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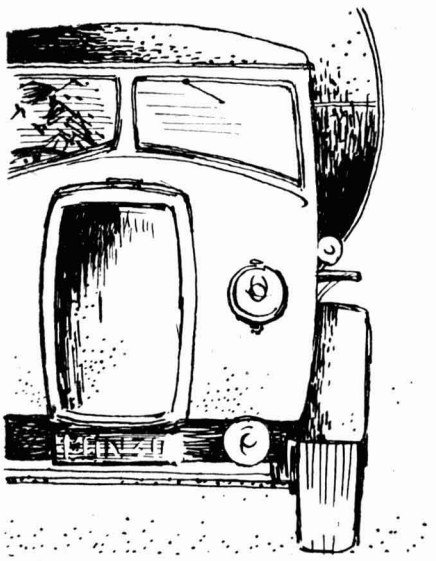

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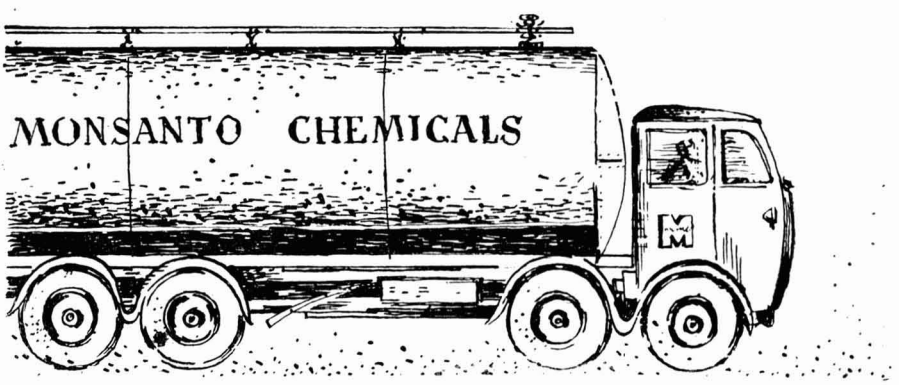

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Chemicals from Oil

NEARLY one quarter of the United States' total chemical needs are said to be provided today by the 35-years-old American petrochemical industry; and it is predicted that this already impressive proportion will rise to 50 per cent by 1965. From 1930 to 1940 the ascent of this new branch of industrial chemistry was slow but sure. It is since 1940, and especially since 1945, that the rate of expansion has been so remarkable. Between 1940 and 1945 an annual output level of £5,000,000,000 of petrochemical products was reached; between 1945 and 1950 the £15,000,000,000 level was left behind; today, the output is at least £25,000,000,000 and the story is still one of fast-rising success. Nor does this appraisal by figures include such basically simple products from oil as benzene or ethylene—these are defined as crude products, not as true petrochemicals.

It is natural enough—natural, at any rate, in the sense of logical evolution—that a large industrial country blessed with oil reserves and abundant supplies of natural gas, and enjoying a long period of expanding economy, should so impressively develop a petrochemical industry. There are several major disparities to be borne in mind when embarking upon Anglo-US comparisons. Nevertheless, too limited a view of petrochemical prospects should not be taken merely because oil is not one of Britain's home-derived resources. A new survey of the US petrochemicals industry (R. L. Bateman and J. A. Field, *Chemical & Engineering News*, 1953, **31,** 4074-4079) should therefore be of considerable interest.

The authors point out that a petrochemical has no precise definition although it has come to imply 'a chemical compound or element recovered from petroleum or natural gas, or derived in whole or in part from petroleum or natural gas hydrocarbons and intended for chemical markets.' This is a broad definition which brings problems with it. Petrochemical statistics are, or can be, 'tricky,' for 'the same atoms can be easily counted two, three, or four times in progressing from crude starting materials to the final end products.' Hence the ruling out of crude products such as benzene and ethylene, as already mentioned; whereas such products as aniline and ethyl alcohol are classified as 'intermediates,' and dye-stuffs and cellulose acetate are examples of 'finished products.' It is also difficult to decide where the petrochemical industry ends and such industries as rubber, textiles, plastics, and detergents begin. A survey which acknowledges these problems of definition and classification, before providing figures and data, is certainly one that can be assimilated with unusual confidence.

