The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. LIV
No. 1398

SATURDAY, APRIL 13, 1946
REGISTERED AS A NEWSPAPER

6D. PER COPY
POST FREE 8D.

THERMAL LINKAGE

CUTS FACTORY'S FUEL BILL 35%

Not merely a fuel-saving theory, but a proven fact.

THERMAL LINKAGE saves fuel, cuts production costs, increases output.

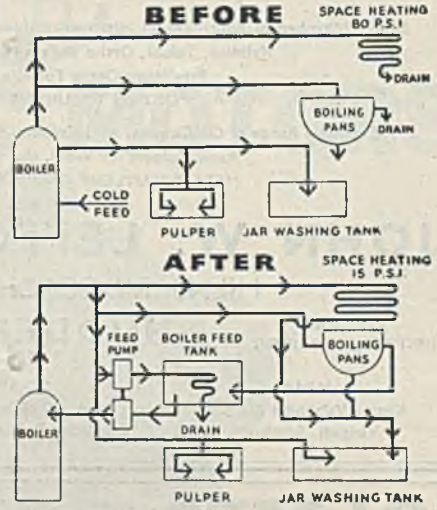
These are facts, proved by experience.

Thermal Linkage is no new experiment ; no temporary device to overcome the fuel shortage. It is a proven principle of practical value already in use in many progressive plants.

Stated briefly, Thermal Linkage means overhauling and integrating your various heat-using processes and, as far as possible, operating them as a single co-ordinated heat-using unit. Instead of heat being supplied independently to several separate points of consumption, and the surplus going to waste, it is circulated from point to point and none wasted while there is work for it to do.

PUT THERMAL LINKAGE INTO PRACTICE

What THERMAL LINKAGE does in other plants it can do in yours. In converting or reconstructing do not miss the chance to increase plant efficiency and production at lower cost by adopting THERMAL LINKAGE. For general information see *Fuel Efficiency Bulletin* No. 21 (" The Construction of a Factory Heat Balance ") or, for specific advice and guidance, contact your Regional Office of the Ministry of Fuel and Power.



AVERAGE SAVING 35%

A Jam Factory used an average of 7 tons of coal weekly to provide a steam load of 1,630 lb./hr. at 80 p.s.i.

Along with the introduction of THERMAL LINKAGE the following adjustments were made to the plant. *BOILER HOUSE :* Boiler efficiency raised 3% by attention to detail. Exhaust from boiler feed pump put through a heating coil in the feed tank. Excess temperature relieved by introducing a shunt line to jar washing tank. *BOILING PANS :* Individually trapped and air-vented ; jackets lagged ; blow-down cocks connected to jar washing tank. *SPACE HEATING :* Steam pressure for space-heating reduced to 15 p.s.i. and thermostatically controlled to 55°F. All condensate from heating and process units returned to the boiler feed tank.

RESULT : Steam consumption reduced from 1,630 lb./hr. to 1,200 lb./hr., effecting an average fuel saving of 35% and an annual cut of £360 in coal alone. Output from Boiling Pans increased.

For full details and complete diagrams of this abbreviated Case History see No. 30 of the *Fuel Efficiency News*, dated October 1945.

Issued by the Ministry of Fuel and Power.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

BOUVERIE HOUSE, 154 FLEET STREET, LONDON, E.C.4

Telegrams: ALLANGAS FLEET LONDON Telephone: CENTRAL 3212 (12 lines)

GLASGOW: 116 Hope Street (Central 3970) BIRMINGHAM Daimler House, Paradise Street (Midland 0784-5)

THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited

VOL. LIV No. 1398. April 13, 1946 Annual Subscription 21s. Overseas 26s.

Carbon Black

CARBON black is frequently described as colloidal carbon, and in the recent address to the Society of Chemical Industry by Mr. Alan Speedy on the subject of carbon black it was referred to as "the most powerful colloid known to mankind." Whether it is in fact a colloid is a scientific question into which we do not here propose to enter. What we are particularly interested in is the possibility of manufacturing carbon black in considerable quantity in this country. Carbon black comands a high price and the quantities which are produced from natural gas in America are considerable. Some recent figures show a production of 856,705,000 lb. annually for home consumption, of which 316,621,000 lb. was used in the rubber industry. During the same year 203,828,000 lb. was exported from the U.S.A. A considerable proportion of those exports came to Great Britain, and, as the price is high, their effect on the dollar exchange is appreciable.

It is hoped by the Ministry of supply that sources of carbon black can be discovered in this country. We have a good deal of the raw material required because it can be made from quite a variety of substances, including pitch which on many occasions in the past has been difficult of disposal. The problem, however, is not quite so easy as that, because there are many different kinds of black, not all of which are equally suitable for all purposes.

For years the "key" material was channel black. This is made by burning natural gas flames in contact with cold iron whereby the chilling of the flames causes carbon to be deposited on the iron, from which it is scraped off through a movement of the channels. Mr. Speedy showed a silent film of this process and the impression left in the mind is that it would be utterly impracticable to use any such process in this country. The works was surrounded by a dense pall of smoke, which was carried 50 or 100 miles away by the wind. Only in the wide open spaces of such a country as Texas could such a process be considered. Nevertheless there are certain processes in which channel blacks have an unassailable position and consequently channel blacks will continue to be made for those purposes.

The principal use of carbon black, however, is in the rubber industry, and here Mr. Speedy showed a striking change in the position within the last few years. What are known as furnace blacks or thermal blacks have come into

On Other Pages

favour and are now equal to channel blacks in terms of output. These blacks are generally somewhat larger in particle size than channel blacks, though not invariably so, and they appear to be peculiarly suitable for blending with synthetic rubber. It was suggested at the meeting that rubber tyres now virtually consist of carbon held together by rubber, so that the wearing surface of the tyre is carbon.

Furnace blacks are made by burning carbonaceous material in an insufficient supply of air, thereby generating smoke which is collected, the solid particles being carbon black. Thermal blacks are made by the decomposition of hydrocarbons under intense heat, the process being intermittent and in many respects resembling the water-gas process. This serves as a reminder that the Severn Valley Gas Corporation and the Swindon Gas Company have gas-making plants, operated on the Leon Jones patents, manufacturing town gas with very large quantities of carbon black as a by-product. It would not seem impossible to set up a carbon black factory on these lines in which the town gas would be the by-product and might be sold to the local gas industry as such.

The yields from these processes are strikingly dissimilar. From natural gas the theoretical yield of carbon is 35.5 lb. per 1000 cu. ft. of gas. The channel process produces from 1000 cu. ft. of this gas only 1.5 to 2 lb. of carbon. The finer the particle size the lower is the yield. The thermal process and the furnace process seem to give from 16 to 20 lb. of carbon. In Czechoslovakia carbon black is produced from coke-oven gas and here the yield is said to be 66 per cent. of the theoretical. The size of carbon black particles varies generally between 25 and 275 mμ. A grade as fine as 9 mμ was produced at one time, but the yield was so low that this has now been abandoned.

The American carbon-black plants shown on the screen did not strike the observer as being of particularly advanced chemical-engineering design. The channel process appears to be particularly crude. The thermal processes were considerably better in this respect, but, judging from the cloud of smoke issuing from all the plants depicted, it appears that there is a good deal of work yet required in the method of collecting the finely-divided carbon. It is known that electrostatic precipitation is not the complete answer to this problem, though it is a little curious why it should not be so. It seems probable that the carbon particles are charged, since in the intense heat of the flame or furnace they may well lose electrons and thus acquire a positive charge. There is scope here for research which might well be of national importance. So far as is known the Severn Valley process does not create any smoke nuisance, but that is probably because the gases are dealt with in the normal gasworks recovery plant, and are thus subjected to methods of purification rather than recovery once the regular carbon plant has been passed in the circuit.

There are believed to be also other plants at work manufacturing carbon black in this country, but so far as we are aware details have not been published. This strikes us as being a field in which we could be self-supporting without any objection on the score of additional expense in manufacture or of reduction in efficiency. On the contrary it is our view that sound chemical engineering methods allied to a certain amount of research into the physics of the process might very well result in a British production of carbon black more efficient than the methods now in use in many other parts of the world. There is no doubt that carbon black is becoming a very important product and that before very long it is likely to find applications not only in the rubber industry, but in the manufacture of plastics.

Raw Material Charges

Sulphuric Acid Freed

IN 1940 and 1941, the Treasury levied charges on the stock or production of various raw materials. Now that the Raw Materials Department and the majority of its controls have been transferred to the Board of Trade, the Treasury has made certain consequential changes.

Sulphate of ammonia charges are to continue, but in future they will be collected by the Board of Trade. Remittances and correspondence should still be directed to Directorate of Nitrogen Supply, 3 Buckingham Gate, London, S.W.1. Sulphuric acid charges are abolished under S.R. & O., 1946, No. 453, but the responsibility for the collection of outstanding charges will be transferred to the Board of Trade, and will be dealt with in the same manner as was done before April 1. Correspondence should still be directed to Sulphuric Acid Control, 166 Piccadilly, London, W.1.

NOTES AND COMMENTS

Budget Concessions

CAUTION is the word that immediately springs to the mind after a consideration of Mr. Dalton's first Budget. We would be the last to blame the Chancellor of the Exchequer for a display of this valuable quality, but we cannot help wondering whether a more experienced Chancellor might not have been able to give the country a little more psychological stimulus, while still keeping well within the margin of safety. However, we may breathe a sigh of relief that things are no worse and register a confirmation of our opinion that the present Government is not as strong on the psychological side as it might be. The abolition of E.P.T. will, we suppose, give some stimulus to trade generally, but the prospect of an alternative tax, if that dubious character, Pte. Enterprise, does not behave himself, will at the same time serve as a brake on too enthusiastic expansion, coupled as it is with the retention of N.D.C. under a new and permanent-sounding title. Any reduction in the crippling income tax is a real relief, and we are sure the long-suffering camel will welcome the removal of some straws from its overburdened back. The repeal or reduction of purchase tax on many articles that are now in short supply may result in a rapid improvement in the supply position. Generally speaking, the Budget may be regarded, on broad lines, as a fairly hopeful one, and Mr. Dalton was quite right in insisting that an increase in production must be regarded as an essential preliminary to further reliefs. The Chancellor has tried hard, if in a rather uninspired way, to provide a few incentives towards this increase in production.

Parliament and Science

IT is quite refreshing to examine the programme of the Parliamentary and Scientific Committee for immediate action. By harassing the Government at every opportunity, their parliamentary members should succeed in obtaining answers to many of the questions that are worrying scientists, both academic and industrial, to-day. The chairman announces his nominations to the "steering" sub-committee, and it is noteworthy that, over and above the *ex officio* members, this sub-committee includes representatives of (*e.g.*) the Institute of Petroleum, the Institution of Chemical Engineers, the Association of Scientific Workers, and the British Scientific Instrument Research Association. Among vexed questions which are due for immediate discussion are the availability of surplus scientific equipment, the needs of universities, not only for money, but also for release of staff, students, etc., the position of the National Research Development Fund, and the status of scientific civil servants. Sir Edward Appleton and Lord Riverdale, both of whom are high in the councils of the D.S.I.R., are to address the Committee next month on the affairs of their department, and a report is expected immediately on the arrangements for visits, by members of the Committee, to Research Institutions managed by the D.S.I.R.

Overseas Trade

EXPANSION of overseas trade will be of increasing importance to the chemical industry in the years ahead and is already prominent in the minds of manufacturers, particularly in view of the world-wide shortage of pure chemicals for laboratory and research use. How far exhibitions and fairs could go in stimulating export trade in the post-war era is somewhat problematical, and it is interesting to note that a lead has now been given by the Committee appointed by the Secretary for Overseas Trade to examine the possibilities of such ventures. The Committee recommends that a Universal International Exhibition be held in London in 1951, not only to demonstrate our recovery from the war, but to mark the centenary of the great International Exhibition held in Hyde Park in 1851. The need for a national trade fair is also urged by the Committee, who suggest this could best be met by reviving the annual British Industries Fair in May each year, beginning in 1947, but with certain changes in its constitution and practice to improve its appeal.

Possible Markets

THERE are probably many manufacturers who are wondering especially whether there is a possibility of increasing exports to the U.S.A. and Canada. The answer is in the affirmative, according to Mr. A. E. Farncombe, who is very familiar with both the U.S.A. and Canada and recently returned from a five-months'

business tour of those countries. From an address which he gave at a meeting of the Institute of Export in London, last week, we gained the impression that of the two he favours Canada as the better potential market. He uttered a warning, however, that in neither case would British goods sell simply because they were British. Maintenance of the recognised British quality was essential—there were plenty of people ready to pay a little extra provided this addition was justified by improvement in quality as compared with the standard of home-produced goods.

World Food Shortage

SURPRISINGLY little material of chemical interest was raised in the debate on world food shortage in the House of Commons last week, considering the closeness of the link between chemical science and food production. The only real reference was made in the course of Mr. R. S. Hudson's intentionally gloomy speech, when he quoted a letter from a firm of fertiliser merchants on the subject of potash. This lays at the door of the Government the entire responsibility for the non-delivery of potash, and notes the contrast between the present position and that of the war years, when every pound of potash was imported. "Then," it says, "I.C.I.'s huge plant kept running continuously . . . whereas this year, when transport has become easier and the danger of sea travel mainly removed, they have had six weeks of idleness owing to lack of raw potash." A good deal of criticism was levelled at the White Paper recently issued on the food shortage, and still more at Government spokesmen who, with their temporising statements, had encouraged the people, far more than was justified, to regard the food situation with comparative equanimity.

Hope from a Conference

A CERTAIN amount of hope for the future may be derived, however, from the words of Sir John Boyd Orr, whose speech fully substantiated his position of independence in the House. It was the speech of a scientist and a sociologist, not of a politician, and it led us to hope that something really important may come out of the conference to be held at Washington on May 20 by the Food and Agricultural Organisation and other cognate bodies, both permanent and temporary. They hoped, he said, to submit a plan which would "go far—indeed, the whole length—to relieve the world of hunger and malnutrition." Nothing specific has so far been said about the use of direct chemical methods for devising new sources of foodstuffs—such as the scheme outlined in our pages on March 16 (p. 277) —but we have no reason to suppose that the conference will not be fully documented, and that every possible source of supply will be examined.

Government Aids Science !

AN apt illustration of how Governmental parsimony results in a lessening of efficiency was given by a civil engineer during a discussion at the F.B.I. conference on "Industry and Research" in London recently. Desirous of ascertaining whether an adequate water supply would be available in a certain area where a new factory was contemplated, the engineer sought the required information from the Geological Survey at Middlesbrough. No one could have been more helpful than the officials concerned and eventually the information reached the inquirer, together with a profuse apology for the delay involved. The official explanation of this was that, on the ground of financial economy, the survey establishment at Middlesbrough was considered too small to warrant the engagement of a staff typist, with the consequence that outgoing correspondence, etc., had to be sent to Edinburgh to be typed and then returned to Middlesbrough for approval and signature!

