emphasised that in order to obtain the best results the esters should be heat-bodied to the maximum degree compatible with their solubility.

Resistance to Solvents

Experimental results show that the resistance to various non-alkaline aqueous solutions is good, and poor to alkalis and organic solvents. In the case of the heat-treated lac-glycol compound, good resistance to various solvents and chemicals is obtained only after two hours' baking at 200°C., and similar prolonged baking would be necessary to achieve the best results from the esters of linseed-oil fatty acids. Such a

* Gidvani and Kamath, London Shellac Research Bureau, *Technical Paper No.* 28, Lac Research Laboratory, School of Mines, 79 Grassmarket, Edinburgh, 1.

prolonged baking, however, is unlikely to be given in modern industrial practice. The results obtained for films on tinned iron, baked at 200°C. for 20-25 minutes, are of the same order as those obtained when the films are stoved for ½ hour at 180°C.

Esters of saturated acids vary in consistency from viscous liquids to waxy solids. The lower esters, like those of acetic and butyric acids and the waxy stearic acid ester do not possess good film-forming properties, while the esters of caprylic and lauric acids give films which remain tacky even after prolonged baking. They can, however, be used in conjunction with other film-forming materials, particularly the amino-resins and cellulose esters and ethers. The lac-glycol ester of palm-kernel fatty acids, however, gives a non-tacky film when baked at 180°C. for one hour in the presence of driers. The film has a soft feel, but has the advantage that it remains flexible even after continuous exposure to high temperatures for a considerable period. Its colour retention on exposure to high temperatures of the order of 200°C. is also good.

Some Industrial Applications

Owing to their superior electrical properties, esters of the lac-glycol compound are suitable for the formulation of insulation varnishes. Such varnishes should, however, be used for stoving purposes since the optimum properties of their films are developed only after baking. Retention of flexibility on continuous exposure to high temperatures, the excellent adhesion and the superior electrical properties of these esters, particularly of the esters of the oleic acid and palm-kernel oil fatty acid indicate their suitability for the preparation of flexible micanite. Good results have been obtained on a pilot plant scale with the oleic acid ester but films from both these varnishes are initially slow to cure.

There is also a demand for insulating films which will not become brittle when exposed for prolonged periods to temperatures of 100-120°C., and these compositions are likely to prove useful in this field. Esters of oleic acid, and fatty acids of palm-kernel and linseed oil are also likely to be suitable for coil-impregnation work.

Lac-glycol/drying oil fatty acid complexes have good adhesion and flexibility on almost all types of surfaces and after heat bodying can be used as metal lacquers. For the pilot-plant experiments. de-waxed lac-ethylene glycol/linseed-oil fatty acids complex was heat-bodied for 30 hours at 140-150°C. and thinned with white spirit to 35 per cent. w/w solution. Sufficient cobalt linoleate was incorporated to give 0.1 per cent. cobalt on the non-volatile matter of the varnish. The resulting varnish was applied by a roller coating machine to sheets of tinned- and black-iron plate at a film weight of 5.5 mg./sq. in. and stoved at 199°C. for 20 minutes in a travelling convection oven. The coated sheets showed no signs of pinholes, "flecks" or other discontinuities of film. They could be stamped, pressed, soldered, etc., without any damage to the lacquer. Further, they were found to resist boiling water, boiling 2 per cent. acetic acid solution, boiling 5 per cent. soap solution, as satisfactorily as some commercial lacquers now in use.

When silk is coated by impregnation with a varnish of heat-bodied complex, an "oil-silk" type of finish is obtained. Ordinarily, linseed-oil-coated silk has to be baked for some hours, whereas that prepared with the complex need only be baked for 2-3 hours at 120°C. or 5-6 hours at 90-95°C. Moreover, the oil-silk from the new lac derivative is non-tacky and a top coat of shellac need not be given; and it is unaffected by hot water at 70°C.

Cellulose Lacquers

Lac-glycol esters of higher saturated fatty acids such as caprylic and lauric can be used as resin-plasticisers in cellulose nitrate lacquers. Their colour, however, is dark and consequently their use is limited to only dark-coloured clear or pigmented lacquers.

Other recent publications of the London Shellac Research Bureau include *Lac Derivatives as Plasticisers for Amino-Resins*, by B. S. Gidvani and N. R. Kamath (reprinted from *Paint Technology*), and *Shellac as an Ingredient of Rubber Compositions*, by J. R. Scott (reprinted from *J. Sci. Ind. Res*).

Reports on German Industry

Second H.M.S.O. List

BELOW is a further list of reports on German industry (see THE CHEMICAL AGE, December 22, p. 596) which are being distributed to the chief public libraries, etc., and to the trade associations concerned. A limited number of copies are on sale at H.M. Stationery Offices.

CIOS II—11. *Société Belge l'Azote, Liége*: Manufacture of inorganic and organic chemicals (6d.).

CIOS VII—8. *Synthetic Rubber* (5s. 6d.).

CIOS XVIII—1. *Chemical Installations in the Cologne Area* (2s.).

CIOS XXII—22. *Synthetic Rubber Plant. Buna Werke, Schkopau A.G.* (5s. 6d.).

BIOS 51. *Zellstoff-fabrik Waldhof, Kelheim, Bavaria*: Manufacture of bleached sulphite pulp from beech wood (1s.).

BIOS 54. *Institut für Cellulose Chemie, Darmstadt*: Research on manufacture of cellulose pulp (6d.).

BIOS 56. *Westfälische Zellstoff A.G., Wildhausen*: Manufacture of high alpha sulphite pulps and the utilisation of waste sulphite liquor (1s.).

Chemicals in South Africa

Government Manufacture of DDT

From our Cape Town Correspondent

A FACTORY established by the Union Government for the manufacture of "necessities for chemical warfare on a considerable scale, involving very large capital expenditure," would be retained so as to be available "for speedy conversion to defence purposes should that ever become necessary," said the Minister of Economic Development when opening the annual congress of the Associated Chambers of Commerce. Meantime, the factory would be used for the manufacture of DDT and certain other chemicals to combat disease and pests, as well as for research work. During the war, as part of the Union's war effort, it became necessary to establish a factory for the manufacture of chemicals for war; later on, the Government was given the formula for manufacturing DDT, on condition that it was not divulged to any private person and that manufacture was done by the Government only for war and defence purposes. Large quantities of this powder were required by the Armed Forces.

At the convention of the South African Federated Chamber of Industries, it was said that a vital principle was involved in the manufacture of DDT by the Government. It is said that the plant concerned had cost more than £1,000,000. It was also to produce caustic soda, chlorine, and various by-products. There was a danger of a snowballing process of State enterprise, a departure from the proclaimed policy of private enterprise. In this field, private chemical industry could undoubtedly produce at lower costs. The manufacture of DDT involved the production of chemical by-products in fixed amounts, which could not be stored, but must be used at once. The Government would have to enter into competition with existing firms to get rid of those by-products.

Gammexane against Locusts

The aerial spraying tests carried out in Zululand, in which the effect of DDT against tsetse-fly is being investigated, are to be discussed at a conference at Onderstepoort. Butterflies and a hive of bees in the area used in the experiments appeared to have been unaffected, although the wasp population diminished after the spraying. There might be delayed action, which was being watched by research officers. The first spraying seems to indicate that the whole of a group, including grasshoppers, crickets, "Hottentot gods," and cockroaches, were not affected by DDT, unless it reached them in big doses. The group included locusts, against which DDT spraying was not very effective. However, the British discovery, gammexane, had shown promise in local laboratory tests against locusts, but there were only small supplies available in South Africa for experimental work. It seemed that, in general, the insect population recovered from DDT spraying after a few days, but there was a marked variation in susceptibility.

