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## **Colonial Progress**

**THE** importance of the British Colonial territories to the sterling area as a whole is not widely appreciated. With the passing of the so-called 'Korea boom,' demand and prices for many colonial exports of raw or primary materials fell in 1952. Despite this a trade balance with the non-sterling area of  $\pm 132,000,000$  is provisionally estimated for 1952, a smaller sum than £205,000,000 and £197,000,000 in 1950 and 1951 respectively, but an exceedingly important contribution nevertheless. The fact that the balance of payments with the sterling area itself is in the red to the extent of £80,000,000 matters much less; a negative balance is, indeed, a normal feature. This economic information is to be found in 'The Colonial Territories, 1952-53,' a recent Command Paper (HMSO, 158 pp., 5s.) It might well have been more firmly emphasised.

It is almost certainly an error in leftwing thought to assume that the provision of education and other social services must dominate colonial progress. These bring the full bitterness of frustration if they are not accompanied by material forms of development, with industrial expansion and all the opportunities that flow from it. Judgment will seek with difficulty a better touchstone than the listing of technical or technological developments in this latest annual report of colonial progress. Our task is to see that both the colonial territories and their native populations steadily earn more. Merely to continue mining the same raw materials and relying upon the same exportable and specialised crops (e.g., Malaya's rubber of Kenya's pyrethrum) is not enough.

Minerals which have been exported in growing quantities in recent years are bauxite, chrome ore, copper, manganese ore, petroleum, and pyrites. For these the increased tonnages were being well maintained in 1952, a fairly reliable sign that expansion was not resting upon the short-lived impetus of the Korean crisis. Of the fibres, raw cotton and sisal are steadily rising. Pyrethrum is maintaining about twice its pre-war demand. Rubber, even if it has dropped back from the peak Korean years, is more than 50 per cent up on pre-war tonnages.

It is certainly a sign of active develop-

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ment that some of the major items that are imported are steadily increasing. Each year in the 1950-52 period has seen a steady rise in cement imports (mainly from the UK); the annual rises in expenditure on machinery show even more marked increases (again mainly from the UK). The cement picture will A new cement factory in change. Jamaica started production in 1952 and is already 'well on the way to its planned output of 100,000 tons per annum." A factory of about half this capacity is to be opened this year in Uganda. In 1954 one of the same size as that in Jamaica will open in Trinidad. A Malayan factory will be in production shortly; a factory in Kenya is now being built. Others are planned for the Gold Coast and Nigeria. In five years' time these factories should be making sharp inroads into the import tonnage for cement, which was over  $1\frac{1}{2}$  million tons in 1952. To aim at greater self-sufficiency in this bulky material is sound technicoeconomics.

For vigorous expansion, however, it is preferable to look for developments of new resources that are likely to add to the export trade of the colonial countries. A first shipment of bauxite was made from Jamaica in 1952 and an alumina plant there has passed its first stages in construction. Twenty-four new oil-wells

were drilled in Brunei and all but three struck oil; oil-drilling in Nigeria has so far Been unfruitful, but it is continuing. American and Canadian companies are oil prospecting in Barbados, the Bahamas, Somaliland, and Jamaica, In all territories uranium ores are being sought; during 1952 11,000 samples were examined in London. Small amounts of uranium-bearing ores have been proved in one of the copper-mining areas of Northern Rhodesia. Several new sources of niobium were discovered in Nigeria, Nyasaland, and Northern Rhodesia, and uranium is associated with the Nigerian In Uganda what is called the source. Sukulu complex—a mineral containing niobium, apatite, and magnetite-is already the basis of a project in which three prominent mining companies have joined interest. The UK Government has given a five-year contract to Uganda producers to stimulate the production of tungsten. All these projects or prospects have the right ring. The combined hydro-electric and aluminium scheme for the Gold Coast cannot yet be claimed as a development, for the final decision still awaits the verdict of a Preparatory Commission; if this could be listed as an actuality of the colonial year reviewed, the total record of new resource development would be exceptionally praiseworthy.

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## Notes & Comments

#### 'Challenge to Britain'

THE Labour Party's latest manifesto . pays the chemical industry the compliment of special selection. It is foolish to disregard this because for the moment the Labour Party is in opposition and the Conservative Government seems firmly entrenched despite its small majority. No pendulum swings more assuredly than the political pendulum. A stated aim of the Labour Party is this: 'To establish positive control over the size and direction of the chemical industry's investment programme, and to overcome the dangers inherent in private monopoly power, a substantial degree of public ownership is required. This will be achieved in a way that will not disturb the smooth functioning of the industry at home or abroad . . . Final decisions as to the boundaries of public ownership must rest on technical and administrative considerations. A Labour Government will obtain from the industry itself such information and records as will enable it to determine the most appropriate sections to be acquired, and the most appropriate methods of acquiring them."

#### Time to Woo is Now

TO DOUBT a chemical business N could get odds quoted, or an insurance rate estimated, on the risk of 'appropriation.' But the odds might change if the economic background of industry changed, as indeed it is now changing with the index of commodity prices under its pre-Korean and (then) the lowest post-war point. Is the chemical industry developing its public relations activities sufficiently widely or vigorously so that a more informed public opinion can play its part in resisting the threat of nationalisation? When the threat has closer reality, it is too late to start wooing the public. The Americans-whose risks of State interference are of a somewhat different and gentler kind-have been less apathetic. The Manufacturing Chemists' Association published a 'Chemical Industry Facts Book' this

May-priced at \$1 a copy-with 108 pages, a book not intended primarily for those in the industry and telling in three sections how the US chemical industry grew, how it now operates, and what its products mean in everyday life. How far away from a similar effort in publicity is our own chemical industry? How far off is the next swing in party politics? The total employee force of the industry is relatively small. People are not very concerned about the nationalisation of industries they themselves do not work in and about which they know little or nothing.

#### Sulphur Recovery

N the latest Fuel Research Board Report, good progress is reported for L sulphur recovery from flue gases. Only at the Battersea and Fulham power stations are full-scale sulphur removal processes operated and these do not recover the sulphur in useful form; all that is achieved is pollution reduction. Furthermore, it is said that these processes 'involve a cost equivalent to 7 to 10 shillings on every ton of coal burnt under the boilers'. What is known as the Fulham-Simon-Carves process, the removal of sulphur from flue gases by means of crude concentrated ammonia liquor (from gas works), has been investigated on both the laboratory and pilot-plant scale. It has been shown that more than 90 per cent of the sulphur can be removed and recovered in useful form, partly as ammonium sulphate and partly as elemental sulphur. Preliminary assessment of costs would seem highly encouraging, for it is said that the recovery process should be operable at a much lower cost than either of the sulphur-removal processes already used in the two London power stations. To quote the Report: 'A stage has been reached at which it is desirable that the process should be tried out with much larger pilot plant to obtain design and cost data for full-scale operation. This is a question mainly for the British Electricity Authority, who are considering the matter.'.

#### A National Necessity

**T** is to be hoped that the BEA's considerations will be both prompt and widely conceived. In view of the many deaths caused last December by London's long-run fog-when the concentration of sulphur dioxide rose to about ten times the normal in several areas-the removal of sulphur from such huge flue-gas outlets as those of power stations is a national necessity. If it can be done at lower cost with actual sulphur recovery, a valuable addition to our sulphur resources is also made. In addition, plenty of ammoniacal liquor is still running to waste in smaller gas works so that it is possible to unite nitrogen salvage with sulphur recovery. This is surely a project to be pushed forward with the utmost vigour.

#### High Vacuum Processes

I N general high vacuum evaporation is used in the processing of heatsensitive and high-value materials, e.g., fruit-juices, antibiotic solutions, and so on. It has hardly seemed practical to introduce a fairly expensive method of water removal to the heavy chemicals industry. However, the costs perspective is never changeless, and it is now being claimed in America that high vacuum concentration can in fact reduce costs. (1) because corrosion rates are reduced and cheaper construction materials may be utilised, and (2) because scaling troubles are diminished and more efficient heat-transfer obtained. (Chemical Engineering, 1953, 61, 6, 134.) Process examples cited are the concentration of black liquor, caustic soda, magnesium chloride, and wet-process phosphoric acid. At 20° C. corrosion rates are only 25 per cent of the rates at 60° C.-this is true, anyway, for salt solutions and mild steel. Another corrosion-reducing influence is the slower velocity of liquids in vacuum evaporation. The reduction of scaling problems may not be a general benefit. However, this is a substantial trouble with certain chemicals whose solubilities decrease with temperature rises in the boiling point range. Tests have shown that for some sodium and calcium salts the time losses for de-scaling work can be cut by as much as half. The deposition of calcium sulphate in brine evaporation particularly is minimised in 10 mm. pressure concentration.



A general view of the almost completed catalytic cracking unit at the Anglo-Iranian Kent Refinery, Isle of Grain. It is expected to be put in commission in the second half of 1953

#### MIDLANDS SOCIETY FOR ANALYTICAL CHEMISTRY

## **Complexones in Analytical Chemistry**

THE last meeting of the present session of the Midlands Society for Analytical Chemistry was recently held in the Chemistry Department, Birmingham University, when members enjoyed a very informative lecture on 'The Use of Complexones in Analytical Chemistry' delivered by T. S. West, B.Sc., Ph.D., A.R.I.C., of the Analytical Research School at the University.

Dr. West's lecture was as follows :---

The term 'complexone' was originally applied by Schwarzenbach in 1945 to a particular class of substances. As the name suggests, these substances are of a polydentate nature and are capable of forming inner complex compounds with a wide variety of cations. The complexones are all aminopolycarboxylic acids, but the definition is restricted to include only those which may be regarded as derivatives of iminodiacetic acid, NH(CH<sub>2</sub>COOH)<sub>2</sub>.

The best known complexone is undoubtedly ethylenediaminetetra-acetic acid.  $[CH_2N(CH_2COOH)_2]_2$ . This compound has achieved widespread popularity because of its versatility and because it is particularly effective for the determination of calcium and magnesium hardness in water. A measure of its popularity is the variety of trade names under which the product is marketed, e.g., Trilon B, Versene, Sequestrene, Nulapon, Iminol D. Two other members of the complexone series have been rather widely used. These are nitrilotriacetic acid, N(CH2COOH)3, and uramildiacetic acid, C<sub>1</sub>N<sub>2</sub>O<sub>3</sub>H<sub>3</sub>.N(CH<sub>2</sub>COOH)<sub>2</sub>.

In a recent paper,<sup>1</sup> Schwarzenbach has suggested that the N,N'-tetra-acetic acid derivative of 1,2-diaminocyclohexane,  $C_eH_{1e}[N(CH_2COOH)_2]_2$  may have as efficient cation binding powers as ethylenediaminetetra-acetic acid, but because of difficulties in synthesis or the expensive nature of the compound little further information on this reagent has appeared in the literature.

#### **Historical Survey**

Although the term 'complexone' is due to Schwarzenbach and although complexones are often referred to as Schwarzenbach's complexes, the credit for the discovery of the remarkable properties of this group of reagents must be conceded to some unknown German research worker in I. G. Farbenindustrie.

In 1936-37, this company took out a patent<sup>2</sup> on certain aminopolycarboxylic acids such as trimethylamino- $\alpha$ , $\alpha'$ , $\alpha''$ -tricarboxylic acid (nitrilotriacetic acid) and alkyl and aryl derivatives of iminodiacetic acid as agents for the prevention of the formation of insoluble metallic salts, particularly alkaline earth salts, in natural waters, etc. Among other agents described were ethylenediamine-tetra-acetic acid and tyrosine-N-diacetic acid.

In the following year, the same company took out another patent<sup>3</sup> on the use of some of these substances, particularly ethylenediaminetetra-acetic acid, as photographic developers. The properties of these substances gradually received recognition on the Continent and two of them, namely nitrilotriacetic acid and ethylenediaminetetra-acetic acid, were marketed under the names of Trilon A and Trilon B respectively. Both these substances were examined as water softeners in the textile industry by Ender<sup>4</sup> (1938) and he established that not only were they useful in preventing the precipitation of soap in hard water, but that they would also dissolve precipitated lime soaps. In 1939, Bird and Molloy<sup>5,6</sup> showed that Trilon B could be used in the dyestuffs industry to prevent the formation of dull shades when dyeing with chrome dyes. The improvement was found to be due to the complexing of Fe ... which caused the dull colours.

By the early years of World War II, the complexones were established as valuable reagents in many industrial processes, e.g., in dyestuffs and textile technology, papermaking, photography, etc. Many ingenious patents are found in the literature which depend on the complexing powers of these substances. For example, a war-time American device<sup>7</sup> for the removal and prevention of heavy boiler scale uses Trilon B. Among other novel uses, the removal of tartar from teeth and the removal of iron from the bloodstream may be mentioned as indicative of the wide field of application which these compounds have found.

#### Schwarzenbach's Work

In a series of 18 papers during the period 1945-1951, Schwarzenbach and his coworkers discussed the physico-chemical behaviour of the complexones and described many of their applications to analytical chemistry. The first complexone to be examined was nitrilotriacetic acid.8 The trisodium salt is strongly alkaline and two of the sodium atoms are easily replaced by an alkaline earth metal with the formation of compounds such as NaCaX.H<sub>2</sub>O, KCaX.-H<sub>2</sub>O, etc. The water molecule cannot be removed by any of the usual dehydration methods as it is bound by complex formation.