"WASTE HEAT" CONFERENCE

As a result of the widespread interest aroused by the presentation to the Institute of Fuel of the series of nine papers on "Industrial Waste Heat Recovery," the Institute has arranged to hold a full-day conference on this subject on April 30 in the Geological Society's rooms, Burlington House, Piccadilly, London, W.1. At the morning session, from 10 a.m. to 12.30 p.m., Dr. H. R. Fehling will present a paper summarising the papers previously presented and then there will be a discussion on the papers by the following: Dr. O. A Saunders, "Regenerators"; Mr. J. B. Wagstaff, "Recuperators"; Dr. E. Seddon, "Waste Heat Recovery in the Glass Industry"; Dr. P. O. Rosin, "Waste Heat Recovery in the Iron and Steel Industry"; Dr. S. Pexton, "Waste Heat Recovery in the Carbonising Industries." After lunch there will be an open discussion and reply will be made by the authors of the original papers.

Chemicals Imparting Wet Strength*

Analysis of Dilute Melamine Resin Solution

by BERTIL IVARSSON and BÖRJE STEENBERG

AMONG the substances which have been proposed as agents for the purpose of improving the wet strength of papers, melamine resins have attracted special attention.[1, 2, 3, 4] For the manufacture of papers having a high wet strength, the method recommended is to dissolve methylol-melamine resins in mineral acid, subjecting this solution to certain treatment before adding it to the stock in the beater. The resin will be retained by the cellulose fibres and it is cured in connection with the drying of the paper on the machine.

From a theoretical point of view this method of imparting wet strength is of great interest. Wet strength can be obtained by the addition of various types of resin to the paper. To these belong the carbamide and phenol resin groups. A study of the literature on the subject makes it clear, however, that these resins cannot be made to adhere to the fibres directly from a water solution. It is necessary to have them in the form of an emulsion and to cause flocculation by the addition of special agents. Statements in literature regarding the outstanding qualities of melamine resin for the purpose seem to indicate that there must be some kind of specific action between melamine and cellulose.[5] Valuable knowledge in regard to the properties of both cellulose and melamine may be gained by closer examination of this effect.

Period of Aging

When applied to the manufacture of wet strength paper, the melamine resin acid colloid must be aged for at least 3-12 hrs. according to different authors, 72 hrs. being a maximum.[1, 2] The addition should be made at the beater, or, even better, at the fan pump, before the stock goes on to the wire. A retention of 70-90 per cent. should be obtained. Practical experience, however, has borne out that the retention is limited to 60-70 per cent. only.[5] A noticeable improvement of the wet strength of the paper is at once obtained, but slow changes take place in the paper so that the wet strength will reach a maximum value only after storage for several weeks at room temperature. Attempts to apply this method in Sweden have not, as far as we know, produced the desired results, as far as the wet strength of the product is concerned.[6] Better results have been obtained by spraying melamine resins on the wet paper web. The size is applied after the wet presses. However, paper prepared in this manner tends to become brittle.

In a later paper the authors will report on the action between melamine resins and cellulose fibres and the manufacture of high wet strength papers by melamine impregnation in the beaters. The folding endurance, elasticity, and porosity of these papers have not been materially changed by the impregnation. Good results are obtained with a lower percentage of resin than reported earlier. These results have been made possible through a better understanding of the interaction of melamine and cellulose. The first step in this investigation was to work out a method of analysis which could be applied when dealing with dilute solutions of melamine resins.

Careful Analysis Required

It is obvious that a method of analysis for melamine resin in connection with paper making must also allow for accurate determinations of minute amounts of substance. The stock has a consistency of less than one per cent. and the melamine resin added is only one or a few per cent. by weight of the fibres. It is essential that the analytical procedure should be capable of detecting as little as a few gammas of resin per ml. of solution, otherwise an analysis of white water would be of little value.

Methylol-melamine displays very few specific reactions. No colour reactions are known. Determination of the nitrogen content by wet Kjeldahl combustion gives very inaccurate results, owing to the stability of the triazole ring.

For analytical purposes, the determination of dry residue is not accurate enough and it is very time-consuming.

The melamine resin acid colloid can be precipitated with picric acid and several salts and alkalis. The picrate, however, is not sufficiently insoluble to be of use for a gravimetric method. The precipitates which are obtained with salts and alkalis are gels and they clog any filter very rapidly.

Because of the ease with which melamine can be precipitated with several agents, the opinion was advanced that a nephelometric method of analysis might lead to the desired result. The precipitated methylol-melamine flocculates very rapidly and deposits a sediment, yet the present investigation led to the conclusion that it was possible to obtain reproducible turbidity measurements by strongly agitating the precipitated solution immediately before the nephelometric observations. This discovery was extremely surprising, and contradicts

* *Svensk Papperstidning*, Jan. 15, 1946.

the findings in the majority of nephelometric analyses.

The present paper will begin with a survey of the melamine resins used and the properties of their solutions, followed by a description of the nephelometric measuring apparatus. Finally, the method of analysis is presented.

For the investigations a polymer trimethylol-melamine resin designated "M—100" has been used. This resin is, according to the manufacturer,* obtained by condensation of melamine with formaldehyde in the molar relation 1 : 3.2. The condensation is carried out in water at 75°C. and a *p*H of 8—8.5. Initially the monomer trimethylol-melamine is formed, although not of quite uniform character. This substance is rapidly polymerised. The condensation process is broken when so much hydrophobic resin has been obtained that a precipitate is formed when 1 vol. of the 50 per cent. solution is diluted with 2 vol. of water at room temperature. After cooling, the product is dried in a spray drier to a white powder, containing max. 1 per cent. humidity. The product contains some free formaldehyde.

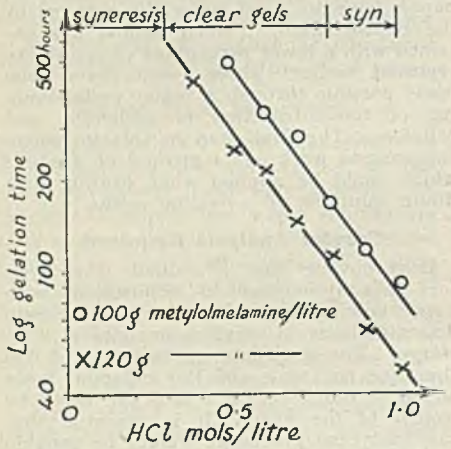


Fig. 1. Gelation of methylol-melamine (M-100) dissolved in hydrochloric acid.

If one part of the resin is treated with one part of water, an almost clear solution is obtained. If this solution is diluted, the resin precipitates. If a small part of the resin is immediately treated with a large quantity of water, the solubility is about 4 per cent. at 20°C. The product is only slightly soluble in organic solvents.

The resin can easily be dissolved in alkalis, but precipitates from the solution in a few minutes as a white gel, which thereafter cannot be brought into solution either by acids or alkalis. Methylol-melamine can be dissolved in mineral acids provided the concentration of the acid is high enough. With low acid concentrations a white opaque gel is precipitated within a few minutes. With an increasing concentration of acid the product can be held in solution for some time but polymerises and is precipitated sooner or later as a gel. Fig. 1 shows the length of time elapsing before the product gels with various acid concentrations. The appearance of the precipitated gel differs according to the acid concentration.† In the case of high acid concentrations a white opaque gel displaying syneresis is precipitated, in lower concentrations a water-clear gel without syneresis is deposited. The condensation obviously takes place in different ways according to the *p*H of the solution. If a 12 per cent. stock solution of melamine in hydrochloric acid is diluted to a strength of about 1 mg. of resin per ml. of solution, a water-clear solution will be obtained immediately, or shortly after the stock solution has been prepared. If the dilution is made after a period of aging, a colloidal solution, characterised by a faint, bluish haze, will be obtained.

The structure of the melamine resin is three-dimensional and consequently the molecular weight cannot be studied by viscometric methods. In fact, the viscosity of a solution of melamine resin is not materially changed during the polymerisation until shortly before gelation occurs. Osmotic methods for molecular weight determinations are difficult to use because of the presence of hydrochloric acid. The most suitable method for molecular weight determinations might be the light diffraction method devised by Debye.[7]

When melamine resin solutions are used for the production of wet strength paper, as small quantities of acid as possible should be used in order to minimise the corrosion. For this reason, the present paper deals only with experiments in which the solutions have been prepared with almost the minimum amount of acid required for the dissolution of the methylol-melamine.

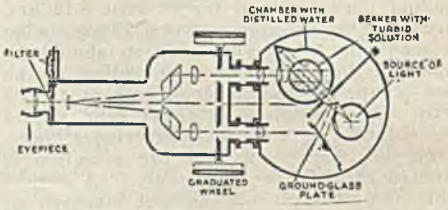


Fig. 2. Pulfrich photometer arranged for nephelometric measurements.

* "Stockholms Superfosfat Fabriks Aktiebolag."

† This observation has also been made by Landes and Maxwell[6] according to a publication which became known to us after this paper was written.

The properties of melamine resin solutions depend intimately upon the way they are made and stored. They change from hour to hour. Extreme care must be taken in order to prepare two solutions of identical properties.

Previously, melamine resin solutions have been prepared by heat[1, 8] This mode of procedure is undesirable because the polymerisation process has a very high temperature coefficient. Thus it is not possible to produce solutions with reproducible properties if they are heated during the preparation. All the investigations reported here were carried out with solutions prepared by stirring the resin in cold water until it was finely suspended and then adding diluted hydrochloric acid in portions. If hot water or concentrated hydrochloric acid is added to the resin it curdles, and the production of a clear solution without heat is more difficult. All stock solutions have been made with 12 per cent. methylolmelamine. Solutions prepared with 27 ml. of hydrochloric acid (sp. gr. 1.19) per litre of solution are designated by *A*, and those made with 40 ml. of acid are called *B*. A number following after these symbols indicates the time of aging of the solution in hours before it was diluted 100 times. If a second figure appears, it denotes the time in hours that elapsed between the dilution of the stock and the investigation of the dilution. For instance, A-0-48 implies that the stock solution was diluted 100 times immediately after the dissolution of the resin

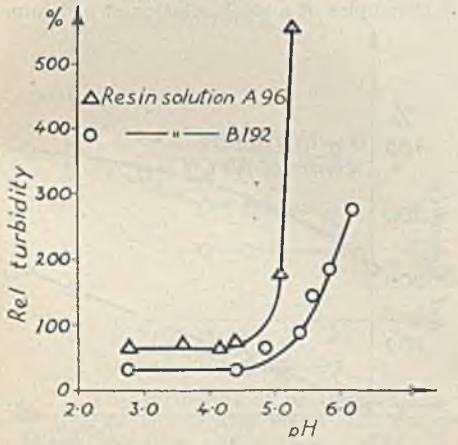


Fig. 3. The influence of varying *p*H on the relative turbidity of methylolmelamine solutions.

and that this diluted solution was aged 48 hours before it was studied. The aging was carried out at a fixed temperature. The analysis of melamine resin solutions was carried out with dilute solutions containing a maximum of 1.2 pro mille resin.

The turbidity measurements have been made with a Pulfrich nephelometer (Fig. 2), using filter *L* : 2 and comparison plate number 4. In the nephelometer the amount of diffracted light at an angle of 45° to the

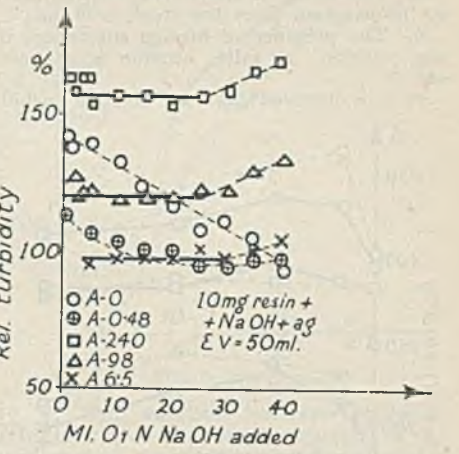


Fig. 4. Relative turbidity of methylolmelamine solutions alkalised with various amounts of NaOH.

incident ray is visually compared with a second ray of light which has passed a standard ground glass plate. The test solution is placed in a 50 ml. beaker, immersed in water. The beam of light diffracted by the turbid test solution and the beam coming from the ground glass are simultaneously observed beside each other in an ocular, and both fields are regulated to the same intensity by varying two shutters. The beakers to be used must be selected for highest optical perfection. Blind readings with pure water in the beaker must be taken at intervals to ensure that the lenses have not been soiled.*

The following principal method of analysis has been adopted. The solution containing the resin to be studied is placed in a 50 ml. beaker and the beaker filled up to 50.00 ml. with water or reagent. As reagent NaOH has been used in all recent experiments. Earlier, chlorides were used. The beaker is immediately placed in the nephelometer and the turbidity measurements taken after intensive agitation. The measurements have to be repeated at least five times after renewed agitation. It is essential that no air bubbles be present in the path of the rays.

The turbidity of the resin solution was found to depend on the following:

* Although the Pulfrich instrument has been used throughout this investigation, this does not imply that other turbidity measuring instruments cannot be used

1. The *p*H of the solution (amount of NaOH added);
2. The time elapsing after the addition of NaOH;
3. The aging of the stock solution;
4. The aging of the dilute solution after its preparation from the stock solution;
5. The presence of foreign substances in the solution, as salts, organic substances, etc.

It was observed that the relative turbid-

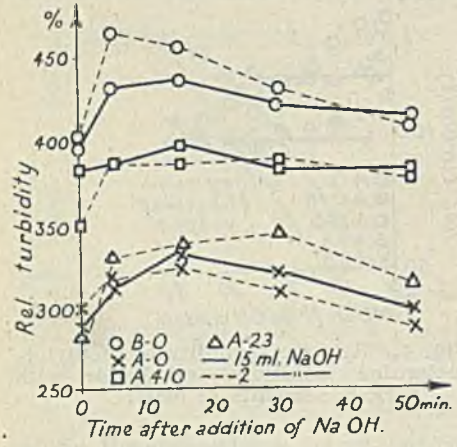


Fig. 5. The influence of time elapsed after addition of NaOH on the turbidity of methylol-melamine solutions.

ity of the dilute resin solution increased with increasing *p*H. The trend of this curve can be seen from Fig. 3. Similar curves were found for all resin solutions irrespective of their aging. It was, however, observed that the turbidity was dependent not only on the *p*H of the solution but also on the kind of electrolytes making up the buffer solution used.

The above-mentioned results have been obtained with acetate buffers. It was found that acetates had very small specific effect on the turbidity.

The stability of the colloid decreases with increasing *p*H. At $pH_1=5$ the solution undergoes a slow Smoluchowski coagulation. After a few hours distinct flocs can be found in the solution. At $pH=4.8$ the solution can be stored for days without noticeable flocculation.