Lever Brothers' Expansion

Industrial developments estimated to cost nearly £3,000,000 are being considered by Lever Bros. (S.A.) (Ptd.), Ltd. Plans involving an expenditure of about £1,000,000 have been completed for the company's Durban undertaking, and more than £100,000 for that in Cape Town. It is intended to build a new factory in Johannesburg at a later date. The expansion of the company's existing site at Maydon Wharf, Durban, will involve the development of the edible oils and fats division of the factory, as well as of the soap division. Lever Bros., whose capital in the Union is £1,500,000, employ at present 2400 persons, but the new expansion outlined will, of course, call for larger staffs.

It was recently reported that soap would be scarce in South Africa for some time to come, but this was afterwards denied. Cabled advice has been received by the Union soaps and oils control authorities from the combined planning authorities overseas that, from now on, the Union can expect supplies of soap-making materials in accordance with all its requirements. These supplies will come from Belgian Congo, from which the Union has been drawing the greater proportion of its soap-making oils for the last few years. For the past six months the Union has received less soap-making materials than in 1944, but soap production in the first nine months of 1945 was only 10 per cent. below that of 1944, when the output was a record one.

South Africa has exported lactic acid for the first time. Before the war, South Africa was wholly dependent on overseas supplies, chiefly from Germany. When the war cut off supplies, two young chemists devised a new production process. Eight tons of local lactic acid have been shipped to Egypt, and it is hoped that further orders will be received.

In the latest report of the South African Fuel Research Board, it is stated that considerable thought had been given to the problem of the regeneration of used lubricating oil. The testing of substitutes for imported earths used for oil regeneration was continued. A number of clays and other indigenous materials were submitted for testing, but calcined magnesite proved to be the only South African material with sufficient activity. Experience showed that the filtration rate of an oil, when active magnesia was used as a regenerating agent, was too slow for commercial practice, and both small and large-scale tests were, therefore, conducted in order to overcome this difficulty.

Many possible local filter aids were examined, only two of which proved of any value. These were kieselguhr and slightly charred wood shavings or sawdust. The most satisfactory method, however, was to use a mixture of 75 per cent. magnesia and 25 per cent. imported bentonite. Satisfactory samples were obtained from a Johannesburg firm, producing active magnesia on a commercial scale. After trials with plants already on the market, the Institute's officers succeeded in devising a new form of regenerator, using South African material in its filter, which proved satisfactory and was adopted by the Controller of Transport for use in Government garages.

A series of interesting experiments was undertaken to determine the suitability of alcohol blends as fuel for ordinary motor cars. A 1939 Ford V8 standard sedan was adjusted for maximum economy in petrol. A two-mile course was taken and three runs were made in each direction with a given blend. The runs on any blend were not made successively and the operators did not know the composition of the fuels which were being tested. Absolute alcohol, denatured with 5 per cent. benzol by vol., was used. No adjustments were made to the car after it had been set for maximum economy on petrol. Very irregular running was obtained with blends containing 60 and more per cent. alcohol. In general, the results confirmed the widely accepted view that in standard engines, with the carburettor and spark set for maximum economy for a standard petrol, little difference in fuel consumption is observed with blends containing up to 20 per cent. alcohol, but that increased fuel consumption is obtained with blends containing greater percentages of alcohol. While it was realised that alcohol could be a valuable addition to petrols of low octane rating, this aspect of the question was not investigated.

A world shortage of paint and brushes, and the unwillingness of the authorities to grant permits to merchants who want to import paint, are partly responsible for the shabby state of South African buildings. The paint-brushes manufactured, at present, from synthetic bristles, are not as good as those made with hog bristles formerly imported from Russia and China. The authorities are not yet ready to grant import permits for paint, although overseas firms have said they could supply all that was needed.

Content of the "Crust" of the Earth

Including the Lithosphere and the Hydrosphere

IT is a not unworthy custom, at the close of each year, to "take stock," in order to form some estimate of the possibilities that lie ahead of us. In the chemical industry, which deals with the conversion of materials to other forms, a stocktaking may justly cover a very wide field. Those who have read our leading article this week will have appreciated the fact that our stocks of certain essential materials are not perhaps quite as plentiful as had been imagined. The table below gives a certain reassurance; but it is the job of the chemical industry to devise methods whereby these stocks can be got at and put to use—yet another crying need for research.

PERCENTAGE OF SUNDRY ELEMENTS

Silicon	27.720	Tungsten	0.005
Aluminium	8.130	Lithium	0.004
Iron	5.010	Zinc	0.004
Calcium	3.630	Columbium and Tantalum	0.003
Sodium	2.850	Hafnium	0.003
Potassium	2.600	Lead	0.002
Magnesium	2.090	Cobalt	0.001
Titanium	0.630	Boron	0.001
Manganese	0.100	Beryllium	0.001
Barium	0.050	Molybdenum	0.000,1
Chromium	0.037	Arsenic	0.000,1
Zirconium	0.026	Tin	0.000,1
Nickel	0.020	Mercury	0.000,01
Vanadium	0.017	Silver	0.000,001
Cerium and Yttrium	0.015	Selenium	0.000,001
Copper	0.010	Gold*	0.000,000,1

*This is equivalent to 24,500,000,000 tons of gold.

Germany's Acetylene Industry

Interesting War Developments Surveyed

It is well known by now that Germany's production during the war of acetylene, both from calcium carbide and by the electric-arc method, was of no mean importance, and led to the production of a large number of products based on this cheap and plentiful raw material. An article by Mr. R. Leonard Hasche, of the Tennessee Eastman Corp., Kingsport, Tenn. (*Chem. Met. Eng.*, 1945, *52*, 116), contains interesting facts and figures on this important subject. The reservation is made that the production figures for the products obtained from acetylene are somewhat difficult to correlate, because of shifts of production from one plant to another, owing to bombing and for other reasons. However, it is believed that the statistics are reasonably accurate for 1942 and for early 1943, which were the peak years in production.

Ambitious Programme

It is interesting to note that facilities under construction, and planned expansions, greatly exceeded the maximum production obtained. As a matter of fact, it is not possible to present a clear-cut picture of the situation in 1944, when the bombing was most intense; in that year the main production of calcium carbide and acetylene derivatives was shifted to three plants operated by I.G., which escaped bomb damage. One of these was the synthetic rubber plant at Schkopau, a few miles north of the Leuna Works at Merseburg. This plant was the second-largest calcium carbide producer in Germany. Damage to the Knapsack plant in the Ruhr, and need for more acetylene, led to the construction of a large unit at Hüls, for producing acetylene by electric-arc cracking of gas from hydrogenation units and from natural gas wells in the vicinity. Another plant, Anorgana Werke G.m.b.H., at Gendorf, a few miles from the Austrian border near Burghausen, was Government-owned. The Gendorf works was near several important calcium carbide producers and had large facilities for the conversion of acetylene to ethylene glycol and to other derivatives. It was to the latter plant that many of the Ludwigshafen operations, and much of the personnel, were shifted in 1944, when it became apparent that rebuilding could not keep pace with the persistent bombing.