The sodium calcium salt of nitrilotriacetic acid is insoluble and this was tentatively suggested as a possible precipitation form for the determination of sodium. Iminodiacetic acid and methyliminodiacetic<sup>®</sup> acid are stronger than nitrilotriacetic acid and form similar complexes. Aminomalonic acid and aminomalonic acid-diacetic acid are relatively weak in complex-forming powers. Uramildiacetic acid<sup>10</sup> forms very stable alkaline earth complexes and also binds magnesium, lithium and sodium. In this case, all the complex salts are very soluble in water. Uramilmonoacetic acid shows only weak complexing powers. The barbituric acid part of the molecule does not tend to bind other metals.

Ethylenediaminetetra-acetic acid<sup>12</sup> is a much stronger acid and also a stronger complexing agent than those previously mentioned. Sodium and lithium form strong trivalent complexes, while the alkaline earth metals form complexes of the type [CaY]" in alkaline solution.

Homologues of ethylenediaminetetraacetic acid, (CH<sub>2</sub>COOH)<sub>2</sub>N.(CH<sub>2</sub>)<sub>n</sub>. (N(CH<sub>2</sub>CHOO)<sub>2</sub>, where n varied from 2-5 were prepared and their complexones were examined by Schwarzenbach and Ackermann. The stability of the calcium complex decreased as n was increased to 5 presumably because of the decrease in stability of the larger chelate rings formed under these conditions. The calcium complexes were always more firmly bound than the barium and strontium complexes. Normally the calcium complex was also more firmly bound than the magnesium complex except when n = 4 or 5.

Many other complexone-type compounds have been examined, e.g.,  $\beta$ -alanine-N,N'-

diacetic acid, taurine-N,N-diacetic acid,<sup>15</sup> and various derivatives of anilinediacetic acid,<sup>11</sup> but only 1,2-diaminocyclohexane-N. N'-tetra-acetic acid<sup>1</sup> shows strong complexing action. The reactivity of this molecule is comparable with that of ethylenediaminetetra-acetic acid itself.

So far only the complexing action on the alkaline earth elements has been stressed. Because these metals show little tendency to form complexes with the usual reagents such as fluoride, cyanide or organic hydroxyacids. a new emphasis is placed on the value of complexones as general reagents.

Very many other metals form quite strong complexes. In particular, complexes of the transition elements and the trivalent metals are very stable; a pH of 13 can be attained before precipitation of the rare earth hydroxides sets in when ethylenediaminetetra-acetic acid is present.

In 1942 Pfeiffer and Offerman<sup>14</sup> examined the copper complexes of nitrilotriacetic acid and ethylenediaminetetra-acetic acid and established their structure. The first copper complex of ethylenediaminetetraacetic acid is of the following structure:—



The first copper atom gives few of the usual reactions of the copper ion, whereas the second one gives all the normal reactions. The complex is soluble in water but insoluble in all organic solvents. Neither sodium hydroxide nor ammonia solution produces a precipitate, but potassium iodide is oxidised to free iodine with the concomitant formation of insoluble cuprous iodide: potassium cyanide decolorises the complex. Hvdrogen sulphide and potassium ferrocyanide produce the usual precipitates. The nickel salt is less easily isolated, but reacts similarly with sodium hydroxide, ammonia and potassium cyanide. In this case neither hydrogen sulphide nor dimethylglyoxime produces the usual precipitate in alkaline solution.

Uranyl salts produce an insoluble yellow compound  $(UO_2)_2H_2C_{10}H_{1/2}N_2O_3H_2O$ , which gives all the normal reactions of the uranyl ion, showing that a complex is not formed.

Brintzinger<sup>15</sup> obtained an insoluble lead compound which gives most of the usual lead reactions, suggesting that only a very weak complex (if any) is formed.

Cobalt oxidised with sodium hypochlorite in the presence of ethylenediaminetetraacetic acid gives:



This complex is extremely stable and gives none of the usual cobalt reactions. Trivalent chromium and ferric iron behave similarly. The compound with chromium is unusual in that it is not formed instananeously, requiring an excess of complexone and prolonged heating for its formation.

## Summary of Reactions with Various Cations

1. Stable complexes are formed with most cations carrying more than unit charge. 2. Dissociation of these complexes depends on pH.

3. Some tervalent cations form stable complexes at pH 1-2, an acidity at which most of the divalent cation complexes are completely dissociated.

4. In alkaline solution the divalent cations are firmly bound and with few exceptions are not precipitated by ammonia.

5. Only a very few ions, such as silver, thallium and titanium, show very little tendency to complex formation.

6. The majority of the complexes are water soluble, but a few form insoluble precipitates, such as those of silver, zirconium, thorium, uranyl. The precipitates are generally soluble in ammonia or excess complexone. 7. Colourless ions form colourless complexes, whereas the colour of coloured ions is invariably deepened. The colour of the trivalent complexes is intense.

8. Complexes are usually formed instantaneously and in stoichiometric proportions so that only in exceptional cases is it necessary to use an excess.

#### Analytical Applications

Ethylenediaminetetra-acetic acid is readily available in a high state of purity. According to Schwarzenbach, the disodium salt which crystallises with two molecules of water of hydration may be used as a primary standard. Schwarzenbach confined his examination to the uses of the complexones in titrimetric analysis and evolved methods for Mg, Ca, Ba, Sr, Cd, Hg, Fé, Cu, Co, Mn, Ni, Pb, Bi, Zn. Most of the metals were titrated by any one of three different methods.

1. Metal Indicator Method

If a solution of the metal ions is titrated with a solution of complexone, the concentration of free metal ions decreases gradually during the titration and falls sharply to a very low value at the equivalence point when virtually all the free metal ions are tightly bound in an undissociated complex. In the presence of a substance which forms a highly coloured compound with the metal ions, a visual indication of the equivalence point is given. Potentiometric methods may be used where an indicator electrode responding to the metal ion is available.

Murexide gives a salmon-pink colour with calcium which changes to blue when all the calcium ions have been complexed with ethylenediaminetetra-acetic acid. Nickel and copper may be titrated in the same way, while Eriochrome Black T may be used as indicator in the titration of magnesium, zinc and calcium.

2. pH Effect Method

The tetra-alkali salts of ethylenediaminetetra-acetic acid are strongly alkaline. (The pK values for 'Enta' are 3.0, 2.1, 6.2, 11.3). Thus two protons are strongly acidic while the remaining two, firmly bound to the nitrogen atoms in a betaine structure, are of low acidity. The molecule therefore forms a strong hydrogen ion complex as well as metal ion complexes. This shows how the hydrogen ion may be used as an indicator in titration of various metals.

When a solution of the metal ions is

treated so that it is faintly acid (pH 5) and then titrated with the tetrasodium salt of ethylenediaminetetra-acetic acid, there is little change in pH during the course of the titration:

 $M^n + Y''' \rightarrow (MY)^{n-4}$ 

However, at the end-point all the free metal ions have been removed from solution and the complexone proceeds to bind the free hydrogen ions; there is an immediate sharp rise in pH which marks the end-point.

 $2H^{\bullet} + Y''' \rightarrow (H_2Y)''$ 

This method has several disadvantages: the procedure works for the majority of metals but is useless for mixtures; the need for near neutralisation causes several ions to come out of solution; and the pH change occurs in the region of 7 and carbon dioxide interferes.

#### 3. Alkalimetric method

The third method used by Schwarzenbach and his co-workers made use of the hydrogen ions liberated when metal ions reacted with dialkali salts of ethylenediaminetetraacetic acid.

 $(H_2)'' + M^{\bullet \bullet} \rightleftharpoons (MY)'' + 2H$ . The liberated acid can be titrated in the normal way, or alternatively, excess potassium iodide and iodate is added and the liberated iodine determined using standard thiosulphate. The chief disadvantage is that the solution has to be very carefully neutralised before the titration is carried out.

The problem of determining one metal in the presence of others is difficult. It can be achieved only by the metal indicator method when a suitable indicator is available and when the metal in question forms a complex, having a stability much stronger than that of the other complex ions. Thus, using Tiron as indicator, it is possible to titrate Fe\*\*\* in the presence of most dival-If the titrated solution is ent elements. passed through an anion exchange column the iron, being the only metal present in an anionic form, is completely removed from This procedure might probably solution. prove of use in steel analysis.

Another example of the determination of one metal in the presence of others is that of calcium in the presence of magnesium, using murexide as indicator. When Eriochrome Black T is used, the total metal content (Mg + Ca) is obtained.

Flaschka<sup>17</sup> applied the Schwarzenbach methods to the micro scale and in addition described indirect methods for the complexometric titration of sodium<sup>18</sup> and phosphate.<sup>19</sup> Sodium was determined after precipitation of sodium zinc uranyl acetate by titrating the zinc, while phosphate was precipitated as magnesium ammonium phosphate and the magnesium in the precipitate was titrated. In both these titrations Eriochrome Black  $\top$ was used as indicator.

#### Pribil's Work

The redox potential of a system is a measure of the extent to which that system may be reduced or oxidised. It is now well known that the redox potential of several systems is dependent on pH. Similarly, the entry of one of the oxidation states of a redox system into a tightly bound complex can cause a sharp change in redox potential. For example,

Fe\*\*  $\rightleftharpoons$  Fe\*\*\* + c; E<sub>o</sub> = 0.771V Fe(CN)<sub>6</sub>""  $\rightleftharpoons$  Fe(CN)<sub>6</sub>"" + c; E<sub>o</sub> = 0.486V Pribil and his co-workers made use of the alterations brought about in the redox potentials of several systems on addition of complexone to evolve new titrimetric methods.

None of the conventional oxidants is powerful enough to oxidise Co<sup>••</sup> to Co<sup>•••</sup> satisfactorily because the redox potential of the Co<sup>•••</sup> /Co<sup>••••</sup> system is too high. Pribil and Malicky<sup>20</sup> found that addition of complexone considerably lowered the potential and they were able to titrate Co<sup>••</sup> oxidimetrically with ceric sulphate. The method is not, however, a very satisfactory one.

Pribil and Horacek<sup>21</sup> evolved a reductimetric method for manganese in which the divalent manganese ion was oxidised with lead dioxide in the presence of complexone. The lead dioxide was filtered off and the intensely coloured trivalent manganese complex was titrated with ferrous sulphate. A potentiometric finish was required. Cobalt interfered, but copper, lead, chromium, nickel, zinc and aluminium were without interference.

A similar method has been evolved for  $cobalt^{22}$  using ceric sulphate at a temperature of 60° for the oxidation. The excess oxidant is reduced by the excess complexone at this temperature; the trivalent chromium is then reduced by titrating it with chromous chloride in an inert atmosphere. When manganese is present, dichromate is used as the oxidant. The excess oxidant is again reduced by the complexone and the manganese is reduced to the manganese.

complexonate. Actually, it is found that the excess dichromate is not always reduced completely and it is necessary to add some sodium sulphite to complete the reduction. The sulphite does not attack the cobalticomplexonate. Hexavalent molybdenum and pentavalent vanadium interfere.

Just as Schwarzenbach developed the direct titration of metals by an acid-base method with complexone, so Pribil and his co-workers developed the direct redox titration of metals with complexone. Redox titrations are generally effected by using a titrant which is an electron donor or acceptor. Little attention has been paid to the type of titration in which changes in redox potential are brought about by addition of an agent which forms a virtually undissociated complex.

> $Ox + A \rightleftharpoons OxA$ Red + A  $\rightleftharpoons$  RedA.

If OxA is many times more stable than RedA and the proportion of Red in the mixture, Red/Ox, is extremely small, then the titration of the system Red/Ox with component A will give a curve analogous to the titration of the system with a suitable reductant. Such titrations are rarely used, because the rate of formation of stable inorganic complexes such as ferri- and ferrocyanide proceeds very slowly.

Ferric iron forms a much more stable ethylenediaminetetra-acetic with complex acid than does ferrous iron. On titration of a solution of ferric iron with ethylenediaminetetra-acetic acid in a medium buffered with ammonium acetate at pH 5, an excellent curve and end-point may be obtained.23 Fluoride and tartrate do not interfere, but Other ions large amounts of citrate do. such as aluminium, copper, zinc and cadmium which also form complexes with complexone interfere. While these ions do not take part in redox reactions, Pribil<sup>23</sup> has developed an indirect method for their titration by adding excess complexone to the solution for analysis followed by titration of the excess with ferric chloride. Divalent cobalt and manganese cannot be determined The Mn<sup>••</sup> complex is too in this way. loosely bound and the divalent cobalt is partially but not completely oxidised by the ferric complexonate.

#### Titration of Fluoride

Several methods for the gravimetric determination of fluoride as calcium fluoride have been devised, but titrimetric methods based on the reaction have received scant attention because of the lack of a suitable indicator. Belcher and Clark<sup>24</sup> attempted to use murexide as an indicator for the direct titration of fluoride with standard calcium chloride solutions, but the end-points proved to be unsatisfactory.

They were successful in developing a method in which the excess calcium present after precipitation of the insoluble calcium fluoride was back titrated with ethylenediaminetetra-acetic acid. Sulphate and phosphate ions, which interfered with the conventional thorium nitrate and aluminium chloride methods, did not interfere. It was unnecessary to separate the precipitated calcium fluoride, but the authors recommended that the solution be allowed to stand overnight before titrating. Murexide and Eriochrome Black T were used as indicators, the latter being preferred.