It was found that the turbidity obtained by the addition of NaOH to the resin solution was independent of the amount of added lye within a large interval, provided the solution had become alkaline. This was, however, only true for resin solutions aged more than 3 hours (Fig. 4). A fresh solution of resin showed a turbidity on the addition of NaOH, which decreased with increasing amounts of NaOH after passing a maximum around the neutrality point.

It was found that the relative *turbidity* after the addition of NaOH increased slowly with time and passed a maximum after 10-30 minutes (Fig. 5). These changes in the turbidity are, however, very small. Because of the fact that the maximum point is not obtained at the same time for all kinds of resin solution, it was found more convenient to measure the turbidity immediately after the addition of NaOH. The change in relative turbidity during the first two minutes does not exceed 0.3 per cent. and it is lower than the order of reproducibility of each measurement.

Experiments have proved that all molecular fractions of the methylol-melamine investigated precipitate on alkalisation with NaOH. Resin solutions were precipitated with NaOH, and the supernatant solution was evaporated. Besides sodium chloride and sodium carbonate, the residue contained organic material, amounting to about 3 per cent. of the resin originally present. This figure was found in all experiments irrespectively of the aging time of the resin solution used. The organic residue, which contained nitrogen, became yellow or orange on heating in alkaline solution, but decolorised by the addition of acid. This reaction was reversible. Part of the substance was soluble in ether. In all probability the residue was not melamine or methylol-melamine. Thus, it seems justifiable to assume that the flocculation of the methylol-melamine in alkaline solution is very nearly complete.

If samples of a stock solution of melamine

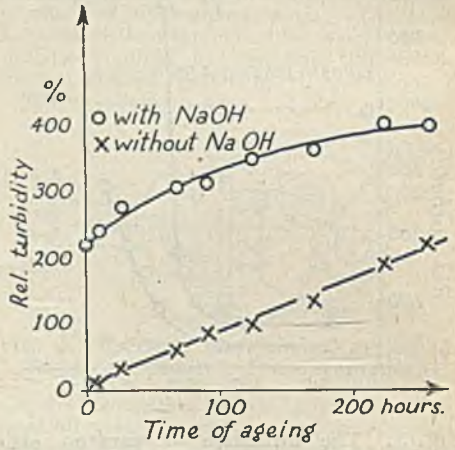


Fig. 6. The influence of aging on the turbidity of methylol-melamine resin solutions.

resin were diluted 100 times after different times of aging, the turbidity of these dilute solutions increased in a regular manner. The turbidity of the diluted solution can be used as a simple indication of the degree of

aging of the stock. An increase in turbidity with increasing aging of the solution was found also after adding NaOH to the diluted solutions, although on a percentage basis it was not so conspicuous (Fig. 6). Another interesting observation was made. If the diluted resin solution was stored, the turbidity of the solution, measured after the addition of NaOH, decreased.

A hypothesis regarding the different effect of aging on stock and diluted solutions may be put forward. The turbidity of a solution is known to be a function of the difference between the index of refraction of the solvent and the solute.[7] In the concentrated stock solution, the polymerisation may proceed in such a direction that the molar concentration rapidly diminishes, but the index of refraction of the formed molecules increases to an even greater degree. The turbidity of the solution will thus increase with time. In the diluted solution the polymerisation proceeds in another way and the index of refraction of the produced polymers is not high enough to counteract the effect on the turbidity of the decreasing molar concentration.

The polymerisation process in the dilute solution proceeds very slowly at room temperature, but rapidly at higher temperatures. After boiling half an hour with a refluxer, the process seems to be fairly com-

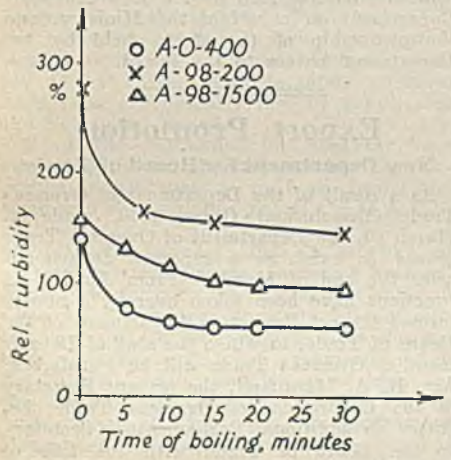


Fig. 7. The influence of boiling on the turbidity of melamine resin solutions measured after addition of NaOH.

plete, as the turbidity of the solution measured after addition of NaOH is at its minimum. (Fig. 7). At room temperature the turbidity decreased to the same extent in about a month. The low- and high-temperature processes are not necessarily identical.

The change in turbidity with a varying concentration of the resin solution after addition of NaOH was investigated. The relative turbidity plotted against the concentration of the resin solution showed an

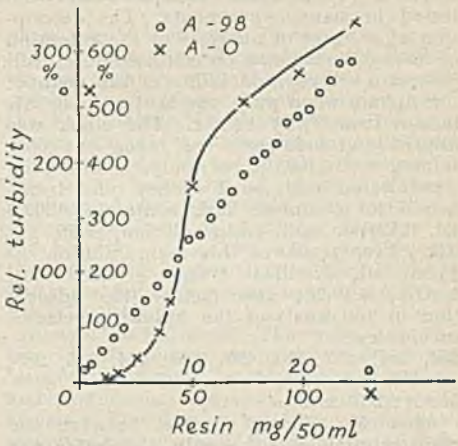


Fig. 8. The relation between relative turbidity and the concentration of a fresh and an aged solution of methylol-melamine solution.

S-shaped curve if the resin solution was aged only for a short time. As the aging proceeded, this curve was smoothed out. Two examples of such curves are found in Fig. 8. This diagram gives an idea of the degree of accuracy obtainable with the method in routine work. Every point represents one single measurement. All analyses are carried out within two hours.

A plot of this type can be used as a calibration curve for analysis of the resin solution in question. A new calibration curve is needed for each resin solution. The calibration should be controlled every day, because of the effects earlier mentioned. As a single measurement can be made in about one minute and a complete calibration curve is prepared in about ten minutes, the usefulness of the method is not materially reduced by these controls.

Additions of different electrolytes, starch solutions, etc., have not been found to affect the accuracy of the method, provided such substances do not themselves cause precipitations with sodium hydroxide. If inorganic electrolytes forming soluble hydroxides are present new calibration curves need not be prepared. If starch or protein is present a new calibration curve is necessary. If alum is present the test solution can be run through a cationic resinous exchanger running on the hydrogen cycle before the addition of the lye. The melamine resin is not taken up by the ion exchanger.

For routine tests, a known amount of the resin solution was poured into a 50 ml. beaker, water added to 35 ml. and 15 ml.

NaOH, 0.1-N, run into the beaker. The applicability of this method of analysis to problems concerning reactions between melamine resins and cellulose has been tested in many experiments. The description of a series of analyses of the retention of methylol-melamine on cellulose fibres will illustrate the reproducibility of the method.

Sulphate wood pulp was beaten to 45° SR in an Iron Vally beater. The stock was diluted and volumes were taken out containing 4.00±0.05 g. of pulp. The pulp was filtered with hard suction and transferred to a conical flask containing 200.0 ml. 0.12 per cent. resin solution, A-98, *p*H 5.0. Twenty ml. of this resin solution + 15.00 ml. distilled water + 15.00 ml. NaOH, 0.10-N., gave before the adsorption in ten analyses the following relative turbidities:

284, 287, 287, 291, 286, 286, 284, 285, 285, 286 per cent.

Mean: 287 ± 2 per cent.

After 30 minutes' contact between the resin solution and the pulp, the latter was filtered off and to 25.0 ml. of the filtrate were added 10.00 ml. distilled water and 15.00 ml. NaOH, 0.10-N, and the turbidity measured as mentioned above. The following relative turbidities were found in ten different experiments:

128, 124, 125 (104), 127, 135, 141, 135, 127, 116 per cent.

Mean: 128 ± 7 per cent.

According to the calibration of the original resin solution the filtrates contained 0.480±0.024 g. resin/litre. Due consideration being taken to the inaccuracy in the amount of cellulose used in the different experiments, the reproducibility of the analysis must be considered satisfactory.

REFERENCES.

[1] Maxwell, C. S., *Paper Trade J.*, 1943, 16, *TAPPI Section*, 39.
[2] Fromm, G. E., *Pulp and Paper Mag., Canada*, 1945, *46*, 157.
[3] Collins, Jr., T. T., *The Paper Industry and Paper World*, 1943, *25*, 203.
[4] Romieux, C. J., *Pulp and Paper Mag., Canada*, 1944, *45*, 532.
[5] Freeman, H. B., *Paper Trade J.*, 1944, *119*, 14.
[6] Liander, H., *Sv. Papperstidning*, 1941, *44*, 481.
[7] Debeye, P., *Journ. Appl. Physics*, 1944, *15*, 338.
[8] Landes and Maxwell, *Paper Trade J.*, 1945, *121*, *TAPPI Section*, 51.

Raw Materials Department

Transfer to Board of Trade

THE transfer of the Raw Materials Department from the Ministry of Supply to the Board of Trade, announced some time ago, became effective on April 1. From that date, the address of the Department is I.C. House, Millbank, London, S.W.1 (tel., FRAnklin 2211), and all inquiries (which hitherto would have been addressed to Shell Mex House) should be addressed there. Branches of R.M.D. situated outside Shell Mex House remain at their present addresses, but under the Board of Trade. Responsibility for salvage and certain semi-manufactured and manufactured articles has also been transferred.

The following materials, however, hitherto dealt with by the Raw Materials Department, remain with the Ministry of Supply:—

Agates; antimony; arsenic metal; cadmium; carbon and graphite electrodes for furnaces; chrome; cobalt; copper; columbite; diamond dies and tools; dolomite; fluorspar; lead; quartz crystals; tantalite; tin; foundry bending materials; grinding wheels (including abrasives); iron and steel and ferro alloys; magnesite; molybdenum; monazite sand; nickel; refractories; tungsten; vanadium; and zinc.

Joint Orders giving effect to the transfer and scheduling of the Control Orders involved have been issued by the Ministry of Supply and the Board of Trade. The Orders are entitled The Ministry of Supply and Board of Trade (Various Controls) (No. 1 and 2) Orders. It is provided that any relevant licences issued prior to April 1 will remain in force.

By an Order in Council, which also became effective on April 1, the Board of Trade takes over the trading functions of the Ministry of Supply in respect of any transferred materials, together with any relevant contracts entered into by the Raw Materials Department on behalf of the Ministry, and the ownership of the stocks held by the Department passes to the Board.

Export Promotion

New Department for Board of Trade

As a result of the Department of Overseas Trade (Dissolution) Order, 1946, made on March 20, the Department of Overseas Trade ceased to exist as a separate department after the end of March. From April 1 its functions have been taken over by a newly-formed Export Promotion Department of the Board of Trade, to which the staff of Department of Overseas Trade will be transferred. Mr. H. A. Marquand, the present Secretary of the Department of Overseas Trade, becomes an additional Parliamentary Secretary to the Board of Trade with the title of Secretary for Overseas Trade.

The Export Promotion Department will doubtless, in due course be housed with the rest of the Board of Trade Headquarters. Meanwhile, they will remain at the present address of D.O.T., and correspondence formerly sent to that Department should be addressed to the Board of Trade, Export Promotion Department, 35 Old Queen Street, London, S.W.1 (Telephone, VICtoria 9040). The new Department will continue to afford all the facilities previously available for exporters.

Association of Tar Distillers

Annual Report : New Officers Elected

THE report of the Association of Tar Distillers for the year ended December 31, 1945, alludes to the fact that the diamond jubilee of the Association was celebrated by a lunch at which the Minister of Fuel and Power was the principal guest. At a meeting in January, 1945, the rules of the Association were amended and the membership rule tightened to restrict membership of the Association to active tar distillers. The Association maintained its active co-operation in the work of the British Tar Confederation. In particular, the Technical Committee of the Confederation, basing the most important item of its activities on the report prepared by the Association on a proposed coal-tar research association, had by the end of the year reached the stage of considering an advance draft of a constitution for such a research association.

Tar Products

The Association continued its close co-operation with the Coal Tar Control in arranging the supply of tar products in those directions considered of the highest national importance.

Tar Fuel Oil.—Negotiations with the oil companies on the disposal of tar fuel oil in the immediate post-war period were practically concluded. Current national needs for C.T.F. 200 (creosote/pitch mixture) have been continuously met by supplies to the Petroleum Board.

Road Tar.—Demands for road tar have continued to be high, but some has been exported in the course of ordinary trade, and some was also supplied to meet S.H.A.E.F. requirements.

Pitch.—In January, 1945, a meeting of all pitch producers agreed to form a National Pitch Committee on the lines of the National Creosote Committee; through this committee, some 145,000 tons of pitch were shipped to Europe for S.H.A.E.F. requirements in the 1944/45 season, and letters of high appreciation of the industry's efforts in this respect were received from the Government Departments concerned. Further supplies were exported to France and Belgium through ordinary commercial channels in the autumn. The demand for pitch for home uses, especially for briquetting, rose steeply towards the end of the year, and special measures were considered by the Association to meet this demand; eventually, a system of programming, developed by the Control with the assistance of the secretaries of the National Creosote Committee and the National Pitch Committee, was introduced.

Phenol.—In the early part of the year, phenol supplies were fairly easy, due largely to the co-operation of crude tar acid producers and refiners with the Control. As the result, washing restrictions were relaxed, the Key Industry Duty was reimposed, and export licences were granted for significant quantities. At the end of 1945, however, it was found necessary, in view of a fresh shortage of phenol for home uses, to restrict exports severely, to facilitate imports by the granting of licences and by re-exemption of synthetic phenol from Key Industry Duty (which exemption came into force early in 1946).

Benzol and Toluol.—The year saw the control of toluene transferred from the Ministry of Supply to the Ministry of Fuel and Power, and the issue of consequential Orders. The Association has continued to co-operate closely with the Ministry on benzol and toluol, through the advisory Committee.

Naphthalene.—A special Naphthalene Sub-committee was set up to survey the supply-demand position and, by the end of the year, the draft of a report based on statistics collected from members was under consideration by the Sub-committee prior to submission to the consumers and the Control.

German Carbon Black

Carbon Black.—At the invitation of the Ministry of Supply, the Association appointed a representative to a team to investigate German carbon black plants; the team went to Germany after the end of 1945. Proposals for collective discussions between tar distillers who were actively interested in carbon black production and the Tyre Manufacturers' Conference as representing an important consuming industry were deferred for consideration after the investigating team had reported.

Wood Preservation.—During the year under review, the Association has co-operated with the British Wood Preserving Association and the Timber Development Association in considering the steps that might be taken to provide a body really active in the interests of wood preservation.