Plants producing calcium carbide were scattered widely throughout Germany. Those in Central Germany (including Czechoslovakia) had, in 1940, a capacity of about 500,000 tons a year, while plants in South Germany and Austria had an annual capacity of nearly 400,000 tons; the capacity of units in West Germany is stated to have been 220,000 tons, followed by those in East Germany (including Poland) with 212,000 tons. The largest units, with 220,000 tons each, were those of the A.G. für Stickstoffdünger at Knapsack, the unit of the Bayrische Stickstoffwerke at Hart, and the Schkopau plant of the I.G., followed by the Chorzow plant of the Vereinigte Stickstoff Werke Moscice-Chorzow, now again in Poland. The total capacity of 20 units was 1,322,000 tons in 1940. Moreover, an ambitious expansion programme was under way, which would have meant approximately doubling the capacity. The I.G. and related groups accounted for approximately two-thirds of the capacity.

In general, the location of carbide plants was dictated by favourable situations regarding raw materials, and cheap and ample sources of power. In the expanded programme, the Ludwigshafen plant was to have had a production capacity of 13,500 metric tons per year. This plant was an exception to the rule, since neither cheap power nor a favourable raw material situation were ready to hand. The plant was operated because of the diversified manufacturing activities at this parent plant of I.G., and it was here that most of the advances were made in acetylene chemistry under the direction of Dr. Walter Reppe. Approximately 23 per cent. of the plants operated on hydro-electric power, and the balance on current generated from lignite. Plants using hydro-electric power were at Burghausen, Hart, Waldshut, and Wylen, with a combined annual capacity of 27,000 metric tons.

Uses of Calcium Carbide

As regards the use of calcium carbide for various purposes, approximately 53 per cent. of the total output was used in the chemical process industries and approximately the same ratio was to be maintained under the expanded programme. It is noteworthy that very large amounts of acetylene went into the manufacture of butadiene. The major portion was made by the four-step process through acetaldehyde and aldol. Another very interesting war development was a plant operated at Ludwigshafen, on the process worked out by Dr. Reppe, consisting in reacting formaldehyde with acetylene to form 1,4-butynediol, which was hydrogenated to 1,4-butanediol. The latter product was then dehydrated in two steps to give in succession tetrahydrofurane and butadiene.

About 710,000 metric tons of calcium carbide, corresponding to 238,000 metric tons of acetylene, were used yearly in the manufacture of chemicals, synthetic rubber and other products. This was supplemented by approximately 70,000 metric tons of acetylene made by the electric-arc method at Hüls. This unit was built as a war-time measure, and had combined with it several new processes for converting acetylene into miscellaneous chemicals. Detailed consumption figures appear in Table I.

the major source employed in the manufacture of ethyl benzene for styrene. It was also the raw material for ethylene oxide and its derivatives, and for polymerisation products, and the capacity for ethylene production from acetylene was considerably increased. For instance, the calcium carbide plant at Schkopau was enlarged to turn out 34,000 tons a year, the increase being divided

TABLE I.—Consumption of Calcium Carbide in Germany.

Use	Consumption tons per month	%	Planned capacity tons per month	%
Calcium cyanamide...	26,000	24	58,000	28
Buna rubber	23,000	21	42,000	20
Ethyl alcohol	—	—	7,000	3
Vinyl compounds and chlor. hydrocarbons	6,000	5	12,500	6
Ethylene (excl. of Buna and lub. oil)	5,000	4.5	18,000	9
Acetaldehyde (excl. of Buna)	23,000	21	28,000	13
Miscellaneous chemicals, acrylonitrile, etc.	—	—	4,500	2
Lubricating oil	—	—	4,500	2
Acetylene black	2,000	2	3,500	2
Domestic requirements*	20,000	18	27,000	13
Other uses	5,000	4.5	5,000	4.5
Total per month	110,000	100%	210,000	100%
Total per year	1,320,000		2,520,000	

Statistics on the production of calcium carbide, acetylene, and solvents in the I.G.'s plants, which accounted for approximately 80 per cent. of the entire German chemical industry, are shown in Table II.

The conversion of large quantities of acetylene to ethylene by catalytic hydrogenation represents yet another interesting development. At the beginning of 1942, productive capacity for ethylene amounted to 73,700 tons per year, that of ethylbenzol to 70,400 tons, and that of styrene to 42,200 tons. Ethylene made by this method represented

between butadiene production and ethylene for styrene. An increasing amount of ethylene was also being used in the manufacture of ethylene oxide and derivatives. However, towards the end of the war, production of these chemicals was shifted to Eastern Germany, at Auschwitz and the large government plant previously mentioned at Gendorf.

TABLE II.—Production of Solvents from Acetylene at I. G. Plants—January, 1942
(Tons per year)

	Knapsack	Schkopau	Hüls	Other I.G. Plants	Total
1. Raw materials					
Fresh lime	262,500	180,000	—	—	442,500
Sinter lime	31,500	160,000	—	—	191,500
*Coal	176,400	272,000	—	—	448,400
Coke oven gas, mill. m^3	—	—	37	—	37
Hydrocarbons	—	—	131,000	—	131,000
Power, mill. kWh.	970	1,160	936	—	3,066
2. Products (primary)					
Calcium carbide...	294,000	352,000	—	—	646,000
Acetylene	—	—	70,000	—	70,000
3. Carbide distribution					
Carbide to cyanamide	84,000	—	—	—	84,000
Carbide (sold)	56,440	—	—	—	56,440
Carbide to acetylene	153,000	352,560	—	—	505,450
4. Acetylene production					
From carbide	47,000	108,000	—	8,520	163,520
By arc cracking...	—	—	70,000	—	70,000
Total	—	—	—	—	233,520
5. Products from acetylene					
Vinyl ethers	—	—	—	2,400	2,400
Vinyl acetate	—	—	—	10,200	10,200
Vinyl chloride	—	15,000	—	3,000	13,000
Chlor. hydrocarbons	—	—	—	13,800	13,800
Acetaldehyde	72,000	142,800	110,300	—	325,100
6. Products from acetaldehyde					
Butadiene	—	48,600	33,700	—	82,300
Ethanol (by-product)	—	20,500	6,640	—	27,140
(Crotonaldehyde)	—	—	—	(26,200)	(26,200)
Butanol	—	3,100	3,200	20,000	26,300
Butyraldehyde	—	—	1,000	1,300	2,300
Acetic acid	24,000	13,000	—	25,000	62,000
Acetic esters and salts	—	—	—	36,000	36,000
Acetic anhydride	13,800	—	—	7,700	21,500
Ethyl acetate	—	—	—	14,000	14,000
Acetone	7,200	2,400	1,630	—	11,230
Diethyl ether	—	—	—	6,480	6,480

* Exclusive of coal for sinter lime.

An important use of acetylene was in the production of vinyl compounds for thermoplastics, adhesives, lacquers, and additives to lubricating oil. Total production of these types of plastics rose from 34,903 tons in 1941 to 46,022 tons in 1943. A development peculiar to Germany was the large-scale production of vinyl ethers of methyl, ethyl, isobutyl, and higher alcohols. These new materials were developed from the research of Dr. Reppe, at Ludwigshafen, and found wide use as lacquers and adhesives, as straight polymers and copolymers with other vinyl compounds. They were marketed under the trade name of *Igevine*, while the vinyl acetate polymers were called *Mowiliths*. Manufacture of these materials was carried out at the Höchst plant of the I.G., and by Dr. Alexander Wacker, G.m.b.H., at Burghausen.