#### **Gravimetric** Analysis

8-Hydroxyquinoline (oxine) is not a specific reagent as it precipitates some 28 different cations. Selective control of experimental conditions (such as pH and the use of masking agents) achieves a certain degree of selectivity, resulting in a widespread use of the reagent. The use of complexone as the masking agent prevents the precipitation of almost all oxinates save those of hexavalent molybdenum, tungsten and uranium.

In the determination of molvbdenum, the majority of metals are held in solution<sup>25</sup> when complexone is present. No contamination is apparent when the precipitate is brought down and filtered in hot solution. In an acetic acid-acetate buffer, separation from copper, lead, cadmium, bismuth and Hg.. is complete. If the filtrate is rebuffered with ammonia and sodium acetate, copper-oxinate precipitates. only The copper is completely precipitated and is free from contamination. Ferric iron and aluminium behave in the same manner as cop-Titanium does not form a complexonper. ate and must be removed before the determination is carried out.

In the presence of hexavalent uranium, molybdenum can be determined by adding oxine to the faintly acid solution containing complexone; the uranium compound can then be precipitated from the filtrate by making it alkaline. Manganese, nickel, zinc and cobalt do not interfere with either determination.

Tungsten<sup>26</sup> behaves in a similar manner to

molvbdenum. In , determining tungsten." large amounts of zinc cause low results. Lead, if present, tends to precipitate as the insoluble tungstate, but may be retained in solution by using a moderate excess of complexone. Pribil and Sedler have outlined methods for the simultaneous determination of tungsten and copper, tungsten and cobait, and tungsten, iron, uranium and cobalt by selective precipitation of the oxinates from complexone solution. No mention is made of the possibility of determining molybdenum and tungsten in the presence of each other. Whereas ethylenediaminetetra-acetic acid forms stable complexes with solutions of most di- and trivalent metals from which the hydroxides cannot be precipitated by addition of ammonia solution, beryllium and certain tetravalent elements can be precipitated.27 Metals such as iron and aluminium remain in solution. A considerable excess of aqueous ammonia and a standing time of at least three hours are required to ensure complete precipitation.

Aluminium can be determined in the filtrate by destroying the complexone with strong hydrochloric acid and potassium chlorate, and then adding ammonia solution. Iron behaves in the same way as aluminium. Trivalent chromium forms a complexonate only on warming the solution, so that in the presence of chromium it is necessary to boil the solution and cool in the presence of excess complexone. Titanium interferes with the determination since it behaves in an identical manner. Phosphate must be removed by precipitating with ammonium molybdate, thus preventing the precipitation of beryllium ammonium phosphate. The use of complexone in conjunction with aqueous ammonia therefore provides a valuable method for the determination of beryllium in the presence of aluminium.

Titanium<sup>28</sup> can be determined in the absence of beryllium in a similar manner. The precipitation time may vary from 30 minutes to 5 hours. Chromium is co-precipitated to a considerable extent with the titanium. Bismuth<sup>29</sup> is the only one of the trivalent metals which can be precipitated from its solution in complexone by aqueous ammonia. Whereas all the trivalent metals save aluminium can be precipitated by means of sodium hydroxide, bismuth is unique in its reaction towards ammonia solution. The method is claimed to be more rapid and

equally as accurate as the method based on the quantitative precipitation of the hydrolysis products of bismuth salts.

#### **Colorimetric** Analysis

In colorimetry, Pribil and his co-workers have made use of the intense colours of the complexonate of trivalent manganese and cobalt. Manganese<sup>30</sup> was oxidised with sodium bismuthate in the presence of ethylenediaminetetra-acetic acid. The colourless cations of zinc, cadmium, magnesium and mercury did not interfere. However. the method is of little value, for the absorption of the solution must be measured within five minutes. Mineral acids interfere and the amount of complexone used must be very carefully controlled. Although several references are made to the colorimetric determination of cobalt, the method itself has not been published. Presumably it is very similar to the method used for manganese, but the colour system may be considerably more stable.

Chromium<sup>31</sup> forms an intensely red complex with ethylenediaminetetra-acetic acid, the colour of which is said to be stable for at least 10 days. In forming the complexonate the solution has to be boiled for five minutes. Colourless ions do not interfere; coloured ions such as copper, iron, nickel, and cobalt must obviously be absent.

A colorimetric method for copper was also described by Sedivec and Vasak.<sup>20</sup> These workers used the conventional diethyldithiocarbamate procedure except that ethylenediaminetetra-acetate was added to complex metals which normally interfere (e.g., nickel, cobalt, manganese and iron). The copper was determined by measuring the absorption of the ethyl acetate extract.

Mercury<sup>33</sup> can be determined by means of dithizone in the presence of ethylenediaminetetra-acetate when other heavy metals which normally interfere with the determination are present. Silver has to be precipitated by means of ammonium thiocyanate and removed from solution before the determination is carried out.

#### Separation Methods

The use of complexones could readily be extended to the quantitative separation of various cations. Relatively little published work has appeared on this aspect. During the past two years occasional papers have been published in the Journal of the Chemical Society on the lanthanons.<sup>34-36</sup> The separation is achieved by fractional precipitation of the oxalates or other insoluble salts on breaking their complexes with the ammonium or alkali salts of ethylenediaminetetraacetic acid. By this method of fractionation, yttrium comes close to dysprosium in the lanthanon series and is separated from the ytterbium earths. A separation of lanthanum and samarium has been claimed and a certain degree of resolution of praseodymium and neodymium achieved by a similar method.

Lead<sup>37</sup> is not precipitated by H<sub>2</sub>S from a weakly acid solution of complexone. The precipitation of copper and cadmium is somewhat delayed, but they are eventually precipitated completely. In the presence of nitrilotriacetic acid, zinc sulphide is precipitated completely by ammonium sulphide, while nickel and manganese remain in solution. The zinc sulphide is free from traces of the other metals and can be ignited to the oxide and weighed. The nickel and manganese can be brought down from the filtrate by addition of calcium chloride. The separation of zinc from either metal is upset by the presence of cobalt.

Ethylenediaminetetra-acetic acid forms more stable complexes with these metals than does nitrilotriacetic acid. Zinc is not precipitated from its complex with this complexone by ammonium sulphide, but addition of calcium chloride gives a complete separation from nickel and Co<sup>•••</sup>.

The alkaline earths form very stable complexes with ethylenediaminetetra-acetic acid in alkaline solution and can displace Mn<sup>••</sup>, zinc and cobalt, but not nickel. The displaced ions may be precipitated quantitatively from solution by sulphide ions. This may be used for the separation of any of these metals from nickel. Manganese may be separated from nickel, cobalt and zinc in nitrilotriacetic acid since it alone is not precipitated by aqueous ammonia in the filtrate is treated with strontium ions the manganese precipitates quantitatively.

Barium and calcium can be separated from lead in complexone solution (Enta) in the presence of acetic acid by precipitating the sulphate and oxalate respectively. The precipitates contain no lead. Many tests for magnesium are based on the adsorption of various organic dyestuffs by magnesium hydroxide. Elements such as nickel, manganese, zinc, cobalt and tin which normally interfere can be held in solution by ethylenediaminetetra-acetic acid while the magnesium is precipitated by addition of calcium or strontium ions.

#### Qualitative Analysis 38

In the presence of an acetic acid solution of complexone only silver and thallium are precipitated by chloride. In ammoniacal solution, silver chloride is soluble, while thallium forms a complex. Complexone therefore offers no special advantage except that silver can be determined gravimetrically in the presence of lead. Iodide precipitates insoluble iodides of silver and thallium in complexone solutions. The normally insoluble iodides of lead and bismuth do not precipitate, and ions such as Fe .... and Cu<sup>••</sup> which normally oxidise the iodide to free iodine are too firmly bound by the complexone to interfere at a pH not exceeding 1.2.

In an ammoniacal solution of ethylenediaminetetra-acetic acid, silver is precipitated by iodide. but thallium remains in solution although it can be brought down in the filtrate by acidifying. From an acetic acid medium containing complexone, chromate precipitates only thallium and barium. Silver and lead remain in solution. Only strontium, barium and calcium are precipitated by sulphate ions from an acetic acid medium containing complexone. This reaction is useful for separating these elements from lead. In alkaline soluton no precipitation occurs. Similarly, oxalate only precipitates the alkaline earths, in particular, strontium and calcium.

In the presence of complexone, the only metals removed from solution are Sb\*\*\* Sn ..... , bismuth, beryllium and titanium; uranium is precipitated as ammonium di-Sodium hydroxide precipitates uranate. only Fe ... , bismuth, thallium, zirconium, uranium and titanium. The presence of trivalent arsenic hinders the precipitation of This difficulty can be ferric hydroxide. overcome by oxidation of As\*\*\* with hydrogen peroxide. The precipitation of metallic sulphides with hydrogen sulphide has already been discussed.

#### Polarography

The application of the complexones to polarography is too large a subject to discuss in any detail, but brief reference may be made to some of Pribil's investigations. The polarograph has proved useful for showing

whether or not a complex is formed when complexones are added to a solution of the ions being examined. The formation of a complex is revealed by a shift in the half wave potential to a more negative value. In this way, it has been shown that thallium<sup>3</sup> does not form a complex in neutral or acid solutions. In alkaline solution, the shift in the half wave potential makes it possible to distinguish between the waves of copper. lead and thallium.

In weakly acid solution in the presence of ethylenediaminetetra-acetic acid, molybdenum<sup>40</sup> forms a complex. This can be utilised for the polarographic determination of traces of molybdenum in the presence of copper, lead and other elements reduced at the dropping cathode at potentials more negative than the reduction potential of the molybdenum complex.

A method has also been described for the polarographic determination of uranium<sup>41</sup> in a solution containing 10 per cent ammonium carbonate and 0.1M in ethylenediaminetetra-Under these conditions most acetic acid. other elements form stable complexes which are not reduced at all in the accessible potential range. Nickel, cobalt, manganese, zinc. chromium, aluminium, beryllium and titanium do not interfere. Only lead and relatively large amounts of copper cause trouble.

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## **Electrical Instruments**

#### New Designs at London Exhibition

TEW and attractive designs of circular N scale electrical instruments are the main feature of the exhibit of Crompton Parkinson Limited at the British Instrument Industries Exhibition which opened at Olympia, London, on 30 June and will continue until 11 July.

The long open circular scale accords with present-day practice of designing instrument scales so that they can be read easily and accurately by an observer who has to make the appropriate and correct response to changing indications, or obtain quickly a series of readings from a control panel.

The circular scale instruments on show include 31 in., 4 in. and 6 in. diameter dial ammeters, voltmeters, wattmeters and frequency meters for switchboard mountings. Of special interest to the chemical industry is the range of circular scale hermetically sealed instruments in light alloy cases, constructed to withstand corrosive atmospheres.

C.P. circular scale instruments are constructed on similar lines to the Admiralty pattern shock tested types. In accordance with the Admiralty specification, these types have to pass the shock test, which consists of beating with a 400 lb. hammer a metal plate which the instrument is mounted. on Although such a drastic test is not required for instruments for industrial service, certain features of design developed to withstand this test are incorporated in all the new C.P. circular scale instruments. The industrial user has the advantage of the same fine quality materials, jewels sprung to protect the pivots from shock, a circular platform scale on a level with the pointer, etc.

## Modern Uses of Organic Polyisothiocyanates

#### **Important Industrial Applications**

A LTHOUGH organic isocyanates were prepared by Wurtz as far back as 1848, it is only recently that these compounds have found important industrial applications. The unique reactions of organic isocyanates with amino, carboxyl and hydroxy groups to give urea, substituted amido and urethane derivatives, as illustrated by the following reactions, may be regarded as the startingpoints for such applications.

(i) 
$$R.N:C:O+R'.NH_2 \rightarrow R.NH.CO.NHR'$$
  
(ii)  $R.N:C:O+R'.CO_2H \rightarrow R.NH.COR'+CO_2$   
(iii)  $R.N:C:O+R'.OH \rightarrow R.NH.CO_2R'$ 

When  $R = NH_2$  in eq. (i) the corresponding isothiocyanate will give thiosemicarbazide.

Theurapeutically these compounds are of interest, since the thiosemicarbazones of benzaldehyde and pyridine aldehyde derivatives have been shown to possess high antitubercular properties. Isoxalones have also been prepared by reacting the appropriate isothiocyanates with sodio acetic esters, followed by treatment with hydroxylamine. [J. Amer. Chem. Soc., 44, 1553 (1922)]. In agriculture, organic polyisothiocyanates are used as fungicides and insecticides (B.P. 478.604).

#### **Isocyanate** Accelerators

Rubber has been vulcanised using compounds prepared by the action of phenylisothiocyanates on guanidine, guanyl phenyl thiourea derivatives being the probable accelerators involved. Effective accelerators are claimed to have been prepared from symdiphenylguanidine and phenylmustard oil (B.P. 501,787). Cyclised rubbers are modified for use as adhesives utilising organic di-isocyanates.

Adhesive compositions have also been prepared by the addition of organic di-isocyanates to crude or reclaimed natural rubber and to such synthetics as thiokol. In the shoe industry, adhesives made from isocyanate-terpene phenolic resins in organic solvents, have been utilised for both shoe soles and uppers (B.P. 636,423). In other fields, cellulosic materials may be bonded to rubber by the use of toluene solutions of appropriate rubber and alkylene di-isocyanate, the cellulosic yarn being passed through the solution containing the di-isocyanate and rubber.