French Tar Industry.—Early in the year a deputation of French tar interests visited this country and was in close consultation with the Association, with special reference to the supply of crude and refined tar to France, especially the former, which was required to help to start up French tar distilleries. A deputation from the Association, together with the Controller, visited France later in the year, to resume discussion on matters of mutual interest, and the French delegation came to this country

again in October. At their request, a comprehensive series of visits to works, etc., was provided. As a result of these meetings, an Anglo-French Standing Committee was in course of being set up at the end of the year with a view to maintaining discussions on matters of common interest.

German Chemical Industry.—The Association has co-operated with the A.B.C.M. and other affiliated bodies in connection with most aspects of the post-war treatment of the German chemical industry, reparations plant, employment and interrogation of German technical experts, etc. The Ministry of Fuel and Power arranged for a team of investigators to go to Germany to examine tar distilleries there.

The Association was engaged during the year in a wide variety of other matters which, however, were of more domestic than general interest.

The following are the officers and executive committee for the ensuing year:—*President*, Mr. S. Billbrough (Yorkshire Tar Distillers, Ltd.); *vice-president*, Mr. W. A. Walmsley (Thomas Ness, Ltd.); *hon. treasurer*, Capt. C. W. Harriss (Burt Boulton & Haywood, Ltd.); *hon. auditor*, Mr. E. Hardman (E. Hardman Son & Co., Ltd.). *Executive committee*: The president, vice-president, immediate past-president and honorary treasurer, together with: Mr. L. Hilton, Mr. T. A. Wilson (Scotland); Mr. J. Colligon, Mr. W. A. Walmsley (N.E. coast); Mr. C. Lord, Mr. A. E. Brown (N.W. Coast); Mr. A. Bradbury, Mr. G. F. Peirson (N. Midlands); Mr. S. Robinson, Mr. W. H. Phillips (S. Midlands); Mr. S. Roberts, Maj. A. G. Saunders (London and S.E. Counties); Mr. H. H. Bates, Dr. T. H. Butler (S.W. Counties); Capt. C. W. Harriss, Mr. C. F. Dutton (Wales); Mr. E. Hardman (smaller distillers' representative); Col. W. A. Bristow (low-temperature distillers' representative). The immediate past-president is Mr. C. E. Carey (South Metropolitan Gas Co.).

Science and Oil

Advance on the Chemical Side

IN the course of the first Cadman Memorial Lecture, which he delivered to the Institute of Petroleum in London on March 27, Sir William Fraser, chairman of the Anglo-Iranian Oil Company, said that until the 1920's, oilfield control was largely in the hands of practical oil men, the pioneers of the industry, but geologists who had alone held the scientific field were joined by geophysicists and physical chemists and a true picture of underground reservoir conditions was brought to light and consequently the most effective method of exploitation evolved.

With the advance in scientific ways of finding and producing oil, there had been an even more impressive advance on the chemical side, leading in turn to new ideas of the multiple products obtainable from crude petroleum. Following the rapid expansion of the cracking process after 1920, about 1930-35 another revolution in petroleum refining methods took place, when synthetic hydrocarbon products, of vital importance in the manufacture of aviation spirit, came to the fore. The year 1937 saw a yet greater advance through the discovery of the alkylation process, where British research workers did some really fine work.

What of the future? Some years ago, Dr. Dunstan prophesied that petroleum would be regarded as a confused collection of chemical substances which, by careful selection and rearrangements, could be converted into practically any organic material required, be it fuel or lubricant, chemicals for synthesis, or synthetic foodstuff. His prophecy was now coming true, declared Sir William, and before them was an ever-widening panorama of possibilities.

British Colour Council

Technical Committee Appointed

THE British Colour Makers' Association has appointed a committee of its members to work in co-operation with the British Colour Council. This committee is to be known as the British Colour Makers' Technical Consultative Committee of the British Colour Council. The function of the committee is to examine, while still in course of production, any colour ranges proposed by the British Colour Council which involve the use of pigments. The object is to advise on the availability and technical suitability of commercial pigments for the conditions to which they will be exposed.

The committee consists of Mr. C. M. Beavis, Golden Valley Ochre and Oxide (Colours) Co., Ltd.; Dr. J. G. Gillan, I.C.I., Ltd. (Dyestuffs Division); Mr. J. H. Grimshaw, Horace Cory and Co., Ltd.; Mr. A. J. Holden, secretary, The British Colour Makers' Association; Mr. T. Drummond Kerr, W. Symonds, Ltd.; Mr. V. Watson, Cromford Colour Co., Ltd.

SUNVIC CONTROLS, LTD., Stanhope House, Kean Street, Aldwych, London, W.2, have developed a thermostat to meet the need for a robust and easily adjustable instrument for accurate laboratory work for which, in the past, only mercury and mercury-toluene regulators have been suitable. A description of this thermostat, known as type TS3, is given in the company's publication A.T.10(c).

Air Attack on the Chemical Reich

An American Criticism

IN a recent issue of this Journal (June 2, 1945) we published a number of photographs illustrative of the present-day condition of the German chemical industry. These photographs were of American origin, and it is again as a result of an American survey* that we are enabled to publish this note on the results of the Allied air assault on the German chemical empire. For Germany during the war was a chemical empire, built on a foundation of coal, air, and water. These three fundamental raw materials provided Germany throughout the war with 85 per cent. of her petrol, over 99 per cent. of her rubber, 100 per cent. of her nitric acid—the basic component of all military explosives, and 99 per cent. of her methanol.

In 1936 Germany produced only a third of her liquid fuel requirements, but by 1939 her rulers were so convinced that they could complete their programme of self-sufficiency in oil and war chemicals that they began the war with less than three months' supply of most essential stocks. The chemical, oil, explosives, and rubber industries in Germany constituted a vast interlocking organism. The gas-generating plants, of which the largest, at Leuna, consumed 338 million cu. ft. of hydrogen-containing process gas and 54 million cu. ft. of fuel gas in a day, constituted the body of this organism. Its arms were represented by the many plants that used those gases, and other material drawn from the coal, to produce synthetic fuels and lubricants, rubber substitutes, and explosive products.

Attacks on Oil

It was not until the spring of 1944 that the German oil industry was made a "top priority" target. There never had been a time since the war began when Germany could not have been strangled in three to four months, had it been possible to destroy her supplies of oil completely. Up to May, 1944, the Allies had sent down 509,206 tons of bombs on enemy targets in Europe, of which 1.1 per cent. went down on oil targets. None of these attacks did important harm to German oil production. From May 12, 1944, to May 8, 1945, the combined Air Forces dropped 191,256 tons on the 87 German oil-producing targets with catastrophic effects upon the enemy's war economy. The first German reaction was to offer increased fighter resistance. This caused the Allies some loss, but it resulted in a terrific drain on enemy storage tanks. By February, 1945, enemy production of oil was down to 500 tons, only 10 tons were produced in March, and none in April. On February 1, 1945, stocks amounted to a bare 82,000 tons.

As production and stocks declined the Germans were driven to desperate expedients. In September, 1944, air training was suspended and all operations except combat flying virtually ceased. German pilots were sent into battle with 40-45 hours of flight training. They were sitting ducks to the well-trained British and American air crews. Germany's large reserves of military aircraft were grounded with empty tanks, instead of being used to defend the frontiers of the Reich when the Allied Armies finally swept across them. The enemy's situation was equally serious in the field. Tanks and armoured vehicles were drawn to the front by oxen. Every motor trip exceeding 60 miles had to be authorised by a General officer. A speed limit of 17 m.p.h. was imposed to husband supplies.

Key Chemicals

Among Germany's key war chemicals were synthetic nitrogen, methanol, tetraethyl lead, and rubber. Without nitrogen not a single ton of military explosives could have been made. Methanol also was essential to certain types of explosives; tetraethyl lead was an essential ingredient in the Luftwaffe's aviation fuel. Without rubber the war machine could not have rolled.

The extraordinary fact emerges that no section of the German chemical industry was selected for deliberate concentrated attack. It was not, apparently, recognised by the Allied Intelligence until the end of the war that enemy supplies of synthetic nitrogen and synthetic methanol had, in fact, been closed down fortuitously as a result of the campaign against oil. The enemy's chemical empire resembled in some respects an octopus; it was not easy to strike at and concentrate upon the most vital parts of the organism. Nevertheless, the apparently fortuitous closing down of the enemy's supplies of nitrogen and methanol as a result of repeated attacks on the great oil plants at Leuna and Ludwigshaven helped greatly towards paralysing the Reich. Germany was deprived ultimately of 91 per cent. of her synthetic nitrogen and 86 per cent. of her synthetic methanol. The loss of these supplies produced a crippling shortage of munitions. Enemy anti-aircraft gunners were forbidden to fire unless Allied planes were actually overhead and attacking the target which the battery con-

* "How German Plants were Knocked Out by Strategic Bombs." Report by the Oil Division of the U.S. Strategic Bombing Survey. (*Chem. Met. Eng.*, 1946, *53*, 150.)

cerned had been ordered to defend. The loss of fertilisers derived from nitrogen had the effect of reducing by 22 per cent. the anticipated yield of the 1945 harvest.

By January, 1945, enemy stocks of explosives had dropped to less than two months' requirements. The enemy actually gave nitrogen plants a higher priority for repair than oil plants. Nevertheless, large explosives and propellants plants which made 70 per cent. of the total German output of high explosives were never selected for serious strategic attack. It is arguable that the production of explosives could have been curtailed more effectively, and with less expenditure of life and material, by attacking these key plants than it was by cutting down enemy supplies of synthetic nitrogen as an indirect result of the assault against his oil. As a result of a single raid by two Halifaxes which dropped two 2000-lb. bombs and 1748 incendiaries half the T.N.T. capacity of one of the 35 large explosives and propellants plants was destroyed.

Alternative Methods

There were two possible ways of knocking out the German oil-chemical organism. The first was by means of a direct blow at the conversion plants, gas-purification plants, or compressors of the process gas—the heart of the German chemical-oil organism. The second way was the indirect method of striking at the water, steam, and electric distribution systems of this organism.

The first method, although obviously the more desirable, was very difficult to achieve. Vital process installations were too strongly protected by blast walls and reinforced concrete "dog-houses." In September and October, 1944, the R.A.F. achieved the destruction of the Bottrop Welheim (Ruhroel) hydrogenation plant by hitting the high-pressure compression house with three 4000-lb. and eight 1000-lb. bombs. The plant could not operate until new compressors were installed—a twelve-months' job if new ones had been built, and a three-months' job if they had been "lifted" from some other plant. These results must be compared with those achieved at Leuna which, after being hit by 1643 tons of bombs in 22 attacks, could have reached 70 per cent. of normal capacity within a few months without the importation of any new heavy equipment.

Nevertheless, it was the second method of attack which in the end did most towards crippling Germany's chemical empire. By November, 1944, for example, there had been over 1500 breaks in the water system alone at Leuna. Each one of these, according to the plant manager, would in peace-time have been considered a serious disturbance to production. The 22 attacks on the Leuna plant resulted in over 5000 breaks in the utilities distributing systems. By achieving a small measure of productivity between attacks the plant averaged about 9 per cent. of normal output during the period of these attacks. The disadvantage of this method of attack, by damaging utilities, is that the bomb dose has to be repeated again and again. Detailed records for three plants—Leuna, Ludwigshaven-Oppau, and Zeitz—show that of 30,000 tons of bombs dropped only 3781 tons hit within the plant fences. Different aiming techniques gave the following results, in percentage of hits:

U.S., visual	26.8
U.S., part visual, part instrumental ...	12.4
U.S., full instrumental ...	5.4
R.A.F., night pathfinder	15.8

It is clear from these figures that in future training of aircrews the greatest single chance of improvement lies in an increase of bombing accuracy. Another vital need is to reduce the percentage of dud bombs. German records show that 14.1 per cent. of all bombs hitting inside the three plant areas named above failed to explode. It was frequently found that bombs had landed flat because the tail fins had become detached during the descent.

Before the opening of the great air offensive against German oil in the spring of 1944, 53 per cent. of the 509,200 tons of bombs dropped were aimed at large centres of population, and only 13 per cent. at industry (including 1.1 at oil targets). During the oil offensive 27.5 per cent. of the 1,477,217 tons dropped were aimed at population centres and 22 per cent. at industry (including 19.5 per cent. at oil targets).

Damage to Morale

It is perhaps natural that the Oil Division of the U.S. Strategic Bombing Survey should criticise, from their standpoint, the comparative smallness of the percentage bomb load rained down upon oil targets. It is fair to point out, however, that other considerations, too, need to be taken into account. It is probable that if the Psychological Warfare Branch were consulted as to its view of the overall effects of Allied bombing, it would stress the vital damage to morale resulting from saturation attacks on lower-middle-class residential areas. It is, after all, from these areas that the enemy draws the mass of his best industrial workers, and the dwellings concerned are so constructed as to offer the greatest scope to the blast and incendiary effects of mass bombing.

The conclusions reached by the Survey team as a result of its investigations are interesting. It considers:

(1) That the Allied air assault stopped enemy oil production with decisive military results.

(2) That the air assault indirectly but nevertheless effectively stopped enemy pro-

duction of military explosives, thereby contributing an additional decisive military result.

(3) That those results could have been achieved with less expenditure of life and material if: (a) targets had been more intelligently selected; (b) a much larger proportion of the heaviest high-explosive bombs had been used against industrial targets; (c) bomb-aiming had been improved; (d) the duration of the raids had been prolonged, and incendiaries had been dropped or set to ignite several minutes after the high explosives had gone down; and (e) sounder military intelligence had been available both as to the targets and as to results.

(4) That as regards the future of air bombing none of the protective measures followed by the Germans is likely, even after major improvements, to provide full protection to British or American industry against enemy air attack.

New Use for Silica

Minister of Health's Statement

A STATEMENT that negotiations were nearing completion for the provision of a house from a china-clay company, using silica deposits as concrete blocks, was made by the Minister of Health, Mr. Aneurin Bevan, when he addressed a housing conference of delegates from Devonshire and Cornish local authorities at Plymouth on March 30. He added that considerable numbers of such houses should be provided for Plymouth.

Commenting on the shortage of bricks in West Cornwall, he said: "There appears to be every reason why these deposits, which are by no means pretty, should be used as basic material. I am also going to explore the possibility of the blocks being made for shipment. So long as there is a brick shortage these blocks may easily be a substitute for areas which are beyond land transport possibilities."

Plastics in Scotland

New Report Published

"PLASTICS in Scotland" is the title of a report just issued by a committee of the Scottish Council on Industry, price 1s. At a recent conference in Glasgow, when the report was first presented, Professor W. M. Cumming, Director of the School of Chemistry at the Royal Technical College, Glasgow, commented on the possibilities of plastics manufacture in Scotland. Ample supplies of coal were available, he said, to supply phenol and unsaturated gases —the bases of various groups of plastics— and he cited the enormous developments with acetylene in Germany. He pointed out that the country was also well equipped with technologists who could deal with the refining of oil, an industry from the by-products of which an enormous plastics industry had been built up in America.