Plastics in Place of Steel

The *Igelits* comprised perhaps the most important class of thermoplastics in wartime Germany. They consisted of polyvinyl chloride; the PCU types were unchlorinated, while the PC types were chlorinated after polymerisation. One of the large uses of unplasticised polyvinyl chloride was in piping and valves for the chemical process industries as a substitute for stainless steel. Piping up to 8 in. diameter was made by extrusion, while larger sizes were fabricated by welding with a hot-air torch. Other extensive uses were in moulding compositions, screen, continuous filament, and staple fibre. Plasticised polyvinyl chloride was used in manufacturing raincoats for the Wehrmacht, and in rubber gloves and similar products. Other important plastics were the *Acronals* or acrylic resins, and various types of polystyrene.

Monomeric Acrylonitrile

The synthesis of monomeric acrylonitrile from acetylene and HCN is another development in this field. Small plants were in operation at Ludwigshafen, Leverkusen, and Hüls. Other vinyl compounds which were produced on a small scale were the derivatives of secondary heterocyclic amines; for example, an experimental plant was in operation at Ludwigshafen on a Reppe development plant for the manufacture of vinyl carbazole. The polymer, called *Luvican*, had a very high melting-point. A trimer, which had a sufficiently high melting-point to be resistant to boiling water, could be moulded by injection. Another *N*-vinyl compound was used as a low polymer in a water solution as a substitute for blood plasma. Other developments, still in the experimental stage, were the synthesis of the acrylates, and a starting material for a nylon type of product.

This remarkable development of acetylene chemistry was occasioned by necessity, in a country lacking in petroleum reserves and carbohydrate material, which had to base its economy on substitute raw materials and cheap power from lignite. Although the utilisation of acetylene for chemical synthesis had made remarkable strides in Germany during the war, the author concludes that only a beginning had been made. Many of the developments of Dr. Reppe's work were in the laboratory and semi-works stages of development and had not yet been put on a commercial scale, and it appears that there are great possibilities yet to be developed in the utilisation of acetylene for chemical manufacture.

French Chemical Notes

Fuel and Transport Difficulties

THE French chemical industry continues to be hampered by the lack of fuel and transport. Restrictions on electricity consumption mean that most factories can now only operate on three days each week, though wages and salaries have still to be paid to workers for a full forty-hour week; the difference will be made up by the Government, though the method by which this will be carried out has not yet been announced.

Production in October was, on the whole, approximately at September levels, though differences occurred in various sections of the industry. Output of superphosphate, for instance, increased from 20,000 to about 40,000 tons, though still remaining considerably below the 1938 average of 114,000 tons. Figures varied considerably according to regions.

Lack of Electric Power

Production of calcium carbide, on the other hand, showed a considerable reduction, owing to the lack of electricity, dropping from 13,000 tons in September to 7000 tons in October, compared with the 1938 monthly average of 13,000 tons. Output of chlorine in October was 2500 tons, against 2581 tons in September and 3540 in 1938; a reduction was shown in output of hydrochloric acid to 3200 tons in October, against 4169 tons in September and 10,000 tons in 1938. So far as sulphuric acid is concerned, October production was 35,000 tons, compared with 29,300 tons in September and 81,000 tons in 1938. Owing to lack of fuel, salt production was maintained at about 14,000 tons, compared with a pre-war average of 40,000 tons. On the other hand, production of liquid oxygen rose to 2,200,000 cubic metres in October, against 1,726,000 cubic metres in 1938. For dissolved acetylene, the corresponding figures were 300,000 and 219,000 cubic metres.

In the organic chemicals sections, results were very varied. Production of ether, acetone, methanol, and formol in October exceeded the average of 1938, but production of phenols and quinine remained very much below it.

Personal Notes

Mr. C. A. Klein has been unanimously re-elected president of the Paint Research Association.

Mr. C. Hughes has resigned from the board of British Emulsifiers, Ltd. His successor is Lieut.-Col. W. D. Gibbs.

Mr. Roger Adams, chairman of the Board of Directors of the American Chemical Society, has been sent to Germany as special adviser to General L. Clay, deputy military governor of the U.S. zone of Germany.

Professor J. A. Revell, acting head of the Department of Chemical Engineering, Queen's University, Kingston, Ont., has joined the research and development staff of Courtaulds', Ltd., Cornwall, Ont., Canada.

Mr. Sidney D. Kirkpatrick, editor of *Chemical and Metallurgical Engineering*, has been awarded the Chemical Industry Medal by the American Section of the Society of Chemical Industry, The American Institute of Chemical Engineers, and the American Chemical Society.

Mr. Robert Foot, chairman of the Mining Association, has been appointed chairman also of the Council of the British Coal Utilisation Research Association. He takes the place of Mr. H. M. Lindars, who has felt compelled to resign owing to the pressure of other claims on his time.

Sir John Anderson, M.P., chairman of the committee dealing with atomic energy, is to be the next president of the Parliamentary and Scientific Committee. The executive of the committee has decided to recommend to the annual general meeting that Sir John should be invited to accept the position in place of Lord Samuel, who is retiring under the three-year rule. It is understood that Sir John is prepared to accept the invitation.

Dr. Harold Hartley, who, as reported in our issue of December 15, has been elected president of the British Cast Iron Research Association, is the technical director (1939) and managing director (1944) of Radiation Limited. He is best known as one of the leading authorities in connection with the domestic utilisation of town gas. Entering Manchester University in 1904, he studied under Professors Dixon, Perkin and Bone during a period of great research activity in the Manchester School. Graduating in 1907, was elected to a Gartside Scholarship of Industry and Commerce. Later he travelled in Norway and Canada, collating data on the cost of power production for electro-chemical industries. While in Canada, he carried out research work at McGill University.

On returning to this country in 1909, Dr. Hartley was elected to the Gas Research Fellowship at Leeds, and in 1912 he was appointed to build up a research section for the Richmond Gas Stove Co. at Warrington. While at Warrington, he was especially concerned in the development of furnaces both for non-ferrous metal melting and for heat treatment processes generally. In 1919 he took the D.Sc. degree at Manchester, one of the theses submitted being concerned with the study of the melting of the brasses.

With the formation of the Radiation Group in 1919, Dr. Hartley was appointed chief chemist and head of the research department. In 1925 the new Central Research Laboratories were inaugurated and there followed a period of activity which has led to marked developments in gas and coke burning apparatus. Dr. Hartley has been for many years an active member of the B.C.I.R.A. He was elected to the Council in 1934, became chairman of the Research Committee in 1936 and chairman of the council in 1938.

CANADIAN STREPTOMYCIN

Construction of large manufacturing facilities for streptomycin has been started at Valleyfield, Quebec, according to the vice-president of Merck & Co., Ltd., manufacturing chemists, and production of the drug is expected to be under way early next summer. A unit, consisting of two buildings, will be set up almost immediately; one of these, a boiler plant, will supply power for the streptomycin operation, and also other operations which will be transferred from the Montreal plant of the company. Dr. M. Darrach, who has supervised streptomycin and penicillin production at the Montreal plant, will direct the new plant, where about 70 people will be employed in initial work. For many months Merck & Co. have supplied military and civilian doctors with streptomycin, and clinical study of the many possible uses of the drug will be continued as more material becomes available. The plant at Valleyfield is, so far as is known, the first in Canada to be built for the production of this new antibiotic.