#### The New Plastic

The most important modern application the organic isocyanates is without of doubt their rôle in the synthesis of isocyanate modified polyesters or esteramidesthe latter being polycondensates of aliphatic dicarboxylic acids, glycols, and either alkyl or aryldiamines. These polyisocyanates function as chain lengtheners, reacting in the first instance with the terminal functional groups in the polyester, to give intermediate di-isocyanates. The reaction is illustrated on a simple basis, with a simple acid-glycol diester:

 $\begin{array}{l} \text{HO.CH}_2\text{.O.CH.}(\text{CH}_2)_n\text{.CO.O.CH}_2\text{.OH} +\\ \text{2OCN.X.NCO} \rightarrow \text{OCN.X.NH.CO.O.CH}_2\text{.}\\ \text{O.OC.}(\text{CH}_2)_n\text{.CO.O.CH}_2\text{.O.OC.NH.X.NCO}\\ (I)\end{array}$ 

(1) is then capable of reacting with other esters to give a modified polyisocyanate polyester macromolecule:

OCN.R.NCO + HOCH<sub>2</sub>.R'.CH<sub>2</sub>OH  $\rightarrow$ OCN.R.NH.CO.O.CH<sub>2</sub>.R'.CH<sub>2</sub>.O.CO.-NH.R.NCO where R is the polyester fragment represented in (I) and R' represents an appropriate fragment of the acid-glycol diester.

This operation gives the polyester *lamina* a less fusible and more rigid characteristic. Further reaction in the presence of organic di-isocyanates tends to initiate a cross-linking operation between the modified polyester *laminæ* at the active hydrogens in the carbamide or urethane linkages. It is also possible that the 'setting-up' phenomenon is associated with the tendency for terminal-NCO radicals of one polyester molecule to react with given active hydrogens of the carbamide and urethane linkages in adjacent chains.

Again the improved tear strength and abrasive resistance of these compounds is probably associated with the hydrogen bonding between the imino hydrogens of one chain with the carbonyl oxygens of carbamide or urethane linkages in adjacent chains, and in this feature the elastomer resembles such polyamides as nylon. These properties render such elastomers useful for the manufacture of tyres, shoe soles, balls, etc.

Combination of these polymers with other elastomers creates further applications, and gaskets, packings, insulators, protective clothing and floor coverings may be manufactured from compositions of di-isocyanate modified esters with polyvinyl chloride and the acetals of polyvinyl alcohols. In the textile trades, viscose and cellulose acetate yarns when treated with isocyanate modified esters yield products with improved heat resistance. Like other polymers, the modified esters yield products which may be cured, such substances as quinone monoxime, trinitrobenzene, benzoyl peroxide and formaldchyde being used in such cases. The operation is accomplished in conventional manner, by the usual mixing of the ingredients on the mill, followed by subsequent moulding at around 140 to 160°

As previously stated, such polymers tend to set-up,' and this characteristic is a serious handicap, especially when the problem of storage or transport is encountered. These early disadvantages have now been overcome by modifications in technique, where di-isocyanate modified polyesters formed *in situ* are treated with such bifunctional compounds as the aryl and alkyldiamines, amino alcohols, etc., such compounds reacting with the terminal -NCX groups (X = S or O).

This process is claimed to give polymers which can be stored for an indefinite period, the sequestration of the terminal-NCX groups preventing possible reaction of the latter with the intermediate carbamide and urethane linkages in adjacent chains. Most of the work in this field is protected by patents assigned to either I.C.I., Du Pont or Farbenfabriken Bayer respectively.

#### New Laboratory Glassware

SINCE H. J. Elliott Limited, E-MIL Works, Treforest, Glam., introduced their 'E-MIL' Gold Line and Green Line brands of volumetric laboratory glassware and thermometers at the beginning of 1949, these instruments have enjoyed much popularity. The company chose the opening of the British Industries Instrument Exhibition at Olympia on 30 June to bring to public notice the introduction of two new brands. These are 'E-MIL Tek-A' and 'E-MIL Tek-B,' which cover types of volumetric laboratory glassware and chemical thermometers in most common demand.

#### Nationalising Chemicals Union Secretary Criticises Proposals

MR. BOB EDWARDS, secretary of the Chemical Workers' Union, speaking at the annual conference of the Union at Sheffield last weekend, described as 'far from clear' the Labour Party's proposals for the chemical industry, adding that they did not give details regarding the organisational strucure of the companies which it was proposed to acquire.

Problems which had arisen out of existing nationalisation would not be solved, the Union felt, unless public ownership of chemical production was founded on democratic principles which allowed for control of the industry by all elements involved—technicians, workers and consumers.

He recalled that the Union had condemned the structure of the industries already nationalised and had offered detailed proposals for their democratisation. It did not advocate the control of chemical production for the sake of planning because planning without industrial democracy was not Socialism.

#### Wasteful and Inefficient

The private ownership of the chemical industry was wasteful and inefficient and it was immoral for great power over the lives of the people to be in the hands of a few business men. Nationalisation did not solve that problem, however, if it concentrated greater power over the lives of the people into fewer hands. Socialism was incompatible with bureaucracy; it led to progress only if industrial democracy was accepted as a desirable and essential detail of the Socialist programme.

The conference agreed to a resolution urging the Trades Union Congress to agree to the principle of a legalised national minimum wage linked to a new revised retail costof-living index. Moving the resolution, Mr. Edwards said that Britain today had the most stupid and most inefficient wage structure. A realistic wage policy had to meet two basic requirements—the needs of the national economy and the requirements of social justice.

#### **British Paints Expansion**

A manufacturing plant in Canada is being sought by British Paints (Holdings), Limited, who at present have no trade with the Dominion. Mr. J. W. Adamson, the chairman, is on his way to Canada.

## The Chemistry of Fuels

#### Some Lines of Investigation at the Fuel Research Station

WITH the object of ensuring real progress in the investigations that are undertaken, the Fuel Research Board have continued their practice of including in their programme only a few of the many fuel problems which are of great national importance. This programme, and the results obtained so far, are described in Fuel Research 1952,' which has just been published.

Work on the chemical constitution of coal has been continued at the Fuel Research Station, Greenwich, and an investigation of the structural changes which bright coals (vitrains) undergo while maturing is being made by a study of their oxidation products. The oxidations are carried out under standard conditions with alkaline potassium permanganate, and the products are CO., steam volatile acids (regarded as acetic), oxalic acid and other non-volatile acids. apparently all aromatic. It is therefore customary to regard the yield of non-volatile acids, exclusive of oxalic, as indicative of the extent to which an aromatic structure was present in the original coal.

Investigations are being continued with a view to elucidating the manner of association of 15 minor elements with coal. The average figure for vanadium content, based on the analysis of some 200 miscellaneous coals from all the main British coalfields, lies between one and 10 p.p.m.

#### Germanium Content of Coals

Data obtained for germanium in seven of the bright coals from South Wales support the conclusion derived from other work, that the germanium content of coals from this area tends to be low; the results also indicate that South Wales coals are likely to prove exceptions to the general conclusion that the greater part of the germanium is in association with the pure coal substance.

Under certain conditions, the addition of powdered carbon or graphite to a sample of material for spectrographic analysis can markedly affect the emission of spectrum lines when these lines are excited by volatilising the sample in an electric arc. Experiments have been undertaken to obtain more, information on this effect, particularly in relation to the determination of major and minor constituents of coal ash. It has been found that the presence of carbon markedly enhances the emission of the lines of aluminium, calcium, magnesium and titanium, when the current passed by the arc does not exceed a certain critical value, above which the enhancing effect disappears abruptly. For the major ash constituents, and also for some minor constituents, the presence of carbon produces little or no intensification of the characteristic spectra.

#### **Estimating Fluorine**

Some trials have also been made of the method of estimating fluorine spectrographically, which involves the measurement of the intensity of the band spectrum of calcium fluoride when the sample is volatilised in an electric arc in the presence of a calcium compound. The method was found to be less satisfactory for coal ashes than for the ashes of shales, the fluoride band spectrum produced by the former being invariably accompanied by an unduly high general background. The limit of sensitivity of the method, of about 0.01 to 0.02 per cent of fluorine, was not entirely satisfactory in relation to the normal fluorine content of coal ashes and shales.

Studies in the Fischer-Tropsch synthesis have now been extended by the construction of pilot plant on a scale to produce 30 to 50 gallons of oil a day, with the object of obtaining basic chemical-engineering data; the design was described in detail in last year's report. An exploratory run has been carried out in the 8-in. diameter fluidised-bed reactor, using mill-scale impregnated with alkali as the catalyst. As facilities for reducing the catalyst in pure hydrogen at the normal temperature of 450° were not available, reduction was carried out *in situ* at the maximum temperature attainable—290°.

Synthesis tests were carried out at pressures of 20 and 30 atm. and temperatures in the range of  $305^{\circ}$ - $315^{\circ}$ , with fresh synthesis gas at the rate of 2,000-2,200 cu. ft. per hr.; this gas contained 26 to 28 per cent CO, and 68 to 70 per cent H<sub>2</sub>. During the best three days of the run, the CO-conversion was 85 per cent and the yield of C<sub>3</sub> and higher hydrocarbons, together with organic compounds recovered from the reaction water, amounted to 104 gm. per cu. m. of synthesis gas. This is equivalent to 43 gal. of useful product per day.

Tests in laboratory-scale reactors showed that the reduction of catalyst under the conditions used in these tests is very incomplete. Despite this, however, samples of catalyst withdrawn from the plant were found to be of high activity when tested in small reactors. The much lower activity exhibited in the plant may have been due to bad distribution of the gas, but the smaller ratio of the height of the catalyst bed to its diameter, as compared with that in the laboratory reactor, may have been a contributory factor.

Some progress has been made towards the use of C-14 as a tracer in investigations of the mechanism of the Fischer-Tropsch synthesis. Carbon monoxide may be prepared from labelled barium carbonate with yields of not less than 95 per cent.

The Grubb-Parsons IR spectrometer is now used to study the distribution of isomers in the products of synthesis. At present the work is confined to the fraction boiling between 49° and 81°, which contains the  $C_6$  hydrocarbons.

As a first step in an examination of the factors responsible for the rheological properties of fuel oil, the oil has been separated into fractions. in each of which a particular group of components is concentrated. Asphaltenes are precipitated by treatment with pentane, and the oil is then adsorbed on magnesia. The magnesia is extracted successively with pentane and benzene, and unextracted residue is liberated by solution in dilute sulphuric acid.

#### **Viscous Properties of Fuel Oils**

In order to study the viscous properties of fuel oils and the fractions derived from them, a coni-cylindrical viscometer, similar to one used by the Anglo Iranian Oil Co., Ltd., has been constructed. The outer cylinder, which contains the oil, is rotated at any speed between 0.25 and 30 r.p.m. by means of a servo-controlled DC motor constant within 0.5 per cent. The liquid in the bath surrounding the viscometer cup can be maintained at any temperature between  $-30^{\circ}$  and  $+70^{\circ}$  by means of a special themostat unit, and at temperatures between 7° and 50° the control is accurate to  $\pm 0.022^{\circ}$ .

A study was made of the chemical separation of emulsions of residual fuel oils and sea water by adding substances likely to reduce the interfacial stability. The mixtures were then heated to 80° and filtered. The most effective substances were found to be the anionic surface-active agents such as the alkyl sulphates and alkyl aryl sulphonates. It was found that with each emulsion there was a critical concentration of surface-active agent to give the maximum separation of water.

Many methods of filtration were examined. The best results were obtained by the use of sintered glass discs, especially when the pore size was approximately the same as the diameter of the water globules in the emulsions, i.e. 0.005 to 0.01 mm. Filtration greatly accelerated the rate of separation of emulsions, but some oils caused the filters to become blocked. The results obtained so far have confirmed the conclusions of earlier workers that the asphaltenes are responsible for the ready formation of emulsions and their stability.

#### Other Lines of Research

Among the other lines of research which have been followed in the past year are investigations of the production of suitable grades of metallurgical coke by blending grades of coal; experimental work on the design and operation of combustion chambers to enable coal and peat to be used as the source of energy for gas turbines; further work on the removal of sulphur compounds from flue gas by scrubbing with crude ammonia; and a nation-wide survey of atmospheric pollution.

A number of extra-mural investigations are also in progress. At Birmingham University, the examination of sub-humic acids obtained by acid hydrogen peroxide oxidation of humic acid extracted from a weathered outcrop coal has been continued under the direction of Professor Stacev Ward. Filterpaper chromatography and partition chromatography on columns silica gel have shown the of complexity of the mixture of acids, but a completely satisfactory method of resolution has not yet been achieved. Solvents under consideration include mesityl oxide, methyl npropyl ketone, methyl iso-butyl ketone. di-iso-butyl ketone, tert-butyl alcohol and tert-amyl alcohol. Very few uses of these solvents have been reported in the literature

and various mixtures under different conditions of flow,  $pH_s$  etc., are being investigated.

Work has been continued in Sir Cyril Hinshelwood's laboratory at Oxford on the thermal decomposition of paraffin hydrocarbons, with the aid of the mass spectrometer for the analysis of reaction products.

The thermal decomposition occurs by simultaneous chain and non-chain (molecular) mechanisms, the latter being isolated by addition of suitable inhibitors, such as nitric oxide. Detailed experiments have now shown that certain small surface effects are secondary disturbances of an essentially homogeneous reaction.