In the course of the report the committee claims that the ramifications of the plastics industry are so wide that its firm establishment is a necessary corollary of industrial development in general. It will act as an adjunct to existing industry, and will not displace the use of light metals and other materials which have their own field.

The committee is proposing to summon a conference of the leaders of the chemical industry in Scotland, including all those producing gas, with representatives of the existing plastic industry and the North of Scotland Hydro-Electric Board.

Hydrogen Peroxide

Great Increase in Strength

WHEN B. Laporte, Ltd., began manufacturing hydrogen peroxide in Luton, nearly sixty years ago, few people could have anticipated the extraordinary developments that would take place in regard to the range of uses to which the product would be applied, or the concentration and stability of the product itself.

The 10-vol. hydrogen peroxide of those early days only trebled in strength in the next 22 years, but a 130-vol. product was available by 1924, and this represented the results of many years of intensive research and manufacturing skill. By the time the recent war had started, a further notable advance had been made, and Laporte were in a position to produce hydrogen peroxide of 410-vol. strength, which represents 90 per cent. hydrogen peroxide by weight, and only 10 per cent. of water. Unfortunately, it was not possible to announce this fact during the war, for security reasons. The importance of this precaution is indicated by the fact that similar concentrated hydrogen peroxide, but of only 80-85 per cent. by weight, was used by the Germans in connection with the launching and propelling of their V weapons.

With the end of the war, Laporte are in a position to announce their new product, not as a curiosity of the laboratory, but as a commercial product. The fears that such a concentration would be dangerous to handle are not justified, as the new product is stable on account of its purity, and safe to handle, if the proper precautions are taken. Hydrogen peroxide has always been considered an ideal oxidant, as it leaves no residue. The concentrated product will find employment in many new directions, as the concentration considerably increases the speed of oxidation and the completeness of many reactions, and also initiates reactions which are not possible with lower concentration.

Parliamentary Topics

Stocks of Copper and Lead

IN the House of Commons last week, Mr. Marples asked the Minister of Supply why stocks of virgin copper had dropped from 307,900 tons in January, 1945, to 122,900 tons in December; and why stocks of refined lead had dropped from 126,500 tons in June, 1945, to 64,800 tons in December; and whether he was taking any steps in the matter.

Mr. Wilmot said that the stocks of copper were adequate for current needs in December, and steps were being taken to maintain them at that level; and that, in regard to lead, production had not expanded to match the large increases in world demand since the end of the war. They were doing all they could to secure a fair share of available supplies, and they expected, by rationing and by using substitute materials, to meet all essential needs.

In reply to a suggestion by Mr. D. Eccles that the bad stock situation would not have arisen if they had not had bulk buying, but had had the London Metal Exchange working freely, Mr. Wilmot said he could not accept that interpretation.

Sir Gifford Fox asked why there had been a 30 per cent. cut from January 15 in lead to sheet, pipe, and paint manufacturers; to which Mr. Wilmot repeated that there was a severe world shortage of lead which made it necessary to ration supplies to all consumers.

Formaldehyde Workers, Bridgwater

Mr. Vernon Bartlett asked the Minister of Supply his plans as to the future of the Royal Ordnance Factory at Bridgwater, and whether the men in that factory were to be used. First of all they were told they were going to produce formaldehyde; then they were told they were not going to produce it.

Mr. Wilmot said that the factory would be retained for Service requirements; it was not expected that the number of persons employed there at present would be reduced.

Carnauba Wax

Mr. W. Shepherd asked the President of the Board of Trade whether he was aware that since the removal of the ceiling price for carnauba wax the price had soared to over £700 per ton; and whether he would confer with the U.S.A. with a view to appropriate action.

Mr. Belcher replied that the limitation of prices depended on the control of imports which, in the case of the U.S.A., was withdrawn after VE-Day. He did not think that the U.S. authorities would now be prepared to re-impose that control, but the price might be expected to fall again with the slackening of the present abnormal demand and the increase in supplies of substitutes.

Mr. Shepherd: Will the hon. gentleman say why he permitted re-exporting of carnauba wax a few months ago, when the price was almost half what it is to-day; and is he aware that this is causing us loss of currency?

Mr. Belcher: No, sir. I could not forecast a few months ago what the price was going to be today.

Linseed : Putty and Whiting

Sir G. Fox asked the President of the Board of Trade why linseed is in short supply to the manufacturers of putty and paint.

Mr. Belcher said that the shortage of linseed oil available for the manufacture of putty and paint and for other industrial uses was due to the world shortage of vegetable oils and oil seeds.

Sir G. Fox asked the Minister of Works why factories stopped putty production for a fortnight in February; and what efforts were being made to increase the production of whiting, which industry is suffering from labour shortage.

Mr. Tomlinson: Of the three putty factories where production was interrupted in February, one closed for two weeks and one for five days, both because of the shortage of linseed oil, while the third was closed for two days to allow essential repairs to be carried out to machinery. The production of whiting is being increased, both by recruitment of labour and by extensions to existing plant and buildings.

A similar reply was made to Mr. W. Shepherd on the question of the shortage of whiting.

Fuel for Power Stations

Mr. Janner asked the Minister of Fuel and Power the present proportion of coal and fuel oil used in steam power stations in Great Britain. Mr. Shinwell said that in 1944, the latest period for which full information is available, 5287 tons of fuel oil were used in steam power stations of authorised electricity undertakers, as compared with 23,118,807 tons of coal. Of the 37,000 million units generated at these stations in 1944, it is estimated that 17 million were produced by oil-fired plants.

Lead Production : Tanganyika

Sir P. Bennett asked the Secretary for the Colonies the prospects of lead production in Tanganyika as a result of recent discoveries; and the terms on which the mines were to be worked by the concessionaires.

Mr. George Hall: I am advised that recent discoveries of lead-bearing ore on mining leases held by Urawira Minerals, Ltd., in Western Tanganyika offer promising prospects of successful exploitation. I am in consultation with the Governor regarding railway access and the terms on which these discoveries should be worked.

The Production of Beryllium

German War-Time Practice

BERYLLIUM production has long been one of the most important activities in the minor metal industries of Germany. Until now, practically the entire world output of this rather unusual metal has been confined to Germany. The main lines of utilisation of this metal are the manufacture of the copper-beryllium alloys with their remarkable aging and hardening properties, and the production of X-ray windows.

In view of the German monopoly of production of this metal, it is interesting to find a complete and detailed account of the methods of manufacture of beryllia and beryllium in a recent report (production of Beryllia and Beryllium at Degussa Plants; B.I.O.S. Report No. 158: Item No. 21). According to the information received, the Deutsche Gold und Silber Scheideanstalt (Degussa) was the sole producer of pure beryllium metal in Germany, reduction, smelting and refining plants being located at Frankfurt-am-Main. With a rated capacity of 10 to 20 tons of beryl ore per day, these plants produced in the pre-war years about 500 kg. of beryllia and 700 kg. of beryllium metal annually. During the war cumulative figures for production were 18.8 metric tons of beryllia and 4.1 metric tons of beryllium metal. Formerly, supplies of beryl ore were obtained mainly from Brazil, while during the war imports were secured from Portugal, Scandinavia, and Italy.

Technical Beryllia

In the manufacture of technical beryllia, the raw ore, containing 10 to 12 per cent. of beryllia, is finely crushed and then sintered with calcium oxide in a rotary furnace at 1500° C. Beryllia is then dissolved from the sinter with concentrated sulphuric acid. Additions of glue help to coagulate the silica, which, together with the calcium sulphate, is then filtered off, leaving a solution containing the sulphates of beryllium, aluminium, and iron. By the addition of ammonium sulphate, aluminium ammonium alum is formed and crystallises out when the solution is cooled down to 15° C., the crystals so formed being removed in a rubber-lined centrifuge. Iron is oxidised to the ferric state and precipitated as the hydroxide by the addition of powdered chalk. Traces of calcium sulphate, also precipitated, are removed with the ferric hydroxide in a filter press. Ammonia, added to the filtrate, precipitates the beryllium as a sludge of beryllium hydroxide, containing only about 6 per cent. of beryllium oxide. The sludge is filtered, dried, and calcined at 1000° C. for about one hour in a continuous kiln furnace.

For the extraction of the metal from the calcined oxide, the beryllium is transformed into the chloride before electrolysis. The oxide is briquetted with powdered charcoal, forming cylindrical briquettes, 2 cm. by 6 cm., which are subsequently fired for a few minutes at 1000° C. before transfer to the electrolytic chlorination cell. Chlorination is effected in a steel tank lined with acid-proof bricks, the calcined briquettes being fed into the space between the two vertical carbon electrodes. Power supply to the electrodes is regulated to maintain a temperature of 700-800° C., while a stream of chlorine is introduced at the bottom of the container. Beryllium chloride, formed under these conditions, volatilises, the vapour being trapped in a condenser fitted to the top of the cell.

Treatment of the Chloride

Crude beryllium chloride so produced contains a number of impurities—mainly silicon, aluminium, and ferric chlorides—from which it is freed by a process combining reduction and sublimation. The crude chloride is subjected to the action of hydrogen at a temperature of 500-550° C., when the ferric chloride is reduced to the non-volatile ferrous compound. Simultaneously the beryllium chloride sublimes off, carrying varying quantities of silicon and aluminium chlorides. The vapours are passed through two conical condensers in series, in the lower of which, maintained at a temperature of 350° C., approximately 94 per cent. of the beryllium chloride condenses. This product contains only 0.1 to 0.2 per cent. of aluminium chloride with traces of silica, silicon chloride, and ferrous chloride. The remainder of the beryllium chloride, heavily contaminated with aluminium chloride, condenses in the second condenser and is returned to the beginning of the process.

Metal Recovery and Refining

Beryllium chloride from the first condenser is mixed with an equal weight of sodium chloride and electrolysed in a nickel crucible at a temperature of 350° C., the crucible drawing about 500 amps. at 40 to 50 volts. Exterior resistance elements assist in maintaining the temperature of the crucible. After 24 hours' operation the electrolyte is siphoned from the crucible to a second preheated crucible, additions of fresh electrolyte are made and the electrolysis continued. Beryllium metal is found deposited as glit-

tering dendritic flakes on the walls of the crucible from which the electrolyte has been siphoned. These metal flakes are pressed to remove traces of electrolyte, washed in water to remove any further adhering traces of electrolyte, and finally purified by washing with a sodium hydroxide solution followed by nitric acid. Recovery of metal flakes from the ore is about 75 per cent.

Refining of the pressed metal flakes is effected by first melting the pressed cake at 1400° C. in an atmosphere of hydrogen, using a slip cast beryllium oxide crucible. Final melting is effected under vacuum in a molybdenum-wound resistance furnace. The furnace is of the tilting type with the mould enclosed in the vacuum chamber which is stated to be maintained at a pressure of only 10^{-4} mm. of mercury. The metal finally obtained from the moulds is stated to have a purity of 99.8 per cent.

For the fabrication of X-ray windows the beryllium metal bars from the previous operation are cut on a dry carborundum wheel, polished, and ground to a thickness of 2.5 to 3 mm. It is claimed that pure beryllium metal might be rolled, but that the manufacture of such high-purity metal would require vacuum distillation and would be a very expensive process.

Plastics Group

New Officers Appointed

THE Plastics Group of the Society of Chemical Industry is to hold its annual general meeting in the latter part of May, it is announced. Full details will be given later. Meanwhile the Group Committee has appointed the following officers for 1946-47: Chairman, Mr. N. J. L. Megson; vice-chairman, Mr. G. Dring; hon. recorder, Mr. C. S. Hollis. Dr. S. H. Bell, Mr. Austin Lowe, and Mr. H. Langwell were re-appointed, respectively, to the positions of hon. secretary, hon. treasurer, and hon. hospitality officer.

Members of the committee who retire under Rule 7 and are ineligible for re-election are: Dr. W. Blakey, Mr. J. Hetherington, Dr. H. W. Melville, and Mr. Alan Speedy. To fill two of the vacancies, the committee has appointed Mr. J. Idris Jones and Dr. J. C. Swallow; members are invited to make nominations for the other two seats on the committee, such nominations to be signed by at least two members and by the nominee, and to reach the hon. secretary (at the Paint Research Station, Waldegrave Road, Teddington) by April 27.

MR. CHARLES EDWARD HILL, Director of Ordnance Factories, Indian Ordnance Service, died at sea on April 1, on his way home from India.

Institute of Fuel

Annual Report : Mr. Pope's Retirement

THE annual report of the Institute of Fuel, placed before the corporate meeting on April 11, records the appointment, as secretary and registrar, of Mr. R. W. Reynolds-Davies, assistant secretary since last October. He succeeds Mr. P. C. Pope, who has resigned to become adviser to the Institute after having been secretary since its earliest days. In expressing their appreciation of Mr. Pope's energy and enthusiasm, and of the great contribution his work and knowledge have made both to the development of the Institute and to fuel technology in general, the Council have unanimously recommended him for election as an honorary member of the Institute.

Earlier in the year under review, Mr. J. F. Ronca succeeded Mr. J. D. Troup as hon. secretary, while Mr. R. H. Gummer replaced Mr. A. L. Lunn as hon. treasurer, Mr. Lunn having resigned both from this office and from the position of vice-president on account of ill-health. On the recommendation of the Policy Advisory Committee, it was decided to reduce the number of vice-presidents to six. During the year, in addition to Mr. Lunn, Sir George Usher resigned from the vice-presidency. Dr. E. S. Grumell was unanimously elected to fill one vacancy, while the other remained unfilled. At the annual meeting, Mr. E. C. Evans relinquished office to give effect to the policy of reduction, while the following were re-elected: Professor C. H. Lander, Dr. Grumell, Messrs. S. McEwen, J. D. Troup, J. Stanleigh Turner, and Lieut.-Col. W. A. Bristow.

Total membership at March, 1946, was 2407 (excluding collective members) and 2557 (including collective members), against 2057 and 2181 a year earlier, and 1038 and 1096 in 1939. Strength in all sections increased during the year: Professor D. T. A. Townend is now chairman of the membership committee, while Dr. P. O. Rosin succeeded Mr. Troup as chairman of the papers committee.

Charter Petition Revived

Consideration of petitions for the grant of Royal Charters having been resumed by the Privy Council towards the end of last year, the Institute's petition, originally addressed to His Majesty in Council in August, 1939, was revived, and is now under consideration by the Privy Council. The charter committee has accordingly been reconstituted, with Professor C. H. Lander as chairman and Dr. G. E. Foxwell as secretary, with a view to submitting the proposed bye-laws of the Institute first to the Council of the Institute and then to the Privy Council for final approval.

South African Chemical Notes

Review of Most Recent Developments

(from our Cape Town Correspondent)

THE reasons for the South African Government's decision to retain ownership of the Klipfontein factory for the manufacture of DDT were outlined in a White Paper tabled in the House of Assembly by the Minister of Economic Development.