Extracted from a mould in much the same manner as penicillin, streptomycin has been found active against certain bacteria which are unaffected by penicillin. In this class fall bacteria causing serious infections of the urinary tract and certain intestinal ailments and wound infections. Streptomycin is already considered the best known drug for the treatment of tularemia. It has also proved highly effective in the treatment of influenzal meningitis. Experiments give hope that it may be useful in treating other diseases, notably typhoid fever and undulant fever, and certain types of tuberculosis.

General News——From Week to Week

The telephone service with Sweden is now open, but for commercial calls only.

Imperial Smelting Corporation, Ltd., has acquired the lease of 37 Dover Street, Mayfair, formerly the home of the Albemarle Club, to use the premises as its headquarters.

The new address of the Boron Agricultural Bureau is Clock Offices, 2 Station Road, Harpenden, Herts. Telephone: Harpenden 3611.

The lecture on carbon blacks, which was to have been delivered by Mr. Speedy to the London Section of the S.C.I. on January 7, has been postponed until April.

At the sixth annual meeting of the Association of British Organic Fertilisers, held in London earlier this month, the five retiring members of the council were re-elected by ballot.

The recently-published biography of Dr. Chaim Weizmann, by Paul Goodman (Gollancz; 10s. 6d.), pays eloquent tribute to his work as a biochemist and as a man of science generally.

It has been announced by Dr. D. G. Davey, the biologist on the I.C.I. team concerned with the development of the new anti-malarial, paludrine, that the formula would be given to the world, and the material made available to the public, in 1947.

Readers are reminded that the thirtieth Exhibition of the Physical Society is being held at the Imperial College, South Kensington, on January 1, 2 and 3. The exhibition will be opened by Sir Stafford Cripps at 2.30 p.m. on January 1.

The Government has appointed a committee to review the financial structure of the cement industry and its ancillary industries, including the manufacture of sacks, and to report on the price structure, with particular reference to the prices charged to merchants and users.

Rock wool, with special reference to possible sources of this insulating material in the British Isles, is the subject of No. 34 of the Special Reports on the Mineral Resources of Great Britain, by E. M. Guppy and J. Phemister, issued by the Geological Survey of Great Britain (H.M.S.O.; 9d.).

Christmas numbers of *600*, the house journal of George Cohen, Sons & Co., and of *The Naft Magazine*, the organ of the Anglo-Iranian Oil Company, Ltd., have reached us. They well maintain the standard of good production, informative articles, and bright humour which we have been trained to expect, and a seasonable touch is lent by the cheerful colours of their covers.

Methods for the isolation of cholesterol from wool alcohols are discussed by C. W. Picard and D. E. Seymour in *J.S.C.I.*, 1945, 64, 304. A process is described which is based on the formation of a cholesterol-oxalic acid complex by reaction of the wool alcohols with anhydrous oxalic acid in ethyl acetate or benzene. The sparingly soluble complex is isolated and converted to pure cholesterol or cholesteryl acetate as desired.

A cordial invitation is extended to all readers of THE CHEMICAL AGE who visit the Gauge and Tool Exhibition at the New Hall, Vincent Square, London, S.W.1, to avail themselves of the services there of Benn Brothers, Limited, proprietors of THE CHEMICAL AGE. The exhibition is open from January 7 to 18, inclusive; Benn Brothers' stand is No. 90 (telephone VICtoria 1577) and copies of THE CHEMICAL AGE, and of other Benn journals, will be obtainable there.

Foreign News

The Ministry of Supply announces that, according to a revised estimate, stocks of metallic tin found in Malaya total 4500 tons.

Plans for the production of 500 kg. per day and 200 kg. of butyl alcohol per day are announced by Cromogenía y Química Curtiente, S.A., Barcelona.

Substantial progress is being made on the initial phases of the 1,500,000,000 dollar development programme for the Missouri River Basin.

Development work in connection with the manganese deposit near Chamberlain, South Dakota, is being continued by the Bureau of Mines.

Corning Glass Works reports the third important development since 1943 in its South American expansion programme with the purchase of a substantial interest in Cristalerías de Chile, largest glass manufacturer of that country.

The 20th Exposition of Chemical Industries, the first U.S. post-war exhibition, will be held from January 25 to March 2, 1946, in the Grand Central Palace, New York. Exhibits will occupy three floors and part of the fourth, the largest exposition in many years.

Rich gold deposits, already worked in the time of Solomon, have been re-discovered in the central region of the Hedjaz by the American Saudi Arabian Mining Company. A concession was allotted to the company by King Ibn Saud, after initial prospecting work had yielded interesting results.

Recent examinations of haematite deposits in the Vila Nova River have proved to have a high iron content, it is reported in the Brazilian Press. Some of this haematite will be processed for exports, with the U.S. mentioned as a likely market.

Increasing interest is being taken, in the U.S., in the use of beryllium oxide crucibles. Such vessels, manufactured by the Brush Beryllium Company, have been employed at temperatures up to 2000° C., and should they crack in service they can be repaired almost indefinitely.

An Egyptian company, co-operating with British and American interests, is to establish a rayon plant at Kafr el Dawar to begin operations by June, 1947. There will also be a subsidiary plant to make sulphuric acid and caustic soda, the machinery of which will be imported from Britain.

According to a statement by the French Minister of Industrial Production, the Rhône Valley pipe-line, laid by U.S. troops from Marseilles to the Saar basin, has been abandoned by the French authorities, which took the line over in September. It has proved to be less serviceable for civilian purposes than expected.

The Swedish Government has appointed a committee of experts to inquire into the question of creating a special department to protect public interest in Swedish mines, says Reuter. At present, several authorities are in charge of the administration of Government interests in such mines as the Boliden and Luossavaara mines.

In Belgium a number of reductions in the price of chemical products have been made possible by the fact that imports had been obtained and home production increased. These reductions included sulphuric acid (85 to 72 fr. per quintal), copper (15 to 12 fr. per kilo), aluminium (20 to 15 fr. per kilo), and lubricating oils (30 to 20 or 15 fr. according to quality).

The Senate committee investigating atom control was told by Dr. Szillard, a pioneer in atom bomb research, that British scientists had decided in advance of U.S. scientists that uranium 235 might be used for atomic bombs. He added that if Britain had not imparted this knowledge to the U.S. in the middle of 1941, the U.S. might never have developed atom bombs.

Nearly all German chemical - warfare material found in the British zone of Germany has now been destroyed, states the Allied Control Commission. About 116,000 tons of shells, etc., filled with war gases were discovered. The gases included phosgene, D.M. (phenarsazine chloride—a sternutatory), chloracetophenone (tear gas), and mustard gas (dichloroethyl sulphide). There was also a reserve of 3300 tons of mustard gas in bulk.

A new fungicide, named *Phygon*, a new DDT composition, *Deetone*, said to be four times as efficient as DDT, and a weed killer, *Polon*, have been announced in the United States, according to the *Journal of Commerce*.

The fact has recently been disclosed that an oil pipe-line had been laid during the war in India, capable of pumping about 12,000,000 gallons of oil monthly from Bombay to a storage centre 280 miles away in the East Kandosh district.

Large-scale emergency production—and application—of DDT in Canada is illustrated in the October issue of *Canadian Chemistry and Process Industries*. The insecticide is being produced by the Naugatuck Chemicals Division of the Dominion Rubber Company at Elmira, Ontario.