Besides carrying out its work on the items of research outlined above, the Fuel Research Station has continued to fulfil its obligation to advise and assist Government Departments at home and in the Commonwealth, and other organisations and industry, in dealing with their fuel problems. But it is pointed out that this occupies a large and increasing part of the time of the staff, and it is becomingly increasingly difficult to make the progress in main items of research which the urgency of the situation demands.

Fuel Research 1952 is published by HMSO, price 2s. 6d.

## Monopoly in Matches

BMC Chairman's Comment on Report CRITICISM of the British Match Corporation by the Monopolies and Restrictive Practices Commission in its recent report (see THE CHEMICAL AGE, 23 May. pp. 785-786) has been answered by the BMC and their comments have been submitted to the President of the Board of Trade.

The BMC claims that the extent and dangers of monopoly power were overstated in the Commission's report and that such power as really existed had not in general been abused but had, in its exercise, served the public interest. The further claim is made that the report underrates 'the very real threat of competition and omits to compare the risks of any abuses with the benefits of the existing conditions in the public interest.'

Speaking in London, Brigadier H. K. M. Kindersley, chairman of the BMC, said he did not know of any evidence for the allegation that the Corporation's production costs were high. No international standard of comparison was available other than that of the Corporation's oversea subsidiaries and so far as they were comparable those costs were higher than those of BMC. So were the costs of the Corporation's competitors in this country.

Referring to the 'everlasting match' which the industry had been accused of suppressing—Brigadier Kindersley said so far as the BMC and the Swedish Match Corporation were concerned there was nothing to prevent anyone making such matches and it was unfortunate that the report did not make that clear.

As to the price of matches, the cost since 1939 had only doubled, whereas the duty on a box of matches had been trebled. Now the Exchequer took more than 1d. in duty out of every 2d.; the cost of production was  $\frac{1}{2}$ d. a box and the distributors received  $\frac{1}{3}$ d. Manufacturers' average profits were about 1s. on a gross of boxes. If they sold at cost, which meant they would soon cease to sell at all, the maximum reduction to the public would be 1d. a dozen boxes.

The Commission's report stated that there was no competition, but in fact 1,064,697 gross boxes were imported into this country last year, partly from behind 'the iron curtain, where politics and the need for foreign exchange count for more than normal commercial profits; the potential dumping is enormous.' Moreover, two competitors manufacturing in this country for 20 years had no complaints to make to the Commission; in fact, they were supplied with timber without profit to the BMC.

#### Swiss Chemical Industry

The Swiss chemical industry has been doing satisfactory business recently and it is confidently expected that the present high level of activity in the export market will continue for the next few months.

During the first quarter of the year exports of pharmaceuticals reached 115,500,000 francs, an increase of more than 2,000,000 francs compared with the first quarter of last year. Dye exports also showed an increase, rising from 61,600,000 francs to 74,000,000 francs. Exports of fats and oils remained at about the same level as for the first quarter of 1952, while exports of basic chemical products, valued at 34,000,000 francs. were down by about 3,000,000 francs.

## Fuel & Power Efficiency

#### Statements Made in the House of Commons

**PROBLEMS** connected with the more efficient use of fuel and power in industry were the subject of two statements in the House of Commons last week.

Mr. Geoffrey Lloyd, Minister of Fuel and Power, stated in a written reply that the committee set up under the chairmanship of Sir Harry Pilkington, to work out a scheme for increased fuel efficiency advisory services in industry, recommended that an independent non-profit-making company should be formed to develop such services.

This would be a company limited by guarantee, not having share capital, and would be set up by the British Productivity Council which would appoint the governing body. The committee considered that the company would need an annual income of about £500,000; it would be staffed at the outset by suitable technical staff from the Ministry, willing to be transferred to it, together with such qualified persons as could be obtained elsewhere.

Discussions with the appropriate representatives of industry had been completed, and the Government accepted in principle all the recommendations of the committee.

#### **Representative Committee**

The British Productivity Council had accepted the responsibility for forming and sponsoring a Fuel Efficiency Company on the lines recommended by the Pilkington Report, and had been asked to ensure that the board of the new company would be as representative as possible of all the appropriate interests, including Scottish interests. The company when set up could expect an income of £450,000 thanks to the promise of annual contributions of £250,000 from the National Coal Board, £100,000 from the British Electricity Authority and £100,000 from the Gas Council. These contributions, which would be guaranteed for an initial period of five years, would be supplemented by fees charged for certain services and, it was hoped, by voluntary contributions from individual concerns, which, it was felt sure, would give all possible support in other ways to the company.

Industrial advisory services of the Ministry would therefore cease to function as the new company established its own. The testing instruments and equipment surplus to the Ministry's needs would be transferred to the new company, free of charge. The Ministry's technical staff would be given an opportunity to apply for appointment to the new company.

In conclusion, Mr. Geoffrey Lloyd stated that as he would retain his responsibilities under the Ministrý of Fuel and Power Act. 1945, for the promotion of the efficient use of fuel and power, he proposed to arrange for one of his officials to be responsible, as an assessor, for liaison with the new company.

#### To Make Survey

The Minister of Fuel and Power, in reply to a question about the potentialities for the back-pressure generation of power, stated that because valuable fuel savings could be made by passing steam through engines or turbines before using it for heating purposes. it had been decided to make a survey of the potentialities for generating power in this way. Approximately 3.000 industrial undertakings, each consuming over 2,000 tons of coal per annum, and also certain other large establishments, would later be asked to supply the necessary information. It was hoped that with the co-operation of all concerned, provisional figures would be made available to the Ministry as soon as possible so that the final results might be published in the Ministry's Statistical Digest for 1953.

At a Press Conference it was stated that the survey was intended to elicit a broad indication of the physical potentialities of back-pressure generation, and the number of firms already taking advantage of it. Whether it would be economic to install the necessary equipment in cases where no back-pressure generation was at present employed would require further investigation.

The Chancellor of the Exchequer. Mr. R. A. Butler, later announced that immediate modifications would be made in the method of allotting loans in the Government scheme to encourage the installation of fuel saving equipment. A leaflet giving full details would be available shortly from the Ministry of Fuel and Power.

## Wood Preservation

#### Some Continental Methods of Chemical Treatment

A MONG the eight papers presented at the Annual convention of the British Wood Preserving Association in Cambridge last week (see issue of 27 June, p. 960) two dealt in some detail with the chemical protection of domestic timber and lumber on the Continent.

Recent research and development in wood preservation in Germany' was described by Dr. G. Becker, of the Materialprüfungsamt Berlin-Dahlem. Fundamental changes in the properties of wood available and in building constructional methods have resulted in a much wider use of chemicals for wood preservation, and the methods of application have been studied by both research and industry.

In Germany, only two or three woods are of interest as building timber, but there are very many preservatives and potentially useful chemicals which require testing. Numerous preparations, amounting in one case to several hundreds, have been tested by the block test in Knolle flasks for their action. on wood-destroying fungi, especially *Coniophora*, *Poria*, *Lentinus* and *Lenzites*.

The leaching properties of some of these preparations were also investigated: biological tests showed that the efficiency is reduced by, on the average, a factor of 30 in the case of U-salts (fluoride-chromate-dinitrophenol mixtures) as compared with 10 for the 'UA-salts (fluoride-chromate-arsenatedinitrophenol mixtures).

#### **Minimising Test Times**

Efforts have been continued to minimise times of test by developing an impact-bending test, and by reducing the dimensions of the sample, changing the cut of the wood, raising the temperature and providing nutriment. The results differed to some extent from those obtained by standard methods.

Special attention has been given recently to surface treatment and the problem of relating laboratory-scale tests to practical building conditions. It was found that the egg larvæ of *Hylotrupes bajulus*, the house long-horn beetle, were able to gnaw through the top layers which contain the highly poisonous substances and penetrate unscathed into the interior of the wood whenever the protective agent acts only as a stomach poison and not simultaneously as a contact or respiratory poison.

The classification of preservatives into several groups, based on chemical composition and method of application, has recently been made. Alkali zincates, compounds which have the advantage of being unaffected by lime, are only a small group. Popular preservatives from another group consist essentially of sodium fluoride.

#### **Reducing Corrosion**

Silicofluorides are much used in building construction, the magnesium compound being more effective than the zinc compound against insects. A method has been found of minimising corrosion of iron, even by fluosilicic acid in suitable mixtures with other fluorine salts, and without affecting the biological effectiveness. Successful tests have also been made with inhibitors.

The remaining water-soluble salts, comprising many different preparations, are collected together. Worthy of mention is the group based on hydrogen fluoride; these are highly soluble, effective and penetrate deep into the timber, since gaseous HF is evolved from them.

From a chemical study of treatment with mercuric chloride, it has been concluded that the compound accumulates on the sidechains of lignin. Efforts to improve the penetration of the mercuric chloride have included steaming the timber, and the addition of sodium fluoride and other salts to the solution. Vapours given off from the wood have been detected by biological means.

The most numerous of the oil preservatives are the creosote and chloronaphthalene preparations. These may be supplied both light and dark coloured, and in some cases contain special admixtures to enhance the fungicidal and insecticidal properties.

In certain carriers pentachlorophenol loses its power against *Hylotrupes* larvæ, although the stomach-poisoning effect is not reduced by the solvent. Oil-salt mixtures are increasing, both in number and diversity, and serve particularly well for the protection of the ground-air junctions of exposed timbers.

Improved methods for the detection of preservatives have proved necessary, and a number of colorimetric methods are in use. The zirconium-alizarin reaction, developed for the detection of sodium fluoride, gives results with silicofluorides which differ from those for fluorides. Hydrogen fluoride gas in wood can also be detected. New methods have been described for the determination of mercuric chloride and of pentachlorophenol.

Messrs. J. Benoit and C. Jacquoit presented a paper on 'The main problems of wood preservation in France' in which they pointed out that, apart from the railway, postal and electricity authorities, most wood users in France were utterly ignorant of the wood-destroying agencies, of the environmental conditions which allow them to establish and develop in wood, and of the efficient technical means for controlling them.

The chemicals which are of widespread use in log preservation are mainly water emulsions of oily solutions of pentachlorophenol and gammexane. Pentachlorophenol by itself is inefficient towards ambrosia beetles, and the same is true of chloronaphthalene and mixtures of sodium fluoride, dinitrophenol, arsenates, chromates, etc. If only protection towards fungi is aimed at, either creosote, pentachlorophenol emulsion or dinitrophenol paste will prove satisfactory.

In the eradication of *Hylotrupes* larvæ, the best results were obtained with thiophene oil obtained by distillation from bituminous schist. Several distillate fractions were tested and the best was found to be that which distils between 230° and 250°, consisting mainly of hexylthiophene. It penetrates readily into the wood, and emits a toxic vapour which makes it efficient several centimetres beyond its penetration limit. It is harmless not only to man and other mammals, but also to plants.

In the tropics also the use of chemicals to prevent fungal and insect attacks is showing considerable advances.

#### **Change of Address**

Peter Lind & Co., Ltd., have removed their offices at Knightsbridge. Oceanic House, Cockspur Street and Stratton House, Piccadilly, to Romney House. Tufton Street, Westminster, London, S.W.1 (Tel.: ABBey 7361).

#### Albright & Wilson, Ltd.

#### **Overseas Agents Attend Conference**

THE Overseas Sales Conference recently organised by Albright & Wilson Limited for their overseas agents—other than those in the continent of Europe—brought a score or so of representatives from nine countries or groups of countries. They took full advantage of the opportunities afforded them of meeting the company's directors, managers, technicians and sales staff.

Delegates assembled at the Dorchester Hotel, Park Lane, London, where they had dinner. The next day's proceedings opened with a sales conference at Hyde Park Hotel. Mr. J. C. Christopherson, one of the directors, opened the conference, and short talks were given by members of the London office sales staff.

Later the same day representatives from Australia, Burma, Hong Kong, India, Malaya, Pakistan and South Africa gave reports on trade conditions and prospects for future sales in their territories. A general discussion followed. In the evening delegates attended the performance of a play at a London theatre.

#### **Motor Coach Tour**

There was a visit by motor coach to Stratford-on-Avon the following day and the programme included a visit to Blenheim Palace (Sir Winston Churchill's birthplace), after which delegates were conducted by Mr. S. Barratt, one of the directors, on visits to some of the chief Shakespearian places of interest. A performance of 'The Taming of the Shrew' at the Shakespeare Memorial Theatre was attended in the evening.

The next day the visitors were taken by motor coach to the company's works at Oldbury. Various plants were inspected and Mr. S. Barratt opened a conference at which members of the staff gave talks. There were further such talks later in the day.

Returning to London via Leamington the following day, the delegates were given a farewell lunch at Hyde Park Hotel. Mr. J. C. Christopherson was the chairman and others present included Mr. A. W. R. Chandler (Thos. Tyrer & Company) and some members of the I.C.I. London office.

## South African Newsletter

#### From Our Own Correspondent

THE concern felt by doctors regarding the effect of the alarming proportion' of chemicals which were daily finding their way into food was commented upon by Dr. W. A. Odendaal at a meeting of the National Nutrition Council. Dr. Odendaal, who is research officer of the Department of Nutrition. in Pretoria, urged a thorough investigation into this matter and stricter control.

He said that the chemicals were used as so-called bleachers, improvers, fat-extenders, sugar substitutes, colouring substances, raising agents and flavouring substances. The chemicals did not appear to be harmful in the small doses in which they were taken. When, however, it was remembered that the effect of many, particularly those which were fat-soluble, was cumulative and depressive, doctors could not help feeling concerned. Saying that cancer and metabolic diseases were increasing. Dr. Odendaal said sifted and processed foods might make their contributions, but chemicals used in foods were also suspect. Many diseases could be attributed to food habits.