The White Paper states that it was decided in 1940 to produce war gases, and two factories were constructed, one at Klipfontein, embodying processes and plants designed by the Union Defence Force, and one at Firgrove, near Cape Town, on behalf of Great Britain. When the need for poison gas supplies passed, the Klipfontein factory was diverted to manufacture DDT required for military use. In July, 1945, the plants lay idle, but were contaminated with hundreds of tons of highly toxic materials. It was estimated that the work of decontaminating the Klipfontein plant would keep a staff of experienced workers busy for at least 18 months. To retain the services of a highly specialised staff it was essential to offer at least some inducement for them to see the job through and the Government accepted the management board's recommendation that the manufacture of DDT should be continued at Klipfontein under Government ownership.

Great Need for DDT

The need for DDT in the Union to-day, the White Paper says, is great and its application wide. The Department of Public Health urgently requires supplies to combat typhus in the Transkei, to suppress malaria in the North-Eastern Transvaal, and to deal with relapsing fever in the Northern Transvaal. The Department of Agriculture is anxious to obtain supplies to eradicate the blowfly, to combat the tick menace, and to assault the tsetse-fly. The civilian population is looking for protection of food supplies from fly infection, and the elimination of the house-fly and many other household pests. It is quite possible that the successful application of DDT in a nation-wide health campaign will result in the Government becoming the principal consumer of the Klipfontein production. The initial investment enabled the factory to produce 20 tons of compounded DDT a day, and to provide direct employment for nearly 400 people. The completed factory will employ between 600 to 800 and indirectly another 200.

It has been suggested in Cape Town that South Africa may lead the world in the production of fish flour for human consumption. Experiments are being carried out by the chairman and managing director of a Cape Town firm manufacturing fish meal and oil. It is claimed that large-scale production of fish flour for human consumption would solve the food problems of the Union and most other countries. It is rich in proteins, vitamins, and many essential mineral salts, and has already been produced experimentally. It can be used in the making of bread, biscuits or, with mealie meal, a 7½ per cent. admixture giving the necessary basic nutritional requirements. Many months ago biscuits were produced containing 10 per cent. admixture of this flour. These biscuits are to-day fresh and wholesome and have no trace of a fishy taste.

Perfect Fish Flour

Although South Africa is said to be leading the world in the quest for the perfect fish flour for human consumption, there remain certain snags in the way of large-scale production. An expert will leave shortly for Britain, Canada, and the United States to search for machinery necessary to overcome these snags. This expert has been wrestling with the problems of fish flour for many years, and in the last two years has been joined in his work by Dr. F. W. B. Osborn, the distinguished nutritional expert of the University of the Witwatersrand, who has had an important share in carrying the work to its present point. If this task is taken over its final hurdle another important chapter will have been added to the history of the South African fish by-products industry.

The Secretary for Public Health said recently that the Government was experimenting to ascertain the best way of introducing food yeast into the daily diet of large sections of the population who needed it most. It would first be necessary to establish a basic diet and then to build it up into a properly balanced diet. It was hoped that South Africa would be able to provide the basic diet. He said it was not a question of producing food yeast by the ton or allowing it to get on the market as another magic cure for all ills. The Government was making arrangements to buy it and to feed it to the people in the proper way. Authority has been given for the Government to purchase 50 tons of food yeast from a Natal firm.

A plant for the manufacture of cyanide for use by the gold-mining industry is to be set up during the next few months by African Explosives and Chemical Industries, Ltd., at the Klipspruit Sewage Disposal

Works, outside Johannesburg. Methane gas will be used in the manufacture of cyanide, and the company's synthetic plant at Modderfontein will supply the necessary ammonia. The company states that the new development has been made possible by close co-operation with I.C.I.

The export possibilities of certain chemicals manufactured in South Africa are stated to be very good. The South African antiseptics and disinfectants are of a very high standard, and the prices competitive. Oversea buyers have on several occasions expressed appreciation of the quality of these products.

A new company with a capital of £300,000 has recently been formed under the name of the Capital Match Corporation, Ltd. The company plans to manufacture safety matches at Bloemfontein, where a 20-acre site may be purchased. The output is expected to be 1400 gross boxes a day, with an output of 2100 gross boxes at a later date.

Russia's Chemical Output

The Fourth Five-Year Plan

THE report presented to the Supreme Soviet by A. Voznesensky, chairman of the State Planning Commission of the U.S.S.R., provides for an increase in chemical production in the Soviet Union by 160 per cent. in 1946-50.

The need for increased fertiliser supplies seems to be particularly urgent. Phosphatic fertiliser output is to be doubled and that of nitrogenous and potassic materials is to be raised by 80 and 30 per cent. respectively. The total production of chemical fertilisers will be 17,000,000 tons, as compared with 8,700,000 tons during the second Five-Year Plan (1931-1935). It is further stated that the pre-war output will be surpassed by 1950. Thus it appears that a considerable part of the new plant will serve merely to replace war damage, but special attention will be paid to developing fertiliser industries in such regions as Uzbekistan, Kazakhstan, and Armenia, a policy which commends itself both on grounds of transport economy and because of the special claims of farmers in these quickly progressing regions. A deputy from Byelorussia suggested that funds should also be made available for superphosphates and nitrogenous fertiliser plants in this most westerly region.

Considerable attention will again be paid to the production of synthetic oil and rubber as well as artificial fibres, leather and plastics. The production of synthetic rubber is to be doubled. The new synthetic fuel plants will have a capacity of 900,000 tons per annum, equal to 4 per cent. of the proposed mineral oil production. The chemical industry will be among the chief consumers of concentrated solid fuel and coal briquettes, for which greatly extended production facilities are to be made available. Underground gasification is also to be encouraged, and gas production increased to 11,200,000,000 cubic metres.

Aluminium production is to be doubled and that of magnesium is to be increased by 170 per cent., largely, it would seem, to make up for war losses. The production of copper is scheduled to increase by 60 per cent., nickel by 90 per cent., lead and zinc by 150 per cent., and tin by 170 per cent. Mining of rare metals will be developed in Kirghizia. A new big copper combine is to be founded in Kazakhstan, and the Lake Balkash copper smelter is to treble its output by 1950 as compared with 1940. A "second Magnitogorsk" for non-ferrous metals is projected in Chingaskhan.

Non-Ferrous Metals

Maximum Prices Increased

THE maximum prices for copper, lead, zinc and zinc products have been increased as follows: Copper, by £10 per ton; lead, by £6 per ton; zinc and zinc sheets, by £8 per ton; zinc oxide, by £7 per ton.

Holders of valid licences to purchase copper, lead or zinc metal (as sold by the Directorate of Non-Ferrous Metals) granted on or before April 6, 1946, may on application to the Directorate at the Grand Hotel, Rugby, cover themselves by purchases, where they have not already done so, against such licences up to and including April 22 at the maximum prices ruling on April 6.

The new Order further provides that licences will now be required for (a) unwrought (No. 22) (Copper, Lead & Zinc) Order, 1946, (S.R. & O., 1946, No. 494) which came into force on April 8. This Order revokes and re-makes in consolidated form, with amendments, the Control of Non-Ferrous Metals (Nos. 11, 17 and 20) (Copper, Lead and Zinc) Orders, 1942-46, together with Directions Nos. 1 and 2 under the (No. 11) Order.

The new Order further provides that licences will now be required for (a) unwrought antimonial lead of all grades; (b) all other unwrought lead alloys containing not less than 97 per cent. of lead; (c) all scrap of lead alloys which contain between 10 per cent. and 75 per cent. lead. Previously only scrap of lead alloys (other than specifically designated scrap, viz., solder, printing metal, and battery plate scrap) containing more than 75 per cent. of lead, was subject to licence. Now all scrap of lead alloys containing 10 per cent. or more of lead is subject to licence.

The existing list of prices of non-ferrous scrap metals issued by the Directorate of Non-Ferrous Metals is withdrawn, and will shortly be replaced by an amended list.

Personal Notes

MR. G. BREARLEY, B.Sc., F.R.I.C., has been appointed a joint managing director of Brotherton & Co., Ltd.

SIR WILLIAM PALMER, K.B.E., C.B., principal industrial adviser to the Board of Trade, is retiring from that office and from May 1 will succeed the late Sir Percy Ashley as chairman of the British Rayon Federation.

DR. A. B. BADGER, M.A., has been appointed manager of the Federation of Gas Employers and will take over from the present manager, Col. S. S. Ogilvie, on July 1.

MR. ROBERT TOUGH, B.Sc., of the Widnes staff of I.C.I., whose candidature was recently announced, has been returned as Councillor for the Waterloo Division of Widnes District Council, representing the Labour interest.

MR. W. T. KIPPS has resigned the chairmanship of Joseph Crosfield & Sons, Ltd., and William Gossage & Sons, Ltd., and MR. P. A. W. CAME has been elected chairman of directors. Mr. Kipps is retaining his directorship of both companies until his return from abroad later in the year.

MR. ROBERT SHONE, who has been appointed secretary of the British Iron and Steel Federation, was in charge of the statistical and economic work of the Federation from 1936 until the outbreak of war, when he became General Director of Statistics in the Iron and Steel Control.

MR. J. S. HOLLINGS, of Guest Keen Baldwins Iron & Steel Co., Ltd., Port Talbot, Glamorgan, has been awarded the Bessemer Gold Medal for 1946 by the Council of the Iron and Steel Institute, for distinguished services in encouraging technical improvement in the manufacture of iron and steel.

MR. ARTHUR HACKING who has been appointed chairman and managing director of Bryant & May, Ltd., in succession to the late Sir Charles Bartholomew, was formerly deputy-chairman and joint managing director, in which positions he has been succeeded by MR. H. G. REED, a director for the past twelve years.

MR. A. S. CHAMBERLAIN, B.Sc., who retired from the board of I.C.I., Ltd. (General Chemicals Division), at the end of March, had had a long association with the chemical industry in an administrative capacity. Educated at University College School and London University, he became secretary of Electro-Bleach and By-Products, Ltd., London and Middlewich, in 1913. The company used the Hargreaves-Bird electrolytic process for the decomposition of brine, and Mr. Luke Hargreaves, son of James Hargreaves, one of the inventors of the process, was operations manager at Middlewich at the time. In this connection it is interesting to note that for some time past Mr. Chamberlain's secretary, first at Middlewich and then at Liverpool, has been Mrs. V. Bostock, a grand-daughter of James and a daughter of Luke Hargreaves. Electro-Bleach and By-Products was acquired by

Mr. A. S. Chamberlain.

[*Courtesy, "Widnes Weekly News"*

Brunner, Mond in 1920, and in due course passed by amalgamation to I.C.I. in 1926, Mr. Chamberlain having remained in his secretarial post throughout. In 1927, however, he was transferred to Liverpool as chief accountant to the United Alkali Company, and later of the General Chemicals Division of I.C.I. In 1939 he was appointed to the board of the Division as finance director, though retaining until recently the office of chief accountant also.

Obituary

DR. THOMAS CALLAN, of Bramhall, Cheshire, who died recently at the age of 60, was head of the analytical department of the Dyestuffs Division of I.C.I., Ltd., for many years, and not long ago became a director of I.C.I. (Pharmaceuticals), Ltd.

MR A. EDGAR KNOWLES, who died at Colwyn Bay, N. Wales, on March 31, aged 75, after a long illness, was chairman and managing director of the International Electrolytic Plant Co., Ltd., Sandycroft, Chester. Mr. Knowles was born at Blackburn and educated at Dulwich College. He was a pioneer in research on the manufacture of oxygen and hydrogen by the electrolysis of water. He had many inventions to his credit, the most noted being for the electro-chemical cell that bears his name. About 1910 he founded the Knowles Oxygen Company, and started manufacturing the Knowles Electrolytic Cells, which have since been installed in most countries. The company was re-formed some years later, and has since been known as the International Electrolytic Plant Co., Ltd.

General News——From Week to Week

The empty munition factory at Dalbeattie, Kirkcudbrightshire, used by I.C.I. during the war for explosives manufacture, has been taken over by the Admiralty for storage purposes.

B. Laporte, Ltd., of Luton, with their associated companies, National Titanium Pigments, Ltd., and Genoxide, Ltd., have opened a sales office at 17 Cadogan Street, Glasgow, C.2, to cope with their increasing sales in Scotland.

The number of fully qualified men in the industrial chemistry sphere in Scotland is estimated at about 1000, and at present rates Scottish universities are turning out considerably more graduates than are required to fill vacancies.

The Road Tar Research Committee has published "Road Tar Bulletins Nos. 1 and 2." The former deals with full-scale surface-dressing experiments as the result of prolonged study of the factors and improvements in technique, and the latter deals with the viscosity of road tars.

The Minister of Supply announces that as from April 10 the price of virgin aluminium in ingot or notch bar form is reduced from £85 to £67 a long ton delivered into consumers' works. The new price applies to metal of a purity of 99 per cent. to 99.5 per cent. inclusive, with premiums for higher purities.

Young industrial chemists are reminded of the annual award of the Students' Medal and prize offered annually by the Institute of Fuel. Particulars of the rules governing the competition were published in THE CHEMICAL AGE on June 24, 1944 (*50*, p. 606), and entrants are reminded that papers must be received by the secretary on or before September 1.

While two Scottish coal pits are being closed (Gateside, Cambuslang; Fauldhouse, West Lothian) on account of low production and unofficial stoppages, it is announced that a new colliery, designed to produce 1000 tons a day, is being developed in the Douglas Valley, Lanarkshire, by Wilsons & Clyde Coal Co., Ltd., and should be capable of employing 600 men.

From the income of the trust created in 1940 by Mr. Charles F. R. Brotherton, payments amounting to £10,000 are being made for charitable and educational purposes in centres associated with the interests of Brotherton and Co., Ltd. Grants made in Liverpool amount to £1010, benefiting nearly thirty organisations. The sum of £450 goes to Liverpool University for post-graduate scholarships.

Thought to have been due, possibly, to an electrical fault, a fire broke out at night, last week, at the chemical works of Sadler and Co., Ltd., Middlesbrough, resulting in the destruction of the naphthalene plant, hundreds of tons of naphthalene, three railway wagons, which were in the loading bay, and a number of small buildings.

The Minister of Labour has announced that the chemical industry (apart from certain undertakings engaged in the manufacture of heavy chemicals or fertilisers), and the stoneware industry, will be withdrawn from the scope of the Essential Work Order at the end of three months, *i.e.*, about the end of June.

In order to dispel the misunderstandings which seem to be widespread concerning the Government's vocational training scheme, the Ministry of Labour is preparing a leaflet dealing with a number of the points which are most frequently the subject of inquiry. In the meantime, THE CHEMICAL AGE, is in a position to deal with queries from readers on the subject.