The Société Française des Glycerines is to increase its capital from 13,772,800 to 27,500,000 fr., by the issue, at 150 fr., of 137,272 new shares of 100 fr. nominal value, and the Compagnie Générale de Duralumin et du Cuivre ("Cegedur"), is to issue 40,000 preference shares of 10,000 fr. each, at 4 per cent., redeemable in 35 years.

A programme for strengthening the U.S. Patent Office, according to recommendations by industry and patent law experts, has been announced by the Patent Commissioner. It includes the addition of 200 new patent examiners to the present staff and an increase in salaries to attract and keep competent personnel.

The vanadium content of the Fricktbal iron ores, from Canton Aargau, Switzerland, has been considered as the possible basis for a new Swiss industry. The operating company, Jura-Bergwerke A.G., however, states that the utilisation of the ores for this purpose will depend on a lowering of the cost of electric power.

The growing importance of Tanganyika as a producer of mica is shown by some recent figures from the territory. In 1940, 9 tons of mica were shipped abroad; in 1943 the figure had risen to 40 tons, and in the first six months of the present year 63 tons were sent. During the war considerable quantities were flown regularly to the U.S.A., in addition to priority shipments to the U.K.

A comprehensive review of the Swiss patent legislation has been undertaken by the Swiss authorities, and the draft of a Bill revising the present Federal Law concerning Patents for the Protection of Inventions is shortly to be submitted to an expert committee to consider, in particular, the desirability of an official interim examination of the novelty of the inventions submitted for patent protection. In the past, Swiss inventors used to rely on patent applications in Germany for finding out whether their invention warranted patent protection.

Forthcoming Events

January 1. Electrodepositors' Technical Society (Birmingham Section). James Watt Memorial Institute, Great Charles Street, Birmingham, 6.30 p.m. Mr. L. Mable: "Polishing Methods and Technique."

January 2. Institute of Fuel. Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2, 6 p.m. Major W. Gregson: "Waste Heat Boilers."

January 3. Royal Institute of Chemistry. (Belfast and District Section). Queen's University, 3 p.m. Dr. W. Haughton Crowe and Dr. T. C. Shaw: "Christmas Crackers." (Lecture and demonstration for school children).

January 3. Association for Scientific Photography. Theatre of the British Council, 6 Hanover Street, London, W.1, 6.15 p.m. Dr. A. J. Holland: "Glass and Photography."

January 3. Royal Institute of Chemistry (Cardiff and District and South Wales Sections). Mining and Technical Institute, Bridgend, 6.15 p.m. Dr. H. T. Emeléus: "Some Chemical Aspects of Recent Work on Atomic Fission."

January 4. Society of Chemical Industry. Reynolds Hall, College of Technology, Manchester, 6.30 p.m. Mr. J. G. King: "The Application of Chemistry in Industry."

January 7. Society of Chemical Industry. Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1, 6.15 p.m. Mr. J. Newton Friend: "The Rare Earths."

January 8. Royal Institute of Chemistry (Huddersfield Section). Field's Café, Huddersfield, 7.30 p.m. Mr. R. K. Dickie: "The English Oilfields."

January 8. Scottish Engineering Students' Association. Institution of Engineers and Shipbuilders, Glasgow, 7.15 p.m. Miss Helen Towers: "The Selection of Steels for Industrial Uses."

January 8. Hull Chemical and Engineering Society. Regal Room, Regal Cinema, Ferensway, Hull, 7.30 p.m. Mr. J. W. Bull: "Machines for the Tensile-testing of Materials." (Presidential Address.)

January 8. Society of Chemical Industry (Chemical Engineering Group) and **Institution of Chemical Engineers.** Apartments of the Geological Society, Burlington House, Piccadilly, London, W.1, 5.30 p.m. Mr. H. W. Thorp: "Production of Magnesia."

January 9. Society of Chemical Industry (Microbiological Panel, Food Group) and **Society for Applied Bacteriology.** Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1, 2.15 p.m. Dr. A. T. R. Mattick and Miss E. R. Hiscox: "Some Observations on Heat-Resistance of Micro-Organisms"; Dr. C. L. Hannay: "Some Problems in the Bacteriology of Rivers"; and Mr. A. J. Musgrave: "Mould Growth on Leather."

January 10. Institute of Welding. County Technical College, Stoke Park, Guildford, 7.30 p.m. Mr. C. G. Bainbridge: "Application of Welding to Agricultural Machinery."

January 10. Society of Chemical Industry (Plastics Group) and **Faraday Society.** Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, 2.30 p.m. Dr. G. B. B. M. Sutherland: "The Infra-Red Examination of Plastics."

January 11. Society of Chemical Industry (Birmingham Section). Chamber of Commerce, Birmingham, 6.30 p.m. Dr. F. J. Llewelyn: "Electro-statics in Industry."

January 11. British Association of Chemists (St. Helens Section). Y.M.C.A. Buildings, St. Helens, 7.30 p.m. Mr. F. Moult: "Hormones."

January 11. Institute of Welding. James Watt Memorial Institute, Great Charles Street, Birmingham, 7 p.m. Mr. R. W. Ayres: "Developments in the Technique and Use of Resistance Welding."

January 11. Institution of Chemical Engineers (North-Western Branch). Conference Hall, Manchester Town Hall: 2 p.m., Civic welcome to members by the Lord Mayor; 2.30 p.m., Dr. C. J. T. Cronshaw: "Chemical Engineering Research" (followed by a buffet tea). Midland Hotel, Manchester, 7 p.m.-1 a.m., reception, dinner and dance. Application for tickets for the dinner and dance should be made before January 1 to the hon. organising secretaries, 49 Kiln Lane, St. Helens, Lancs.

Company News

Knull & Co., A.G., chemical manufacturers, Liestal, Switzerland, have raised their nominal capital from 500,000 to 1,000,000 Swiss francs, but only half the new shares have been paid up.

Martin Philipsen & Co., Ltd., chemical manufacturers, etc., Albemarle House, W.1, have increased their nominal capital by the addition of £9000 in £1 ordinary shares beyond the registered capital of £1000.

Prices of British Chemical Products

SATISFACTORY trading conditions have been reported from most sections of the London general chemicals market this week and a moderate increase in new business has taken place. With regard to deliveries against contracts, the movement is steady and in the aggregate fairly substantial. The price position remains steady throughout the market. In the soda products section there has been a fair amount of inquiry for caustic soda and bicarbonate of soda, while Glauber salt and salt cake are in good call. Hyposulphite of soda is a brisk market and there has been a moderate inquiry for industrial refined nitrate of soda. Among the potash chemicals offers of caustic potash and bicarbonate of potash are being promptly taken up, and permanganate of potash is a good market. A steady demand is reported for red and white leads, and there is a good inquiry for zinc oxide and tin oxide, which continue on a firm basis. There is nothing fresh to report from the coal-tar products section this week, most items being reasonably active.

MANCHESTER. Trading conditions on the Manchester chemical market during the past week have been extremely slow, and little new business has been possible owing to the holidays which, as a rule, have been observed to greater length than normally. Contract specifications to home industrial users have also been seriously interfered with. In the case of the latter, however, the movement of supplies of the soda compounds, the mineral acids and other heavies, has been steadily resumed and is expected to be back to normal very quickly, certainly very soon after the New Year holiday is over. Prospects for a steady increase in export business is looked for with confidence by shippers.

GLASGOW. In the Scottish heavy chemical trade during the past week business in the home trade has been moderate. Prices remain very firm. There is no change in the export position.