There was no reason why old age should be synonymous with degeneration. Many diseases of old age, such as senility and brittle bones, were due to nutritional shortcomings. As proteins stimulated the appetite, the question had been raised whether a reducing diet should not rather be low in proteins than in fats and carbohydrates. The clinical implications were, however, not yet clear, because appetite was a complicated sensation depending also on the brain centres. Because amino-acids-the absence of one of which lead to loss of appetite--could not be stored in the body, it was now realised that breakfast should include protein such as milk. eggs. cheese or meat.

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The paint section of the South African Bureau of Standards has published several specifications for the ingredients of paint. but more recently it has been drawing up specifications for manufactured paint. and the three now available cover cold water distemper for interior application, red lead base primer for structural steel, and non-reflective olive green camouflage enamel. They are obtainable at 5s. each from the S.A. Bureau of Standards, Private Bag 191, Pretoria. The distemper specification covers non-washable distemper in powder form, in five standard colours, with provision for the addition of many other colours.

The specification describes physical and chemical requirements, including mixing and application qualities, colour, etc. Tests are also mentioned. The second specification covers four types of primers, of which the first two are for use on such structures as bridges and on ferrous metal surfaces of other types. The third item is for covering properly cleaned iron and steel surfaces, and the fourth is for use on structures facing severe humidity or fresh-water immersion. The camouflage paint is mainly used by the Union Defence Force and the specification provides for requirements of a most exacting character.

Ross and Reunert (Pty.). Ltd., Isipingo Rail, near Durban, Natal, are using the trade name of Romet for their current range of oil and rust solvents, water-proofing solutions. radiator cleaners and boiler compounds. The oil and rust solvent is the latest addition to the range and it is available in containers holding from 4½ oz. to four gallons.

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Chemical Services (Pty.). Ltd., P.O. Box 5562. Johannesburg, have received a licence from the Magnus Chemical Company, Garwood. New Jersey, USA, to manufacture in the Union the Magnus 755 carburettor cleansing solution, the first of this type of product to be made locally. It is available locally with the familiar cleaning kit. It can also be obtained without this basket, in containers ranging in capacity from one gallon to 45 gallons.

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Chemical Services have also received the local right from Formax Manufacturing Corporation, of Detroit, USA, to make in South Africa the Formax range of hand rubbing compounds and wheel polishing compounds. It is claimed that this is the first time such items have been produced locally. Formax is being packed in drums varying in capacity from 12 lb. to 500 lb. There is expected to be a big demand for these lines from various industries in the Union.

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Derustit (Transvaal), Ltd., Johannesburg, has developed a new treatment for the removal of mill scale, and a big market for it is being developed locally. The time taken for the solution to act is from  $1\frac{1}{2}$  minutes to 15 minutes; it costs 45s. per 1,000 gal.

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Rhodesia Plastics (Pty.), Ltd., Salisbury, Southern Rhodesia, the first plastics factory erected in Central Africa, is now making a wide range of products. Initially it made picnic ware, plates, bowls, ashtrays and other types of moulded goods in plastics. It then proceeded to make unbreakable crockery with the aid of the new plastic material based on melamine. This company claims to have been one of the leaders in the world in producing thin-wall thermosetting mouldings, and these are of notable strength. They have long been used for pill boxes and recently the firm received an order from the Johannesburg General Hospital for 500,000 of them. It is reported that the cost to the hospital is no more than if the pill-boxes had been made of cardboard, with the additional fact that they are more durable and hygienic. This aspect of the plastics market was developed after the firm had tried to find a large-volume market so that it could operate on a large scale. In addition to the thin-wall pill-box they are making a transplanting 'cell,' a tiny flower-pot for garden use, in which seedlings can be raised. Later plant and cell are put into the ground and the latter then disintegrates.

## Visit to Sweden

#### Superphosphate Manufacturers Meet

DELEGATES from 20 different countries. including New Zealand, India and the USA, totalling 280, attended the annual series of meetings recently held in Stockholm by the International Superphosphate Manufacturers' Association.

Mr. R. Standaert (Belgium), president since 1949, did not offer himself for re-election, for health reasons, and Mr. D. J. Bird (UK) was elected in his place. At the general meeting, a warm tribute was paid to Mr. Standaert for his outstanding services to the association during his years of office. and he was elected honorary president. Mr. A. Bloembergen (Holland), resigned as vice-president on his retirement from business and sincere thanks for his considerable services were tendered to him at the general meeting, as also to Mr. Stevenius-Nielsen (Denmark), retiring vice-president and chairman of the Raw Materials Committee for several years.

For the year 1953/54, the following officers were elected or re-elected: President, Mr. D. J. Bird (UK); vice-presidents, Mr. H. Bührer (Switzerland), Mr. J. Capelo Portabella (Spain), Mr. B. Colbjörnsen (Sweden), Mr. R. Grandgeorge (France), and Mr. J. D. Waller (Holland), secretary, Dr. G. F. New.

Visits were paid to the superphosphate works of A. B. Förenade Superfosfatfabriker at Norrköping and to the works of Gäddvikens Superfosfatfabriks A.B. in Stockholm.

Delegates were entertained at a cocktail party in the Technical Museum of Stockholm and a banquet in Stockholm Town Hall by the Swedish superphosphate manufacturers, who were also the hosts at an opera and ballet performance in the theatre of the palace at Drottningholm.

The date and venue of the 1954 series of annual meetings have not yet been settled.

#### **Chemical Plant Conference**

WITH the object of spreading information about the British chemical engineering industry, a Chemical Engineering Conference is to be held at Olympia at the time of the Engineering, Marine and Welding Exhibition and the Chemical Plant Exhibition-7-11 September.

The Institution of Chemical Engineers and the Chemical Engineering Group of the Society of Chemical Industry are the organisers of the conference, at which a discussion on British chemical engineering in the light of recently published reports will be opened by Sir Harold Hartley and Mr. J. Grange Moore. The reports will be the OEEC report on 'Chemical Apparatus in the USA' and the Anglo-American Productivity Council report on 'Heavy Chemicals.' Mr. J. Grange Moore was leader of the AACP team which produced the latter report.

Papers on all aspects of chemical plant engineering will be read by experts from a number of manufacturing companies.



KINETICS AND MECHANISM. By Arthur A. Frost and Ralph G. Pearson. Chapman & Hall, Ltd., London. 1953. Pp. 343. 48s.

Perhaps the most important conclusion which can be drawn from nearly a century of studies in chemical kinetics is that the majority of chemical reactions are much more complex than might at first sight appear. Even such a well-known reaction as that between oxygen and hydrogen to form water is now known to be so complicated that it is not yet completely understood. The naive assumption that this reaction occurs on collision between two hydrogen molecules and an oxygen molecule is Jefinitely not true. Similarly the reaction between hydrogen and bromine in the gas phase at elevated temperatures follows a complex course involving dissociation of bromine molecules into atoms, followed by reactions between atoms and molecules. On the other hand, the apparently similar reaction between hydrogen and iodine under the same conditions is known to take place by the obvious route involving only bimolecular collisions between single molecules of each kind.

The recognition of this type of problem has led to an intense study of reaction mechanisms, partly because of the academic interest of the problems themselves, but also on account of their importance in chemical engineering practice. This is because a knowledge of mechanism may permit successful prediction of reaction products or of optimum reaction conditions, matters of no small importance in plant operation.

The work under review, which is concerned mainly with the theoretical aspects of the subject, is directed at the graduate student of kinetics and at the young research worker embarking on studies of mechanism by the kinetic method. The authors have sensibly avoided the temptation to present a 'catalogue of recently published work. Instead, more than two-thirds of the book is devoted to a thorough exposition of the theoretical foundations of the subject, illustrated by many examples. A lucid account of transition-state theory is followed by the theoretical treatment of reactions in the gas phase and in solution, and of important problems in homogeneous catalysis and in chain reactions. The remainder of the book consists of studies of a limited number of reactions whose mechanisms have been investigated, in considerable detail, by kinetic and other methods. Among the reactions dealt with are the nitration of aromatic compounds, the decomposition of nitrogen pentoxide and the aldol condensation.

While it would be going too far to claim, with the authors, that this is the first textbook to treat kinetics and mechanism in other than a perfunctory manner, there is no doubt that for the rather limited categories of readers for which it is intended, this book offers a great deal of interest and value.—R. C. PINK.

RADIOACTIVE ISOTOPES. By W. J. Whitehouse and J. L. Putman. Oxford University Press. Geoffrey Cumberlege. Oxford. 1953. Pp. 424. 50s.

This book has been written with the avowed intention of presenting an outline and guide to those scientific workers who may use radioactive isotopes in the course of their investigations or operations, that is, the class of scientists to whom the isotope is the means rather than the end.

There are two possible methods of constructing such a guide. The author may attempt a complete review, collecting all the information and classifying it roughly into sections, or he may write a textbook setting out the theory of the subject first, and then illustrating the application of this theory by selected, examples. The authors of this particular volume have chosen the latter course. Although they have both been at Harwell for many years, and thus might be expected to have access to, and familiarity with all the available literature, the problem of compressing the many thousands of papers which have been published upon the applications of radioactive isotopes into a coherent whole must be considered as insuperable. Instead, in their chapter upon applications, they have selected examples which illustrate the types of use to which the materials have been put.

The result has been an extremely clear and ordered text which may be read and understood by a large number of workers in different fields. The same may be said of the section dealing with the manipulation of radioactive compounds. It is information such as this, which can only be provided by scientists having personal contact with the work they are describing, which has the greatest value. It is unfortunate that this chapter is so short, as there must be many more problems of the remote control of reactions and equipment which the prospective user of radioactive isotopes will want solved. It is to be hoped that this section will be expanded in a later edition.

Earlier chapters deal with theory and measurement, and after a brief historical survey the authors summarise the scope and purpose of the book. There follows a description of nuclear reactions as they are applied to the production of artificial isotopes. Although wherever possible a mathematical treatment has been avoided, some working knowledge of pure mathematics is needed for an appreciation of the latter pages of this chapter, and this also applies to subsequent sections on the modes of nuclear disintegration. The text continues logically, having described the structure and breakdown of the nucleus, to consider the nature of the radiation emitted by the disintegrating nucleus.

An account of the production of radioactive isotopes in the uranium pile and also in the cyclotron might be considered to be an intrusion into the main scheme of the book, since it deals with processes that will remain perhaps for ever in the hands of a strictly limited number of scientists; but some understanding of these processes is essential, and the authors have been content to confine their descriptions to the results rather than the construction or operation of these machines.

The remaining chapters cover the detec-

tion and measurement of emitted particles and the gross effects of emitted radiation. Attention has been concentrated upon the counter tube, and reference to some of the newer methods of counting  $\alpha$  particles has been omitted largely because of their incomplete stage of development. Reference is also made to the problem of standardising radioactive isotopes, an important matter in view of their future wide distribution to industrial laboratories. This is a problem which is being investigated at the present time by the National Physical Laboratorv.

The book is concluded with a number of tables of physical data; many more or these are distributed within the text, and references to the original literature are given at the end of each chapter.—J.R.M.

PETROLE--PROPRIETES AND UTILISATIONS. Vol. 11. By A. Cabaret, Y. Durier, J. Lefebyre de Giovanni, A. Guillermic and J. Lefol. Presses Documentaires. Paris, 1953. Pp. 313.

An admirable introduction is presented in French on the properties and uses of fuels from petroleum sources. The book is in five sections, the first of which deals with gaseous fuels. General properties, manufacture, storage and uses of liquefied petroleum gas are covered in this first part comprising 105 pages. Examples are given of domestic and industrial heating systems which operate on the gas, and special uses such as in the heat treatment of steels are briefly covered.

The second deals with fuels for internal combustion engines. A brief introduction is given on the theory of I.C. engines, followed by a more detailed treatment of the various properties such as volatility, calorific value, latent heat of vaporisation, vapour pressure, octane rating, sulphur content, etc.

Part III is less detailed than the earlier sections, and deals with the properties of diesel oils.

Liquid fuels for industrial heating is the subject of section four. This is a good report on the properties and uses of fuels. illustrated by reference to types of burner. typical furnaces, and furnace control.

•



#### **Plastic Insulation of Cable**

A new type of cable—insulated with polythene instead of the traditional gutta percha, which has been standard since 1850—is being made by the Telegraph and Construction Company, Ltd. The cable, which is 1,250 nautical miles long, is to be put down in the Atlantic by the cable ship H.M.T.S. *Monarch*, the largest in the world. Tests have shown that polythene may be expected to to be as durable as gutta percha over long periods and it has been proved to have superior electrical properties.

#### **Popularity of Rayon**

The latest quarterly statistical review issued by the Cotton Board in Manchester records 'a significant advance' on the part of rayon at the expense of cotton. From another source it is learned that rayon producers are now delivering to the textile industries four times as much rayon staple as they were just over 12 months ago, at the depth of the recession.

#### **Tin Price Falls**

The price of tin dropped at one time to  $\pounds 645$  a ton during an active day's trading on the London Metal Exchange last week. This was the lowest price reached since 10 July, 1950.

#### **Tin-Zinc Alloy Coating**

A tin-zinc alloy coating for steel, developed at the Tin Research Institute, is being used increasingly in industry, according to Dr. E. S. Hedges, the Institute's Director of Research, who spoke at the 26th International Congress of Industrial Chemistry in Paris last week. The alloy, which is electro-deposited, provides a valuable new corrosion-resistant coating for steel.