An Iodine Pharmacopœia is being compiled by the Iodine Education Bureau, Stone House, Bishopsgate, London, E.C.2, in order to meet the increasing demand for information from medical men, research workers, and others. Readers of THE CHEMICAL AGE whose products contain iodine or any of its compounds, are asked to send details of their products to the Bureau for inclusion in the Pharmacopœia, so as to make it as comprehensive as possible. No charge will be made, and the Bureau will supply forms on which the kind of information desired may be entered.

Foreign News

Steel control in India has now been lifted.

Government control of tin in South Africa has been withdrawn.

Calcium was produced in Canada for the first time last year. The relatively small output of 20,000 lb., valued at $22,300, was recovered by Dominion Magnesium, Ltd.

Deliveries of phosphates from North Africa in 1946 are expected to attain the figure of 4,000,000 metric tons, against 2½ million in 1945, and 1¾ million in 1944, according to the Comptoir des Phosphates de l'Afrique du Nord.

The Tube Investments group has started production on a contract for 5000 tons of locomotive boiler tubes for the rehabilitation of the French State Railways. The contract involves the fabrication of 260,000 precision steel tubes.

Brazil's exports of pyrethrum flowers in the period January-October, 1945, amounted to 1008 metric tons, valued at $323,586. The entire quantity was shipped to the United States.

The explosives plant at Allendorf, near Marburg, extending over five square kilometres and said to be one of the largest plants of its kind in Europe, has been blown up by the U.S. military government. Merely the power station and the waterworks have been left intact.

The successful commercial-scale production of good-quality sponge iron in the United States is described in a publication of the Bureau of Mines, demonstrating that periodic brick kilns can be used advantageously without alteration. It is reported that 468 tons of sponge iron comparable in quality to that made in well-known famous Swedish kilns has been produced.

United States pig-iron output may be increased by 500,000 tons a year, according to the Civilian Production Administration, which plans to reopen three blast furnaces and to increase the output of other furnaces. Pig-iron production averaged about 62,000,000 tons up to the year 1944, but last year's figure is believed to have shown a considerable decline.

A considerable expansion in refinery capacity of the Norbottens Jaernverks A/B., Lulea, the well-known iron works owned by the Swedish Government, is at present under consideration. The Government intends to construct new blast furnaces, steel furnaces and rolling mills, some having a larger capacity than hitherto employed in the Swedish iron and steel industry. It is reported that representatives of the company will go abroad to study the problem.

The initial production programme of the Volta Redonda plant, which started operations in March, is estimated at 300,000 tons of steel, but the ultimate production target has been put at 1,000,000 tons yearly. Facilities of this important Brazilian plant will be greatly enhanced by the construction of a new foundry with an annual capacity of 30,000 tons, to provide castings for the maintenance of the plant, including ingot moulds for the open hearth.

The French company, Société Languedocienne de Recherches et d'Exploitations Minières, reports that from the sulphur deposits at Malvézy, near Narbonne, it expects to produce this year 35,000 tons of ore, enriched to 30 per cent. sulphur content by flotation. Extraction began in 1944, and the flotation process came into action in 1945. The company claims that this year's output of the enriched product will be equivalent to 30,000 tons of brimstone, at present imported for the protection of vineyards (*L'Ind. Chim.*, March, 1946, p. 48).

A magnetic survey is shortly to be made of iron-ore deposits in the districts of Momi and Wai, Fiji. Successful experiments have been carried out with the use of ore from the same area as an ochre for colouring cement mixtures and paints.

Regarding a recent question in the House of Commons on thorium deposits in the State of Travancore, it is worthy of note that Travancore ilmenite contains from 2 to 3 per cent. of thorium. These deposits do not seem to be large, but it appears that no thorough estimates of reserves have been made.

Forthcoming Events

April 17. Institute of Fuel (Yorkshire Section). Royal Victoria Station Hotel, Sheffield, 2.30 p.m. Annual general meeting.

April 17. Society of Dyers and Colourists. Bell Hotel, Leicester, 6.30 p.m. Mr. D. Entwhistle: "Synthetic Fibres from Natural Polymers" (Third Mercer Lecture).

April 17. Society of Chemical Industry (Food Group). Rooms of The Chemical Society, Burlington House, Piccadilly, W.1, 6.30 p.m. Annual general meeting. Dr. C. S. Hanes: "Food and Phylogeny."

April 18. Institute of Fuel (E. Midland Section). Demonstration Theatre, Gas Department, Parliament Street, Nottingham, 3 p.m. Mr. O. Lyle: "Inefficiency."

April 24. Institute of Welding. Institution of Civil Engineers, Great George Street, Westminster, London, S.W.1, 6 p.m. Major R. J. Fowler and Major L. F. Denaro: "The Evolution of Welded Armoured Fighting Vehicles."

April 26. Oil and Colour Chemists' Association (Bristol Section). Grand Hotel, Broad Street, Bristol, 6.15 p.m. Annual general meeting.

S.C.I. Food Group

Details of Summer Meeting

AN attractive programme has been arranged for the summer meeting of the Society of Chemical Industry Food Group in Scotland, from May 30 until June 3 inclusive. Most of those attending will travel up from London to Carlisle on May 30 and proceed to allotted hotels, afterwards meeting at the Crown and Mitre Hotel for an informal social function in the evening. A visit to Carr's Biscuit Works the next morning will be followed in the afternoon by a coach trip to Ayr, for a scientific meeting in the evening, arranged by the Nutrition Panel.

On June 1 there will be visits to the

Hannah Dairy Research Institute, Kirkhill, Ayr; the West of Scotland College of Agriculture, Auchencruive; and Alloway (Burns Cottage, Burns Monument, the Auld Kirk and the Auld Brig). A whole day excursion by motor coach to places of interest is planned for June 2, and the programme for the final day will include a visit to the yeast factory of the Distillers Co., Ltd., and a visit to Edinburgh, where the concluding dinner and social gathering will be held at the North British Hotel before the party leaves by the night train for the South.

RUBBER INDUSTRY LECTURE

The Council of the Institution of the Rubber Industry has established an annual lecture to be given by an authority of international standing on a topic of special interest to the industry. Mr. A. Healey, B.Sc., F.I.R.I. (who was the I.R.I. Colwyn Medallist in 1943) will give the first lecture, his subject being "The Future of the Rubber Manufacturing Industry," at the Grand Hotel, Birmingham, on May 10, at 5.30 p.m. Tickets for the lecture, and for a dinner which will follow at 7.30 p.m., are obtainable from Miss C. Carden, general secretary, I.R.I., 12 Whitehall, London, S.W.1.

Company News

British Tin Investment Corporation report profit for 1945 totalling £26,404 (£28,101). Dividend is 2 per cent. (same).

Manganese Bronze and Brass Co., Ltd., report net profit for 1945 totalling £81,407 (£151,161). Final ordinary dividend 17½ per cent., making 25 per cent. (same).

General Refractories, Ltd., report net profit for 1945 totalling £65,923 (£52,928). Dividend is 7½ per cent. (same), plus victory bonus of 1½ per cent. (nil).

William Blythe & Co., Ltd., report net profit for 1945 totalling £33,506 (24,592). Final ordinary dividend 10 per cent., making 15 per cent. (same), plus 5 per cent. bonus (same).

United Glass Bottle Manufacturers, Ltd., report net profit for 1945 totalling £220,666 (£209,026). Final dividend is 7½ per cent. (6 per cent.), in addition to the bonus, already announced, of 2½ per cent. (same).

Benzol & By-Products, Ltd., report a net profit, to September 30, 1945, of £36,787 (£34,760). Preference dividends for two years to March 31, 1937, are being paid (against 1½ years) in addition to a further half-year's preference dividend paid on March 31. Forward, £25,567 (£22,621).

British Plaster Board, Ltd., are issuing, to ordinary shareholders, 705,445 of the unissued ordinary 5s. shares in the proportion of one new share at 30s. for every ten held. Letters of allotment will be posted about May 8. The directors have decided to proceed with new works and considerable extensions to existing mines and works, to a total estimated cost of £1½ million.

New Companies Registered

Cyntelma, Ltd. (407,592).—Private company. Capital £1000 in £1 shares. Manufacturers of and dealers in plastic substances, chemicals, etc. Subscribers: M. Downey, M. V. Shattock. Registered office: 73 Basinghall Street, E.C.3.

Martin, Bergaume & Co., Ltd. (406,948).—Private company. Capital £1000 in £1 shares. Manufacturers of and dealers in plastics, chemicals, etc. Directors: L. Bergbaum, R. A. Drew. Registered office: Audrey House, Ely Place, E.C.1.

Midland Research Co., Ltd. (407,090).—Private company. Capital £10,000 in £1 shares. Research work in relation to metals, minerals, chemicals, plastics, etc. Directors: J. S. Tropman, H. G. Taylor, E. Wood. Registered office: "Ferndale," Brettell Lane, Brierley Hill, Staffs.

Metro Chemical (Ilford) Ltd. (407,534).—Private company. Capital £1000 in £1 shares. Manufacturers of and dealers in chemicals, drugs, etc. Directors: H. J. Thomson, H. C. Sutton, L. J. Godfrey. Registered office: 15a, Clarence Terrace, High Street, Barkingside, Essex.

"Penisan" Hygienic Products, Ltd. (406,959).—Private company. Capital, £1000 in £1 shares. Manufacturers of and dealers in penicillin and substances of which it forms part, manufacturing, wholesale and retail chemists, etc. Director: L. B. Bridge. Registered office: 30 Ridinghouse Street, W.1.

Chemical and Allied Stocks and Shares

FIRM and more active conditions ruled in stock markets earlier in the week, reflecting the better turn in international affairs and the removal of uncertainty as to the Budget. Strength of British Funds remained a prominent feature, and leading industrial shares moved higher, although best levels were not held, profit-taking developing in some directions. Iron and steels were again dull on nationalisation fears, although in some instances prices rallied moderately.

Chemical and kindred shares reflected the better market tendency, Imperial Chemical strengthening to 40s. 9d., while B. Laporte moved higher at 85s. 1½d., and Turner & Newall were better at 82s. 6d. Elsewhere,

W. J. Bush remained tightly held and quoted at 85s. Dividend of the last-named company has been limited to 10 per cent. since 1938, but earnings on the shares have been much in excess of this, and in respect of 1944 were over 56 per cent. Hopes that now the war is over a more liberal dividend policy may be adopted strengthened De La Rue to £10⅞, although it is realised that in many departments the company and its subsidiaries are still expanding and developing. Higher dividend hopes also raised Dunlop Rubber to 56s. earlier in the week, and Murex rallied to 93s. 9d. Levers showed steadiness at 50s. 6d. Distillers touched 120s. earlier in the week and United Molasses were higher at 49s. 1½d. A good feature was provided by a rally in shares of paint manufacturers, reflecting the view that recent declines on uncertainty regarding the raw materials position had been overdone. Goodlass Wall recovered to 27s., Pinchin Johnson to 38s., and Lewis Berger to 122s. 6d. After their rise, profit-taking developed in German Potash bonds, the 7 per cents. receding to 45 and the 6½ per cents. to 42½.

Although affected by nationalisation fears, iron and steels firmed up a little, Guest Keen improving to 43s. 3d., and Dorman Long to 24s. 3d., while there were also a number of small gains among colliery issues, Powell Duffryn being 21s., Bolsover 45s., and Staveley 43s. 6d. In other directions, General Refractories at 20s. 7½d. were firm on the full results. British Aluminium have been steadier at 37s. 9d., with British Oxygen 88s. 1½d. ex the increased payment, Borax Consolidated deferred 43s. 6d., British Match 43s. 9d., and Triplex Glass 10s. ordinary 40s. 3d. British Glues 4s. ordinary continued firm at 14s. 3d., but elsewhere Amalgamated Metal eased to 17s. 4½d. United Glass Bottle were 74s. 4½d. awaiting the full results and chairman's annual statement, while Canning Town Glass 5s. shares, on market hopes of a higher dividend, changed hands up to 13s. 7½d. British Lead Mills 2s. shares were 10s. 3d. following the raising of the dividend from 10 per cent. to 30 per cent. Textiles showed a better tendency, with Courtaulds 55s., British Celanese 35s. 6d., Bradford Dyers 25s. 9d., Calico Printers 21s. 10½d., and Bleachers 12s. 9d.

In other directions, British Drug Houses continued active and moved higher to 58s. 9d. Beechams deferred at 23s. also advanced and Boots Drug rose to 57s. 6d. Timothy Whites were 47s. 6d. and Sangers 30s. 3d. Monsanto Chemicals 5½ per cent. preference kept at 23s. Burt Boulton were 24s. 9d. and Greeff-Chemicals Holdings 5s. ordinary 10s. 3d. Elsewhere, Bennis Combustion 5s. shares attracted buyers on the favourable yield and changed hands up to 11s. 6d. Yield considerations also drew attention to Blythe Colour 4s. shares which rose to 40s. Cellon 5s. shares marked 26s. 9d., Cooper McDougall & Robertson 36s. and Fisons were dealt in up to 56s.

Anglo-Iranian rose to 105s., while Canadian Eagle Oil were good at 26s. 9d., sentiment in this section responding to the news that oil is to be used on a larger scale to make good the inadequate supplies of coal.

British Chemical Prices

Market Reports

THE London chemical markets have continued on a very firm basis and pressure for supplies against contracts has been sustained. A fair amount of new and replacement business is reported and the volume of export inquiry remains at a high level. Almost the whole range of the potash and soda products is receiving active attention and actual bookings are restricted only by supply considerations. British-made formaldehyde is in good call, and acetone, acetic acid, tartaric acid, and citric acid are in good demand. Owing to the increase in the price of the metal, quotations for red and white lead are dearer. The market for coal-tar products is firm and a brisk inquiry is reported.

MANCHESTER.—Brisk trading conditions have been reported on the Manchester chemical market during the past week. Fresh inquiries have been circulating satisfactorily from the home trade and a fair amount of replacement buying in textile and other chemicals has been reported. There has been no falling off in buying interest on export account, and shippers' inquiries have covered substantial quantities of chemicals. Sulphate of ammonia, nitrate of soda, superphosphates, and the compound manures are meeting with a good demand on the fertiliser market, and the leading coal-tar products are also finding a steady outlet.

GLASGOW.—In the Scottish heavy chemical market prices are firm, showing actual increases in several cases. Spot and contract demands for the home trade have been very brisk and inquiries and orders for export continue to exceed the available supplies. Considerable activity has been experienced with sulphur, zinc oxide, potassium permanganate, and saltpetre in the export market, but, generally, inquiries cover the whole range of heavy chemicals.

Price Changes

Lead, Red.—Basic prices, per ton: Genuine dry red lead, £60; orange lead, £72. Ground in oil: Red, £73; orange, £85. Ready-mixed lead paint: Red, £76; orange, £88.

Lead, White.—Dry English, in 8-cwt. casks, £72 10s. per ton. Ground in oil, English, in 5-cwt. casks, £85 10s. per ton.