Price Changes

Rises: Lactic acid: linseed oil.
Falls: Pitch.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80%, technical, 1 ton, £39 10s.; 10 cwt./1 ton, £40 10s., 4/10 cwt., £41 10s.; 80% pure, 1 ton, £41 10s.; 10 cwt./1 ton, £42 10s.; 4/10 cwt., £43 10s.; commercial glacial, 1 ton, £49; 10 cwt./1 ton, £50; 4/10 cwt., £51; delivered buyers' premises in returnable barrels, £4 10s per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r.

Aluminium Sulphate.—Ex works, £11 5s. per ton d/d.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Carbonate.—£37 10s. to £38 per ton d/d in 5 cwt. casks.

Ammonium Chloride.—Grey galvanising, £22 10s per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac.

Antimony Oxide.—£103 10s. to £109 10s. per ton.

Arsenic.—Per ton, 99/100%, £26 10s. for 20-ton lots, £31 for 2 to 10-ton lots; 98/99%, £25 for 20-ton lots, £29 10s. for 2 to 10-ton lots; 96/99% white, £21 15s. for 20-ton lots, £25 15s. for 2 to 10-ton lots.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £18 15s. per ton d/d; 2-ton lots, £19 10s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.: extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£15 to £16 per ton, ex wharf. Granulated, supplies scarce.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5⅜d. per lb.

Chromic Acid.—1s. 7d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6⅜d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Oxide.—Black, powdered, about £100 per ton.

Copper Sulphate.—£32 5s. per ton, f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from £13 17s. 6d. for 10-cwt. lots to £14 1s. per cwt. lots, d/d. Less than 1 cwt., 2s. 5½d. to 2s. 7½d. per lb. d/d.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d.

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 to £5 per cwt., according to quantity; in drums, £3 19s. 6d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d. per lb., according to quantity.

Lactic Acid.—Pale tech., £60 per ton: dark tech., £53 per ton ex works; barrels returnable.

Lead Acetate.—White, 52s. to 55s. per cwt. according to quantity.

Lead Nitrate.—About £47 per ton d/d in casks.

Lead, Red.—Basic prices, per ton: Genuine dry red lead, £45 10s.; rutile, £45 10s.; orange lead, £57 10s. Ground in oil: Red, £59; orange, £71. Ready-mixed lead paint: Red, £63 10s.; orange, £75 10s.

Lead, White.—Dry English, in 8-cwt. casks, £55 per ton. Ground in oil, English, in 5-cwt. casks, £67 per ton.

Litharge.—1 to 2 tons, £44 10s. per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £18 15s. to £22 15s. per ton.

Magnesium Chloride—Solid (ex wharf), £22 per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt lots, 8s. 5d.; for 7 to 28-lb. lots, 8s. 11d.

Mercurous Chloride.—10s. 1d. to 10s. 7d. per lb., according to quantity

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 2s. 4d. per gal., pyridinised 64° O.P. 100 gals., 2s. 5d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£60 to £65 per ton for ton lots, carriage paid, in 5-cwt. casks; smaller parcels would be dearer; deliveries slow.

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate.—Crystals and granular, 7⅜d. per lb.; ground, 8⅜d. per lb., for not less than 6 cwt.; 1-cwt. lots, ¼d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £67 5s. per ton ex store; hydrated, £61 10s. per ton.

Potassium Chlorate.—Imported powder and crystals, nominal

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 12s. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Soda, Caustic. — Solid 76/77%; spot, £16 7s. 6d. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6½d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£36 to £45 per ton, nominal.

Sodium Hyposulphite.—Pea crystals (4-ton lots or more), per cwt. in kegs 24s. 3d., in bags 17s. 9d.; (ton lots) 25s. in kegs, 18s. 6d. in bags; commercial, 5-ton lots, £16 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 9s. 11d. per lb., for not less than 7 lb., 13s. 1d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£16 10s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£20 15s. per ton.

Sodium Percarbonate.—21½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £22 per ton d/d for ton lots. Tri-sodium, £25 per ton d/d for ton lots.

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£4 10s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. Manchester: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £18 5s. per ton, d/d, in drums; crystals, 30/32%, £12 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton, ground, £15-£16.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d.; 2 to 5 cwt., £15 11s.; 1 to 2 cwt., £15 13s. Less than 1 cwt., 3s. 1d. to 3s. 3d. per lb. d/d, according to quantity.

Tin Oxide.—Nominal.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d: white seal, £38 15s.; green seal, £37 15s.; red seal, £36 5s.

Zinc Sulphate.—Tech., £20-£21 per ton, carriage paid, casks free.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 2d. to 2s. 1½d. per lb. Crimson, 2s. 2d. to 2s. 6d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 3s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£34 to £39 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£44 to £49 per ton, according to quantity.

Chromium Oxide.—Green, 2s ped lb.

India-rubber Substitutes.—White, 6 3/16d to 10¼d. per lb.; dark, 6 3/16d. to 6 15/16d. per lb.

Lithopone.—30%, £25 per ton; 60%, £31 to £32 per ton. Imported material would be dearer.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Plus 5% War Charge.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton d/d farmer's nearest station, £20 15s.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in January, £9 19s., rising by 1s. 6d. per ton per month to March, 1946.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, in January, £14 13s. 6d.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £15 15s. per ton; granulated, over 98%, £10 14s. per ton.

Coal Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.: pure, 2s. 8½d.: nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 11½d. per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 9½d. to 11½d. per lb., d/d; crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 6½d. to 7d. per gal., f.o.r. maker's works. MANCHESTER, 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £7 4s. to £10 13s. per ton, according to m.p.; hot-pressed, £11 10s. to £12 14s. per ton, in bulk ex works; purified crystals, £25 15s. to £28 15s. per ton. Controlled prices.

Pitch.—Medium, soft, 70s. per ton, f.o.b. MANCHESTER: 70s. per ton f.o.b.

Pyridine.—90/140°, 18s. per gal.; 90/160°, 13s. MANCHESTER: 14s. 6d. to 18s. 6d. per gal.

Toluol.—Pure, 3s. 0½d. per gal.; 90's, 2s. 4½d. per gal. MANCHESTER: Pure, 3s. 1d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £21 per ton; grey, £24. MANCHESTER: Grey, £24 to £25 per ton.

Methyl Acetone.—40/50%, £56 per ton.

Wood Creosote.—Unrefined, about 2s. per gal., according to boiling range.

Wood Naphtha, Miscible.—4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. per gal.

Wood Tar.—£5 per ton.

Intermediates and Dyes (Prices Nominal)

***m*-Cresol** 98/100%.—Nominal.

***o*-Cresol** 30/31° C.—Nominal.

***p*-Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

***p*-Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

***o*-Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

***p*-Toluidine.**—2s. 2d. per lb., in casks.

***m*-Xylidine Acetate.**—4s. 5d. per lb., 100%

Latest Oil Prices

LONDON.—December 27.—For the period ending December 29 (January 5 for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package: LINSEED OIL, crude, £65. RAPESEED OIL, crude, £91. COTTONSEED OIL, crude, £52 2s. 6d.; washed, £55 5s.; refined edible, £57; refined deodorised, £58. COCONUT OIL, crude, £49; refined deodorised, £49; refined hardened deodorised, £53. PALM KERNEL OIL, crude, £48 10s.; refined deodorised, £49; refined hardened deodorised, £53. PALM OIL, refined deodorised, £53; refined hardened deodorised, £58. GROUNDNUT OIL, crude, £56 10s.; refined deodorised, £58; refined hardened deodorised, £62. WHALE OIL, crude hardened, 42 deg., £51 10s.; refined hardened, 46/48 deg., £52 10s. ACID OILS: Groundnut, £40; soya, £38; coconut and palm-kernel, £43 10s. ROSIN, 30s. 6d. to 45s. per cwt., ex store, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

Chemical and Allied Stocks and Shares

A STEADY close to the year has been shown by stock markets, aided by firmness in British Funds, 2½ per cent. Consols and other long-dated stocks giving indications of resuming their upward trend. International factors and nationalisation projects are a restraining influence, and a waiting attitude prevails, but the undertone of markets is steady with little selling in evidence. The Coal Nationalisation Bill was closely studied, and the general opinion was that it provides a satisfactory basis for "fair compensation"; there was a moderate demand for coal shares, particularly of those companies which have important trading and non-colliery interests.