#### **Trapped** in Lime Chamber

A sudden inrush of hot lime and dust in an underground dust chamber attached to a Ministry of Supply lime kiln at Workington trapped two workmen, William McEwan and Robert Corrie. The latter managed to scramble out and although in great pain hauled his unconscious workmate to safety. When aid came, in response to his cries for help, he also lost consciousness. Both were taken to hospital.

#### Iron & Steel De-nationalisation

July 13 is the date selected for operative de-nationalisation of the iron and steel industry. The Minister of Supply, Mr. Duncan Sandys, announced this in the House of Commons this week. On that day --the 'Appointed Day' under the Iron and Steel Act—all the iron and steel securities held by the State will be transferred to the Iron and Steel Holding and Realisation Agency, while the Iron and Steel Board. created to supervise the general policy of the industry, will begin its work.

#### **Moulding Powder for Plastics**

The President of the Board of Trade, Mr. H. Strauss, was asked by Mr. A. Skeffington in the House of Commons recently how many UK firms manufacture moulding powders used in the plastic industry and whether he was satisfied that new entrants to the industry could obtain supplies of the powder. Mr. Strauss replied that about two dozen firms manufactured such powders and that in general their products were freely available to manufacturers.

#### **Preventing River Pollution**

Lancashire and Cheshire industrialists. particularly those in the north eastern area of the Mersey River Board, have been urged to increase their efforts to combat river pollution. The appeal was made at a meeting of the Board in Manchester by Mr. T. Winstanley, chairman of the north eastern area when he presented a quarterly statement on pollution. 'We are not receiving very much co-operation in this matter from certain industrialists,' he said. 'and some of them are even trying to dodge us.'

#### **PVC Tubing Extrusion**

With reference to an article entitled 'Extrusion of Rigid PVC Tubing' which appeared in THE CHEMICAL AGE on 4 April last (pp. 515-517), we have been asked to make it clear that the photographs included were reproduced by courtesy of Lavorazione Materic Plastiche, Torino, Italy, and that the plant described was manufactured under patents owned by Mr. P. Guareschi.



#### **Rubber** Consumption in USA

Preliminary estimates show that the total new rubber consumption in the USA during May amounted to 119.062 tons, compared with 126,439 tons in April and 103,686 tons in May last year. Of the total for May this year 46,613 tons were natural rubber and 72,449 tons synthetic.

#### **Brazilian Chemical Imports**

The Bank of Brazil has granted licences authorising the import of chemicals and other materials needed for manufacturing rubber articles. Prominent producers, including the Goodyear and Firestone tyre companies, announced earlier that further delay in issuing licences would result in a partial closure of factories in San Paulo.

#### Tanganyika Mica Output

A second mica-processing plant has been opened in Tanganyika by the New African Mica Company in the Morogoro area. The company—a joint concern of Van Eeghen & Maclaine (East Africa) and Otto Gerdau & Company, New York—entered the mica industry about a year ago and has now outgrown its original premises. Most of the company's expanding production goes to the USA, but Great Britain is also a customer.

#### **USA Plutonium Production**

Improved operational methods have resulted in 'spectacular' reductions in the cost of producing plutonium for atom bombs according to Mr. David Shaw, project manager of the Hanford works of the USA Atomic Energy Commission. By doubling the plant and Government investment in the Hanford project — which will total \$1,000,000,000 when it is completed by 1955 —they might, he said, be getting four or five times as much plutonium.

#### Japanese Synthetic Fibres

A five-year plan to increase the production of synthetic fibres from 10,000,000 lb. a year to 100,000,000 lb., and so enable drastic savings to be made in the purchase of Australian wool and USA cotton, has been launched by Japan. Imports of cheap wood pulp from the USA are to be increased for the production of viscose rayon and chemical cellulose.

#### New Zealand Oil Fuel

Government approval of a project to produce oil fuels and by-products from coal deposits at Ohai, Southland, New Zealand, is being sought by Sol Development Company. The company has taken out options and rights over the deposits, which are estimated at between 150,000,000 and 200,000,000 tons, and has sent a director on an investigation tour of Britain, the USA and Germany.

#### 'Terylene' Plant at Ontario

Dr. Richard Beeching, director of Imperial Chemical Industries of Canada. Limited, addressing members of the Silk and Rayon Institute at Toronto, said the new I.C.I. plant at Millhaven, Ontario, costing \$20,000.000, would reach full production of 'Terylene' fibres and yarns from the new textile fibre by about the middle of 1955. He added that the company would employ about 1,000 people and it was their wish that these should be all Canadians.

#### **Indian Glass Factory**

A team of glass workers employed by Pilkington Brothers, Ltd., St. Helens, are leaving for India in the autumn. They will be responsible for the initial training of Indian labour in the firm's new factory at Ascansol, Bengal, which is being worked in conjunction with the Hindustan Development Corporation, Calcutta. It is expected to be in production by the end of this year. Flat drawn sheet glass manufactured will be used for housing purposes. The new factory will be known as the Hindustan Pilkington Glass Works, Ltd.

#### South American Superphosphate

It was reported in the issue of 21 March that two new factories to be built in Brazil. with a capacity of 75.000 tons of superphosphate per year, would be the first of their kind in South America. The Companhia de Superfosfatos e Produtos Quimicos has now drawn our attention to the fact that. since the beginning of 1952, they have been producing superphosphate at a factory with comparable capacity, near Sao Paulo. The factory employs a modern continuous process.



LIEUT.-COL. SIR FRANCIS H. HUMPHRYS, who has been vice-chairman of Associated Portland Cement Manufacturers Limited and British Portland Cement Manufacturers for 17 years, has relinquished those offices, but continues as a director of both companies. MR. J. A. F. BINNY, chairman of London and Colonial Investment Corporation. has been appointed vice-chairman in his place.

SIR EDWIN PLOWDEN, Chief Planning Officer to the Government and chairman of the Economic Planning Board, will retire from public service at the end of Ocober. The Economic Section of the Cabinet Office will then be transferred to the Treasury and MR. R. L. HALL—its director—will become Economic Adviser to the Government. SIR BERNARD GILBERT, a Second Secretary in the Treasury, will be chairman of the Economic Planning Board. Sir Edwin Plowden will continue to be a member of the Board.

DR. WILLIAM R. VEAZEY, who has been a director of the Dow Chemical Company of Canada. Ltd., for 26 years, has retired after 37 years' service with the company. MR. HERBERT D. DOAN, son of the president, Dr. Lelan I. Doan, and MR. HERBERT H. DOW II, son of the late Dr. Willard H. Dow, have been elected to the board. Three new vice-presidents are DR. RAY H. BOUNDY, director of research and a director of the company; MR. DONALD WILLAMS, director of sales; and DR. J. D. HANAWALT, manager of the magnesium department.

MR. ROBERT L. TAYLOR has been appointed director of public relations of Mathieson Chemical Corporation. He is a past officer of the Manufacturing Chemists' Association. Inc.. and for a number of years was editor of *Chemical Industries*, now *Chemical Week*, published by the McGraw-Hill Publishing Company, Inc. Prior to that he was associated with Monsanto Chemical Company. St. Louis, Missouri. He is a graduate of the University of Michigan and a member of the Chemists' Club. New York, and the University and National Press Clubs. Washington, D.C. MR. G. A. CAMPBELL, director of Geigy & Company, Ltd., Middleton, Manchester, gave a talk on DDT to Rochdale Rotary Club.

MR. C. B. READ has been appointed manager of the edible oil refinery at the Stork Margarine Works of Van den Berghs & Jurgens. Ltd., Purfleet. Essex. He was formerly assistant production manager of the margarine factory and succeeds MR. H. GATES who is taking up a technical position in India. Mr. Read is an M.Sc. of London University.

At the sixth annual general meeting of the Fertiliser Society, held at Ascot on Thursday, 25 June, 1953. MR. T. P. DEE, MR. A. W. DONALD and MR. J. T. PROCTER were elected to the Council in place of MR. A. GILLIES, DR. J. H. HAMENCE and MR. A. K. VERNON, who had retired by rotation. MR. J. ANGUS was elected president and MR. J. T. PROCTER vice-president.

MR. HARRY B. MCCLURE, who has been appointed executive vice-president of Carbide and Carbon Chemicals Company (a Division of Union Carbide and Carbon Corporation, New York), has been vicepresident since 1944. He became a member of the Union Carbide organisation in 1928 as a research fellow at Mellon Institute of Industrial Research, Pittsburgh, and for the past 20 years has been concerned mainly with the development of new chemicals and finding new industrial uses for them. On this subject he has written many technical papers and articles and is a member of numerous USA professional and technical societies.

DR. BRUCE B. ALLEN, manager of the Summit, New Jersey, research laboratories of Celanese Corporation of America, last week announced several appointments in connection with the expanded research programme of the Plastics Division of the company.

DR. WILLIAM L. EVERS has been named assistant manager in charge of Plastics Division research at the laboratory. He was formerly associated with Rayonier Corporation and Rohm & Haas Company. He attended the University of Akron. Northwestern University and Penn State.

DR. WALTER D. PAIST was named head of the newly formed applications research section of the Plastics Division. Dr. Paist joined Celanese in 1941 and attended the University of Pennsylvania and Columbia University.

DR. RICHARD E. DAVIES was appointed head of the Plastics Division's polymer research section. He joined the company in 1946 and attended Union College at Schenectady. New York, and Columbia University.

MR. LAWRENCE LYNN was named head of the Plastics Division process engineering section. He joined the company in 1949. and is a graduate of Texas A. & M.. and Columbia University.

DR. MOSTAFA MAHMOUD HAFEZ, Controller of the National Research Council of Egypt, is visiting the United Kingdom for five weeks, under the auspices of the British Council, to study the organisation of scientific and industrial research in Britain. He began his programme of visits on 23 June when he spent the day at the headquarters of the Department of Scientific and Industrial Research. Much of his programme will be concerned with the work of the Department and its research laboratories. He will also visit the British Leather Manufacturers' Research Association at Egham. Surrey. a scientific glassware factory at Sydenham and several industrial research establishments. He will visit Cambridge on 17 July. Birmingham on 20 and 21 July and Manchester on 22 and 23 July.

Dr. Hafez graduated from the Higher Training College, Cairo, in 1930. In 1935 he came to Britain on an Egyptian scholarship and took his B.Sc. with 1st class honours in Chemistry at Sheffield University in 1938. In 1940 he took a Ph.D. in Chemistry at the University of London. King's College, and for a few months worked as a demonstrator at Bristol University before returning to Egypt in 1941.

He was a lecturer at Alexandria University from 1942 to 1946 and a Visiting Fellow at Princeton University. USA. from 1946 to 1948. On his return to Egypt he became an Assistant Professor at the Faculty of Science and the Institute of Industrial Chemistry at Alexandria until 1950, when he was called to the National Research Council as Controller. He is one of two Controllers, being responsible for the scientific side of the Council, and his co-Controller for the staff side.

## Obituary

The death has occurred of MR. PERCY ALFRED WILFRED CAME, chairman of J. Crosfield & Sons. Limited, and of William Gossage & Sons. Limited, aged 62. Mr. Came, a native of Bristol, went to Warrington in 1938 as works manager of Crosfields. Soon after World War II began he was released by the company to superintend the building and to bring into production a new ordnance factory in Leicestershire. became deputy director of the Ministry of Supply in London, and held the position until 1944, when he became technical director of Crosfields. He was appointed chairman in April, 1946.

PROFESSOR ALWIN MITTASCH died in Heidelberg in his 83rd year on 4 June. He started as a chemist, studied the mysterious phenomenon of catalysis under Ostwald, and was then commissioned by Carl Bosch in Ludwigshafen to find a method for commercialising Fritz Haber's experiments on the catalytic formation of ammonia from nitregen and hydrogen. In this attempt he was fully successful. Later he broadened his studies and thoughts about catalysis and in 1948 he was able to publish a book under the title 'Von der Chemie zur Philosophie.' His trains of thought brought Mittasch in contact with Robert Mayer, and he published a great number of essays dealing with Mayer's writings. In the last year of his life Mittasch published two books of considerable importance. 'Friedrich Nietzsche als Naturphilosoph' and guite recently 'Erlösung und Vollendung." Mittasch enjoyed the rather exceptional honour of being made a member of the Heidelberg Academy of Science without being a university professor. but on the occasion of his 80th birthday the title Professor was awarded to him. Up to his last illness which led to his death within a few weeks, the old scholar was in the full possession of his mental powers and incessantly busy writing articles and answering, mostly by return mail, the letters of a wide circle of friends which his enthusiastic temperament and his kind nature attracted to him.-DR. G. RABEL.

## Publications & Announcements

AMONG operators of high-speed grinders. drills and similar tools that tend to project particles upwards at high velocity, there has long been demand for a device which would guard the face more effectively than conventional goggles or headband-suspended The Protective Industrial face shields Clothing Division of the R.F.D. Co., Ltd., have now produced the R.F.D. Shoulder-Braced Face-Guard, which represents a completely new departure in facial protection, the shield being firmly supported by comfortable felt-lined shoulder braces. A lightweight chemical-proof or flame-proof fabric bib is attached to the lower edge of the shield to protect the neck and chest. The full-vision face shield, which is supplied clear or tinted, is trimmed with aluminium. and completely protects both front and sides of the head. The whole equipment can be adjusted or released in a moment, and while wearing it the operator has both hands completely free.