Zinc Oxide.—Maximum prices up £7 per ton.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Emulsifying agents.—H. Adams, and G. H. Briggs, Ltd. 8288.

Thermoplastic articles.—E. Altman. 8150.

Plasticised elastomer compositions.—American Cyanamid Co. (United States, April 4, '45.) 7656. (United States, April 4, '45. (Cognate with 7656.) 7657.

Mesobenzanthrones.—G. Baddeley. 7994.

Plastic materials.—F. W. Berk & Co., Ltd., E. Mell, and L. H. Bellamy. 8195.

Carboxylic acids.—Boots Pure Drug Co., Ltd., W. Howieson, H. A. Stevenson, and W. F Short. 7883.

Organic compounds.—British Celanese, Ltd. (United States, March 20, '45.) 8342, 8343.

Tartaric acid.—U. Busico. (Italy, March 29, '45.) 8367.

Pulverising of granular materials.—G. Cohen, Sons & Co., Ltd., and V. G. Ford. 8155.

Pickling apparatus.—Curran Bros., Ltd., and P. H. H. Thomas. 7955.

Pickling ferrous metals.—Curran Bros., Ltd., and H. Toner. 7782.

Anhydrides.—Distillers Co., Ltd., A. Elce, H. M. Stanley, and K. W. H. Tuerck. 8199.

Complete Specifications Accepted

Electron microscopes.—British Thomson-Houston Co., Ltd. Dec. 1, 1942. 576,003.

Treatment of regenerated cellulose fibres with formaldehyde.—Courtaulds, Ltd., C. M. Whittaker, C. C. Wilcock, W. Armfield, and H. H. W. Best-Gordon. March 23, 1944. 575,964.

Process for the preparation of tetramethylenediamine.—E.I. Du Pont de Nemours & Co. Sept. 11, 1943. 576,015.

Production of acetals.—E.I. Du Pont de Nemours & Co., and D. D. Coffman. Aug. 30, 1943. (Sample furnished.) 576,027.

Production of methyl methacrylate compositions.—E.I. Du Pont de Nemours & Co., and F. L. Johnston. Dec. 32, 1943. 576,071.

Manufacture of sulphur trioxide.—E.I. Du Pont de Nemours & Co., J. J. Bradley, and A. Regenbrecht. Dec. 31, 1943. 576,009.

E. L. Streatfield. Aug. 16, 1944. 576,014.

Softening of water.—Filtrators, Ltd., and (Divided out of 576,014.) 576,019.

Production of esters of iodobenzoic acids.—A. A. Goldberg, H. S. Turner, and Ward Blenkinsop & Co., Ltd. Dec. 8, 1943. 576,035.

EDUCATIONAL

Great Possibilities for
QUALIFIED CHEMICAL ENGINEERS

VAST and far-reaching developments in the range of peacetime productions and markets of the Chemical Industry mean that the profession of Chemical Engineering will be of great importance in the future and one which will offer the ambitious man a career of outstanding interest and high status. The T.I.G.B. offers a first-class training to candidates for the Chemical Engineering profession.

Enrol with the T.I.G.B. for the A.M.I.Chem.E. Examinations in which home-study students of the T.I.G.B. have gained a record total of passes including—

THREE " MACNAB " PASSES
and
THREE FIRST PLACES

Write to-day for the " Engineers' Guide to Success "—free—containing the world's widest choice of Engineering courses—over 200—the Department of Chemical Technology, including Chemical Engineering Processes, Plant Construction, Works Design and Operation, and Organisation and Management—and which alone gives the Regulations for A.M.I.Chem.E., A.M.I.Mech.E., A.M.I.E.E., C. & G., B.Sc., etc.

THE TECHNOLOGICAL INSTITUTE OF GREAT BRITAIN
219, Temple Bar House, London, E.C.4

SITUATIONS VACANT

APPLICATIONS are invited for the position of Senior Research Chemist to take charge of the chemical research section of a company in the Midlands interested in heavy chemicals, tar, distillation, by-product recovery, acids, alkalis, chlorine, and ancillary products. The applicant should be a man of sound training, experience and ability in research organisation and supervision. Considerable importance will be attached to ability and initiative in individual research and development. The salary attached to the position will be determined by the qualifications. Applicants are invited, in strictest confidence, to supply full details of age, training, qualifications and experience, and salary requirements, to Box No. 2282, THE CHEMICAL AGE, 154, Fleet Street, London E.C.4.

CIVIL SERVICE COMMISSION, DUBLIN.
Position Vacant: State Chemist in the State Laboratory (under the Department of Finance).

Prospective candidates are asked to note that the latest time for accepting completed application forms for the above-named post has been extended to 5.15 p.m. on 14th May, 1946. Application forms and particulars of the post may be obtained from the Secretary of the Commission, 45, Upper O'Connell Street, Dublin.

GENTLEMAN, with good commercial knowledge of Fine and Heavy Chemicals wanted to work on own initiative within framework of already existing connection. Good salary and good prospects for later participation. Box No. 2273, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

MESSRS. FISONS LIMITED, Ipswich, have vacancy for young man with chemical engineering experience and/or qualifications, to assist in development and research work which will involve investigations on full scale plant in their various factories and the operation of experimental units.

METALLURGICAL Chemist required to take complete control of Light Alloy Laboratories in Midlands. Must be fully qualified and conversant with all modern methods of analysis and physical testing. Reply stating age, qualifications and salary required to—Messrs. Price Atkins & Price, 71, Temple Row, Birmingham, 2.

REQUIRED, Chemical Engineer with mechanical bias or mechanical engineer from chemical plant, for detail erection and operation of several new Chemical plants in India. Write Box ZT. 510, Deacons Advertising, 36, Leadenhall Street, London, E.C.3.

WANTED

WANTED.—Supplies of Nitre Cake in ten-ton lots. Box No. 2126, THE CHEMICAL AGE, 154, Fleet Street E.C.4.

SITUATION WANTED

CHEMICAL ENGINEER, B.Sc., Chemistry: King's College, Diploma in Chemical Engineering: Graduate Inst. Chem., Eng.: Ex-officer Royal Engineers, requires responsible position, preferably one in which initiative can be used. Box No. 2280, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

FOR SALE

ALL Copper **FRACTIONATING COLUMN**, overall height, 13 ft. 6 in. by 10 in. diameter, column constructed in four sections, each being 3 ft. long and containing five trays fitted with bubbling hoods, placed approximately six inches apart; bottom section arranged with 5 in. diameter flanged connections and the top of the column is fitted with a small dephlegmator, 12 in. high, comprising ¼ in. ball copper coil six turns; 7 in. diameter, 1 in. diameter gas risers, each section fitted with 6 bubbling hoods, 1¼ in. diameter

Vertical All Copper, direct fired **STILL** with steel body 2 ft. dia by 2 ft. 9 in. deep; bolted on dome cover with 6 in. flange vapour connection with copper swan neck, tapering to 2 in. diameter coil condenser; jacket between copper lining and outer steel casing, suitable for oil.

Copper Steam Jacketed **STILL** by John Dore, 3 ft. 3 in. diameter by 5 ft. deep by ¼ in. thick, copper construction, dome top with dished bottom; 10 in. diameter opening in side, bronze cover fitted with quick locking bolts; gauge glass; interior fitted with agitating gear of 2-bow type agitators on horizontal shaft 1¾ in. diameter, belt driven, fitted with copper swan neck.

Copper **STILL** in two sections, 9 ft. deep overall by 2 ft. 8¾ in. internal diameter; detachable phosphor bronze inspection cover, 17¾ in. diameter on top portion, secured by three ¾ in. diameter quick acting swing bolts; bottom section, 1 ft. 6 in. deep, secured by heavy phosphor bronze locking ring and six ¾ in. diameter locking swing bolts; 1 in. diameter nest of copper, steam coil in bottom, covered with perforated copper plate, complete with bolted tubular copper condenser.

Steam Jacketed Copper **STILL** by John Dore, 3 ft. 4 in. deep on straight by 3 ft. 6 in. diameter with bolted on dome cover, arranged with two 3½ in. inspection covers. Bottom portion dished and steam jacketed, still complete with copper swan neck, tapering to 1 in. diameter from 4½ in.; complete with aluminium coil condenser, mounted in steel tank.

Cast Aluminium **POT STILL** 21 in. diameter by 27 in. deep, bolted on stone cover, with sight glasses and complete with aluminium swan neck.

Cast Iron **JET CONDENSER** by Lurgi, 9 ft. deep on straight with 12 in. conical bottom and 2 ft. 6 in. diameter; 1 ft. 4 in. diameter flange vapour connection, 7 in. flanged bottom run-off, two 3½ in. diameter liquid connections.,

GEORGE COHEN SONS & CO., LTD.
STANNINGLEY near LEEDS and
SUNBEAM ROAD, PARK ROYAL, LONDON, N.W.10.

CHARCOAL, ANIMAL, and VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal-insulating; also lumps ground and granulated; estab. lished 1830; contractors to H.M. Government.—THOS. HILL-JONES, LTD., " Invicta " Mills, Bow Common Lane, London, E. Telegrams, " Hill-Jones, Bochurch, London." Telephone: 3285 East.

FOR SALE.—One secondhand Gas Holder, complete with guides, 1,000 cu. ft. capacity. Lying at Dundee. Offers to—Expanded Rubber Co., Ltd., 675, Mitcham Road, Croydon.

JACKETED PANS 1 Copper 36 in. dia. by 36 in. deep.
1 C.I. 36 in. dia. by 36 in. deep.
1 M.S. 48 in. dia. by 36 in. deep.
THOMPSON & SON (MILLWALL), LTD.,
60, HATCHAM ROAD, OLD KENT ROAD, S.E.15

25-TON hydraulic drum flattening press to take drums up to 20 in. dia. by 3 ft. long; double acting; floor mounting; with self-contained pump driven by 5 h.p. A.C. motor. Lying in Glasgow. Reed Brothers (Engineering) Ltd., Hydraulic Plant Specialists, Bevis Marks House, E.C.3.

FOR SALE

MORTON, SON & WARD, LTD.
Offer from Stock

"HATHERNWARE" FILTRATION PLANT

TWO—White glazed "Hathernware" 3-piece filters, 25 in. dia.
TWO—White glazed "Hathernware" 3-piece Filters, 16 in. dia. (All with spare filter fittings.)
ONE—10-gallon "Hathernware" Decanting Vessel, complete with fittings.

VACUUM PUMP

ONE—Horizontal Wet Vacuum Pump by Evans, 4 in. bore by 10 in. stroke, fast and loose pulley drive.

AIR RECEIVERS

ONE—Vertical Air Receiver 3 ft. 9 in. dia. by 5 ft. overall height, by ⅜ in. riveted plate, 100 lbs. w.p. With standard manhole and cover and fabricated supports.
ONE—Vertical Air Receiver 6 ft. 5 in. long by 3 ft. 9 in. dia., 50 lbs. w.p.
ONE—Vertical Air Receiver 2 ft. 6 in. long by 2 ft. dia., 100 lbs. w.p.
ONE—Vertical Air Receiver 3 ft. long by 1 ft. 6 in. dia., 150 lb w.p.
ONE—Vertical Air Receiver 2 ft. 3 in. dia. by 4 ft. high with domed top and dished bottom. 150 lbs. w.p.

TANKS

ONE—Boiler Storage Tank, 12 ft. long by 4 ft. 9 in. dia.
ONE—Rectangular Galvanised Storage Tank, 6 ft. 8 in. by 6 ft. 8 in. by 2 ft. 8 in. deep.
ONE—Vertical Enclosed Cylindrical Tank, 5 ft. high by 3 ft. 6 in. dia., with manhole and cover.
ONE—Rectangular enclosed M.S. Storage Tank, 4 ft. by 3 ft. 6 in. by 3 ft. 6 in.

MISCELLANEOUS

TWO—Horizontal Worm Conveyors 9 in. scroll, 18 ft. centres, steel trough, fast and loose pulley drive.
ONE—Kestner double pipe contraflow Heat Exchanger, six banks each 16 ft. 6 in. long, 4 in. outer and 2 in. inner tubes.
Also good selection of steam-jacketed Pans and Mixers.

WALK MILL, DOBCROSS, Nr. OLDHAM
'Phone: Saddleworth 68

LARGE number of Plating Generators for sale, 350 amps. upwards. Fyfe, Wilson & Co., Ltd., Bishop's Stortford. 'Phone: B.S. 1000.

100 HYDRO EXTRACTORS by leading makers from 18 in. upwards, with Safety Covers. Jacketted Steam Copper and Iron Pans. Calorifiers-Washing Machines—Gilled Pipes, etc. List sent on request. Randalls, Engineers, Barnes. Tel.: Riv. 2436.

'Phone 98 Staines.

250 and 500 Gall. Aluminium Tanks: 500 Gall. Copper Still and Condenser; Single Effect Evaporator and Condenser; 6 ft. Cast Iron Edge Runner. Vacuum Mixer 4 ft. by 3 ft. by 3 ft. 6 in. C.I. Jacketed Tipping Pan 40 galls.

HARRY H. GARDAM & CO. LTD, STAINES

1000 STRONG NEW WATERPROOF APRONS. To-day's value 5s. each. Clearing at 30s. dozen. Also large quantity Filter Cloths, cheap. Wilsons, Springfield Mills Preston, Lancs. Phone 2198.

WORKING NOTICE

THE Proprietors of British Patent No. 499,529 for "Preparation of Arsenical Compounds for Use in Spraying or Dusting Plants," desire to enter into negotiations with a firm or firms for the sale of the patent, or for the grant of licences thereunder. Further particulars may be obtained from Marks & Clerk, 57 & 58, Lincoln's Inn Fields, London, W.C.2.

SERVICING

GRINDING, Drying, Screening and Grading of materials undertaken for the trade. Also Suppliers of Ground Silica and Fillers, etc. JAMES KENT, LTD., Millers, Fenton, Staffordshire. Telegrams: Kenmill, Stoke-on-Trent. Telephone: 4253 and 4254, Stoke-on-Trent (2 lines).

GRINDING of every description of chemical and other materials for the trade with improved mills.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams: "Hill-Jones, Boohurch, London." Telephone: 3285 East

PULVERISING and grading of raw materials. DOHM LTD., 167, Victoria Street, London, S.W.1.

PATENTS & TRADE MARKS

KING'S PATENT AGENCY, LTD. (B. T. King, A.I.Mech.E., Patent Agent), 146a, Queen Victoria Street. London, E.C.4. ADVICE Handbook, and Consultation free. Phone: City 6161.

Printed in Great Britain by THE PRESS AT COOMBELANDS, London and Addlestone, and published by BENN BROTHERS, LTD., at Bouverie House, 154, Fleet Street, E.C.4, April 13th, 1946. Entered as Second Class Matter at the New York, U.S.A., Post Office.