Comparison of movements in industrial shares during the past twelve months shows rather wider fluctuations than was the case in 1944, when the trend was uniformly upward. During the past month new factors have come into play, namely, the difficulties of the transition period in the absence of adequate supplies of materials and labour, the General Election result, and the unsettlement provided by the nationalisation policy; while a wide range of companies, it is recognised, will probably have to report a downward trend in earnings owing to the cancellation of Government contracts. In the circumstances the trend of share values has been better than might have been expected. The sharp falls which followed the General Election have been largely regained in most cases. Nevertheless, many leading industrial shares are closing the year well below highest levels recorded in the past twelve months and in numerous instances current levels show no material change from those ruling at the end of 1944.

Chemical and kindred shares have moved very closely with the prevailing trend. Imperial Chemical are now 39s. 9d., compared with 39s. at the end of 1944 (highest and lowest levels in 1945 were 42s. and 34s. 6d.). Dunlop Rubber, now 51s. 6d., were 48s. a year ago, and extremes in the past twelve months were 57s. 6d. and 44s. General Electric (1945 extremes 100s. 9d. and 85s. 6d.) are now 93s. 6d., compared with 98s. 3d. a year ago. Courtaulds, which had extremes of 59s. 3d. and 49s. 3d. in 1945, are now 53s. 9d., comparing with 57s. 3d. a year ago. British Celanese are now 34s. 9d. as against 36s. 9d. at the end of 1944. The following give current prices and those of a year ago in respect of a number of shares: British Plaster Board 32s. 9d. (40s.), Associated Cement 57s. 6d. (62s.), British Oxygen 81s. 6d. (87s. 6d.), British Aluminium 39s. 1½d. (46s.).

De La Rue have risen substantially during the year from £9 11/16 to £10 1/8 on the company's progressive policy and the plastics interests of the group. B. Laporte at 83s. are within 9d. of the level a year ago. In contrast with many other shares of companies identified with building and allied trades, paint shares have risen well on the year, Lewis Berger being 123s. 9d. compared with 106s. at the end of 1944, International Paint 125s, compared with 116s. 3d., and Goodlass Wall 24s. 7½d. compared with 18s. 9d. Elsewhere, Lever & Unilever are 48s. 3d. against 46s. a year ago, and Turner & Newall 80s. as against 81s. 3d. at the end of 1944.

Among iron and steels, United Steel are now 24s. 3d. compared with 25s. 10½d. at the end of 1944; Thomas & Baldwins 11s. 3d. compared with 13s. 6d.; Dorman Long 25s. 9d. compared with 27s. 7½d.; Guest Keen 41s. 3d. compared with 38s. 4½d.; and Babcock & Wilcox 56s. 6d. compared with 53s. 9d. Stewarts & Lloyds are 56s. 3d. against 55s. 3d. a year ago, and Tube Investments £5⅝ against £5 15/32. Among shares of companies with colliery interests, Powell Duffryn have declined on the year from 23s. 9d. to 22s. 3d., Staveley from 52s. 6d. to 45s., and Bolsover from 51s. to 46s. 9d.; but while the general movement has been downward in this section, a number of increases are shown, and Shipley have risen on the year from 25s. 3d. to 29s. 3d.

In other directions, Boots Drug are now 55s. 4½d. in contrast with 55s. 9d. a year ago, Beechams deferred 21s. compared with 19s. 3d., and United Glass Bottle 73s. 9d., compared with 70s. Among oils, Shell are 80s. 7½d. against 83s. 1½d. a year ago, Burmah Oil 78s. 1½d. against 83s. 9d., while, partly owing to the recent fall on the Persian news, Anglo-Iranian have declined on the year from 115s. 7½d. to 99s. 4½d.

EDUCATIONAL

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SITUATIONS VACANT

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.

A CHIEF Research Chemist is required by an old established Chemical Company. Candidates must be of Ph.D. standard with at least 5 years' executive experience. Age not more than 40. The appointment which is permanent and carries a good four-figure salary, offers great scope for a man of initiative, imagination and one who can think and act constructively. The prospects are excellent for the right man. Apply, giving brief replies regarding age, qualifications and experience to Box 2254, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

THE BRITISH IRON AND STEEL RESEARCH ASSOCIATION. Scientists and engineers with University degrees or professional or equivalent qualifications required in grades of Scientific Officer or Senior Scientific Officer :—

(a) SENIOR SCIENTIFIC OFFICER (ENGINEER) with knowledge of design and maintenance of engineering plant, particularly with reference to structural design and electrical gear of overhead cranes. (Ref. No. C.3012XA).

(b) PLANT ENGINEER preferably with experience of iron and steel industry and knowledge of structural, mechanical and electrical engineering. Experience in committee work desirable. (Ref. No. C.3013XA).

(c) SCIENTISTS for operational research on problems (e.g., logistical problems) of the industry ; experience in mathematical and statistical analysis of technical problems desirable. (Ref. No. A.1045XA).

(d) METALLURGIST with knowledge of blast furnace operation, preferably with some experience in running a blast furnace. (Ref. No. F.5414XA).

(e) METALLURGISTS, CHEMISTS, PHYSICISTS and ENGINEERS mostly in the grade of Scientific Officer ; some posts at London Headquarters, others in Provinces. (Ref. Nos. F.5415X F.5416X).

Appointments will be made within the following scales according to qualifications and experience :—

Scientific Officers ...	£300—£550 p.a.
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Also—

(f) SCIENCE GRADUATE, preferably a woman, for technical information and library work. Knowledge of German desirable. SALARY : £300—£500 according to qualifications and experience. (Ref. No. F.5417XA).

All posts are superannuated under F.S.S.U. Written applications only quoting B.I.S.R.A. and appropriate Reference Number with full curriculum vitae, to Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 572, York House, Kingsway, London, W.C.2, by 30th January, 1946.

SENIOR Lady Shorthand Typist required immediately by Chemical Mfrs. E. London. Applicants must have high standard education, prev. exp., knowledge office routine, Chemistry and German an advantage. Permanent position. Write Box H/C 71, Deacons Advertising, 36, Leadenhall Street, E.C.3.

WANTED.—Chemical Engineers or Chemists with good academical qualifications and practical experience of at least seven years for the manufacture of Bone products such as Superphosphates, Bone Crease, Glues, Gelatine and other by-products of bone, Phosphoric Acid, Ammoniacal liquor, Bone Char, etc.

The selected candidates will be required to work in India. Apply to Managing Directors, M/S. Delhi Cloth and General Mills Co., Ltd., Delhi, India

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