THE subject of oxidation-reduction balance is of considerable interest and importance. Originally of limited application in the field of biology, it is now of increasing practical significance for the industrial chemist and others in many spheres. This development is largely due to the extension by W. Mansfield Clark and others of the system of oxidation-reduction indicators introduced by Ehrlich in 1885. These indicators offer to the chemist a tool by which he may study and control many of the substances he is required to handle. In this connection, readers will learn with interest that the British Drug Houses Ltd., Poole, have now issued a fifth edition of their booklet entitled 'The Colorimetric Determination of Oxidation-Reduction Balance,' which has been revised and extended.

THE 1953 edition of the British Standards Yearbook has just been published and gives a list of the 2,000 British Standards current at the end of March, 1953, with a brief description of the subject matter of each. A comprehensive index simplifies reference. The Yearbook gives the usual information on the membership of the General Council. the Divisional Councils and the Industry

Standards Committees, together with the names of the representatives on the main Special Committees and Advisory Committees. For the first time the Yearbook gives a list of the British Standards under which the Institution's certification trade marks are used, while particulars of the work in hand of all the Industry Standards Committees are also given. The Yearbook is essential to all those engaged in industry and commerce if they are to keep up-to-date with the increasing momentum of practical standardisation and simplification. Copies of the Yearbook may be obtained from the British Standards Institution, 24 Victoria Street. London, S.W.1, price 12s. 6d.

\*

FOR many years synthetic resins have been regularly and successfully used to bond widely different materials: wood, metals and plastics. A new manual has now been published by Bakelite Ltd. to assist users in the selection of the adhesive best suited to any particular work they may have under consideration. Seventeen sheets giving instructions for use, including preparation of surfaces, mixing procedure, spreading, pressing and setting, together with graphs of useful life and basic curing times, and three appendices of generally useful information, make up this extremely useful manual. It is hoped that it will prove of service to the many who already use Bakelite adhesives as well as to those not familiar with the advantages to be gained by their use.

\*

LATEST developments in mechanical handling are described in the new List 284 of J. Collis & Sons, Ltd. The 'VertiVevor' is designed for continuous vertical conveying between floors, with automatic loading and unloading at predetermined heights; the 'SlatVeyor' will carry heavy packages and similar articles at spaced intervals, up sharp inclines and over doorways and passages; and the 'LoadaVeyor' is a mobile inclined conveyor for carrying packaged, loose or bulked materials from one level to another. Details are also given of various patterns of conveyor, which are available with solid top, roller top, and trough top, and with types of belt to suit most requirements.

THE committee of the Microchemistry Group of the Society of Public Analysts and Other Analytical Chemists has selected 40 substances for use as analytical standards in organic micro-analysis. Thirty-one of these can be supplied from stock by BDH Laboratory Chemicals Group, Poole. A list of these has been issued by BDH, who state that they are available in the high state of purity required. The remainder are expected to be available shortly. In consequence of the Microchemistry Group's recommendations. the substances previously issued as 'BDH Organic Analytical Standards' (catalogue page 185) are now withdrawn unless they are included in the new list. Each of the new standards, which are also suitable for use in macro-analysis, is labelled with its formula and molecular weight and the percentage of the significant element or group.

\* \* \*

HERCULES Powder Company Limited of 140 Park Lane, London, W.1 announce that they have concluded an agreement to act as sole distributors for the United Kingdom of AKULON, a polyamide-type injection and extrusion moulding material manufactured by Algemene Kunstzijde Unie, N.V., of Arnhem, Holland. Several grades of AKULON are supplied for specific purposes. each of which has interesting characteristics such as high softening point, wear resistance and a range of translucent and opaque colours. Lengths of AKULON rod are also offered from stock in sizes between 15 mm. and 150 mm, diameter. Technical literature containing interesting data and photographs is available on request.

\* \* \*

THE first edition of a useful 'facts book' dealing with the USA chemical industry has just reached us from the publishers, the Manufacturing Chemists' Association, Inc., Woodward Building, 15th and H Streets. N.W., Washington 5, D.C. Simply entitled 'The Chemical Industry,' it contains 108 pages and is divided into three sections -'Growth of the Chemical Industry,' 'How the Chemical Industry **Operates** ' and 'Chemicals in Everyday Life.' Among facts brought to light are that since the end of World War II, USA chemical manufacturers have spent more than \$8,000,000,000 on new plant and equipment and that sales in 1952 reached about \$18,660,000,000. The outstanding feature of recent history in the USA chemical industry, it is stated, is the trend towards synthesis and the production of new and complete products.

\*

MAGNETIC properties of the nickel-iron alloys are given in a data sheet included in the May issue of 'The Nickel Bulletin,' published by The Mond Nickel Company Limited, Sunderland House, Curzon Street. London, W.1. A progress report tracing the history of gas turbine development is given in the form of a series of papers reviewing current applications in various fields and emphasising the contribution made by improved high-temperature materials. Abstracts dealing with allov steels include a review of the literature of temper-brittleness and a report of research on the effect of composition and heat-treatment on susceptibility to embrittlement. ...

TECHNICAL Bulletins recently issued by The British Oxygen Company. Ltd., Chemicals Division, Vigo Lane, Chester-le-Street. Co. Durham, include No. 2 (revised), the purpose of which is to describe a procedure which, in the experience of the company, will result in the formation of stable resin syrups suitable for the production of melamine laminates, adhesives and moulding powders. Another bulletin is No. 10. This deals with Dicyandiamide NH<sub>2</sub>C(:NH)NH-CN, which is now being manufactured in commercial quantities in Norway by an associated company of the British Oxygen Company, Ltd., Odda Smelteverk, A/S.

\*

TERGITOL dispersant NPX, a non-ionic surface-active agent with outstanding detergent, dispersing, and emulsifying properties. is described in a new technical information sheet (F-8,156) issued by Carbide and Carbon Chemicals Company, 30 East 42nd Street. New York 17, N.Y., a Division of Union Carbide and Carbon Corporation. The bulletin includes information on physical shipping properties, data. solubility characteristics, wetting power, stability and compatibility, physiological action. and applications. Many suggested formulations are given, including those for detergents and cleaners, textile specialities, insecticide and herbicide concentrates, metal cleaners, etc. It is also finding wide application in textile processing, particularly in scouring and wetting operations and in leather processing for backwetting, deliming, and degreasing.



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## Law & Company News

#### **New Registrations**

#### Bonham & Porter (Chemists) Ltd.

Private company. (520,107). Capital £3,000. Wholesale and retail chemists and druggists, etc. The directors are: E. Bonham, Mrs. H. D. Bonham, G. S. Porter. Reg. office: 36 Dennis Road, Coventry.

#### Fertilisers & Chemicals Ltd.

Private company. (520,122). Capital £20,000. Buyers, sellers, exporters, importers and manufacturers of and dealers in agricultural and chemical fertilisers, feeding stuffs, etc. Subscribers: J. T. Race, J. B. Osborne. First directors not named. Solicitors: Durrant Cooper & Hambling, 70/71 Gracechurch Street, E.C.3.

#### Strix Ltd.

Private company. (520,140). Capital £100. Manufacturers of toilet and cosmetic goods of all kinds, manufacturing and analytical chemists and druggists, etc. Subscribers: T. S. Sutherland, M. B. Main. First directors are to be appointed by the subscribers. Solicitors: Frere Cholmeley & Nicholsons, 28 Lincolns Inn Fields, W.C.2.

#### Hydrophane Ltd.

Private company. (520,200). Capital £3,400. Manufacturers of and dealers in fine chemicals and other pharmaceutical medicinal or surgical products, etc. Directors: E. C. E. Hemstead, P. W. Dodd, Mrs. M. Hemstead. Reg. office: 212 Strand, W.C.2.

#### Ivie Hair & Co. Ltd.

Private company. (29,475). Capital £40,000. Drysalters. Directors: W. L. F. Shaw, T. Yuille. Reg. office: 23 Tyndrum Street, Port Dundas, Glasgow.

#### Maxwell Iddon Ltd.

Private company. (520,217). Capital £1,000. Wholesale or retail consulting, analytical, manufacturing, pharmaceutical and general chemists, etc. Directors: Mrs. E. Iddon, J. Proctor. Reg. office: 91 Bolton Street, Chorley, Lancs.

#### Hyzone Ltd.

Private company. (519,977). Capital £100. Manufacturers, importers and exporters of and dealers in chemicals, detergents, soaps and cleansing substances, etc. Subscribers: R. T. Owen, J. C. Edwards. R. T. Owen is first and permanent director. Reg. office: 2 Windmill Road, Hampton Hill, Middx.

#### Lloyd Roach Ltd.

Private company. (520,865.) Capital £6,000. Wholesale or retail consulting. analytical, manufacturing, pharmaceutical and general chemists. Directors: T. Lloyd Roach, M. Lloyd Roach, D. Lloyd Roach. D. M. A. M. Holtham, J. W. Green, B. M. Williams. Reg. office: 6 and 8 Waterloo Road, Smethwick, Staffs.

#### British Visqueen Ltd.

Capital (520,859.)Private company. £240,000. To enter into an agreement with Imperial Chemical Industries, Ltd., and the Visking Corporation; to acquire the business of manufacturers and merchants of and dealers in polythene film now carried on by the Imperial Chemical Industries, Ltd., in the United Kingdom of Great Britain and Ireland. Imperial Chemical Northern Industries, Ltd., and Visking Corporation have the right to appoint four and two direc-The first directors are: tors respectively. J. C. Swallow, J. E. Sisson, both of Imperial Chemical Industries, Ltd. (Plastics Division). Black Farm Road, Welwyn Garden City, Herts; and H. C. Raine, A. F. Gowler (appointed by the said Imperial Chemical Industries, Ltd.); and F. C. Howard, A. T. Peterson (appointed by the Visking Corporation). Solicitor: F. J. P. Craven, I.C.I. House. Millbank, S.W.1.

#### Cannon (CP) Ltd.

Private company. (520,682.) Capital £35,000. Chemical engineers, manufacturers of and dealers in chemical plant, etc. Subscribers: J. B. Gowman, G. S. C. V. Flint. First directors are not named. Solicitors: Clifford Turner & Co., 11 Old Jewry, E.C.2.

#### Theraproducts Laboratories Ltd.

Private company. (520,678.) Capital £5,000. Manufacturers of and dealers in chemicals, gases, drugs, medicines, etc. Directors: J. F. Barham, Dr. A. Clark. Reg. office: 43/5 Fulwood House, Fulwood Place. W.C.1.

#### Smith & Starkey Ltd.

Private company. (520,562.) Capital £1,500. Pharmaceutical, analytical, manufacturing, photographic and dispensing chemists and druggists, etc. Directors: F. Smith, Mrs. P. Smith, F. R. Starkey and Mrs. C. Starkey. Reg. office: 308 Waterloo Road, Blackpool.

continued on page 44



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## Company News

#### Howard & Sons Ltd. A sudden drop in demand for the com-

pany's goods from early June onwards and a sharp fall in the prices of many of the company's raw materials and finished products were the main reasons for the net loss of £34,099 sustained by Howard & Sons, Limited, in the year ended 31 December last. compared with a profit of £107.696 for the previous year. The directors explain this in their annual report, but point out that although the level of turnover is still below that of 1951 and 1952, there have been signs of an upward trend since the beginning of 1953. Having cut overhead expenses substantially, the directors hope that the company is again operating at a profit. No dividend is recommended on the ordinary shares; for each of the three previous years the dividend was 15 per cent. less tax.

#### British Celanese Ltd.

Increased demand for the company's acetate yarn is referred to by Mr. G. H. Whigham, chairman of British Celanese Limited, in a statement circulated in connection with the annual meeting on 16 July. The demand

for the varn during the latter part of the nine months of trading under review has been in excess of the company's ability to supply, states Mr. Whigham. This is despite the steady increase in output as new labour has been trained and become efficient. Turnover in both the home market and for export shows considerable improvement. Net profit of the group for the nine months ended 28 March was £1.841.346 (before taxation), this being at a rate broadly equivalent to that earned the previous year. The net profit of British Celanese, Ltd., was £744,341 (after tax). The dividend recommended on the ordinary stock is 12 per cent (actual), which is equivalent to a rate of 16 per cent for 12 months.

## Market Reports

LONDON.—A steady trade is being done in most sections of the general chemicals market, and the movement to the chief consuming industries has been well maintained. Prices are unchanged with the exception of an increase in the convention quotations for red and white lead, prices of which were received after going to press last week. Dry white lead is now quoted at £139 per ton and red lead and litharge £123 per ton. Quiet markets are reported for the coal tar products, but the price of naphthalene, balls and flake, was reduced £5 a ton on 1 July.

MANCHESTER .--- The past week has seen little change of any consequence in trading Manchester chemical conditions on the market. Deliveries of textile and other descriptions of chemicals have again been affected to some extent by the holidays and this factor has also left its mark on the volume of new business. There has been a fair movement of supplies of the leading alkalis, and also of the potash, ammonia and magnesia chemicals. Values have mostly continued on a steady basis. Apart from one or two lines, seasonally quiet conditions obtain in the fertiliser section. In the by-products market, creosote oil, pyridine, benzol and xylols are in fairly steady call. but in most other sections the demand the week has been only moderate.

GLASGOW.—As opposed to trading conditions during the previous week, business this week has been quite brisk with a steady demand for general chemicals. Export on the other hand has not shown any change.

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