Aliphatic products are still the most important range of US petrochemicals. Eighty-two per cent of all aliphatic chemicals were petrochemical in origin in 1952, the remaining 18 per cent coming from coal and agricultural materials. Aromatic petrochemicals are relatively new introductions, dating only from 1940. They are mainly intermediates—phenol, styrene, and aniline—derived from benzene or toluene. But new though they may be, aromatic petrochemicals already account for 40 per cent of the total US usage of

aromatics. Obviously, inorganic petrochemicals cannot account for a very large proportion of total inorganic chemical production—nevertheless, they have already reached the surprising score of 7 per cent and this is almost wholly due to three products—ammonia, sulphur, and carbon black. Here, however, is one of the specific advantages possessed by the US for these three products are based upon natural gas, and the US natural gas industry has long had a developed establishment comparable with that of coal-gas in European countries. Just how logically ammonia should be regarded as a petrochemical is a matter of scientific query, no matter how the commercial lines of production are laid out; after all, the nitrogen is won from the air and it so happens that hydrogen from methane break-down is a preferable source to the usual coal-water process.

An important point, especially for British reflection, is the fact that the biggest single 'end-use' for US petrochemicals is found in the synthetic rubber industry—20 per cent of all production (mainly butadiene, styrene, and carbon black) is taken by America's synthetic rubber plants. This proportion is set into realistic perspective when the figure for detergents is put beside it—a mere 2 per cent of petrochemical output is utilised for making detergents! The dependence of petrochemicals upon the existence of a vigorous synthetic rubber industry is clearly shown; the absence of such an industry in Britain will remain a severe handicap to petrochemical development so long as that absence persists. Anti-freeze and 'anti-knock' fluids for cars and planes account for 17 per cent of the US petrochemical market. The size of this proportion is remarkable, but there are more cars for every 100 people in America than in Britain, and in many parts of the States the climate in winter calls more emphatically for anti-freeze help. But what happens to this important slice of the market if the current European idea of air-cooled car engines makes widespread progress? The synthetic fibre industry's demand upon petrochemicals (15 per cent) seems more likely to grow and endure with certainty; indeed, add this to the share absorbed by plastics (14 per cent)—a joint classification that is not illogical—and the 'polymer' share is 29 per cent. Here is the major end-use opportunity at which the British petrochemicals industry perhaps should aim with the most determination. In the manufacture of agricultural chemicals, particularly modern weed-killers, 11 per cent of US petrochemical production is now utilised; raw material opportunity has coincided with rapid expansion in another technology. This again is a field for British petrochemicals, for there is not only a large demand for synthetic weed-killers at home, but there are world-wide export opportunities.

So far, however, the story of petrochemical end-uses is only partially unfolded. In the last few years new petrochemicals have emerged and speedily achieved what the Americans call 'tank-car volume'—esters, ethers, amines, acids and anhydrides. At this point we may well ask where the petrochemical industry ends and ordinary organic chemistry, albeit on an industrial scale, starts; for once simpler organic molecules are available, their conversion into more complex molecules can be regarded as a matter of independent decision and processing. The diverse 'chemicals-from-coal' charts of 20 and 30 years ago, so often impressively displayed at exhibitions, were not dissimilar, for the variety and number of products were expressions of organic chemistry's flexibility rather than true expressions of versatile chemical wealth in the original raw material. Nevertheless, it is that versatility which can stabilise the future of a rapidly-grown, giant-sized industry. It need not depend upon too small a number of eggs in its sales basket. Certainly it is very apparent that the US petrochemical industry has devoted prodigious effort and expenditure to developing the largest possible number of eggs; otherwise the proportionate dependence upon synthetic rubber demand would be much more than 20 per cent, and it may well be that this—as a proportion, anyway—will decrease in the next five or ten years.

The still very youthful British industry has its growing pains, but apprehension should surely fade in the light of the older US example.

Notes & Comments

'Chlorparacide'

THE new ovicide and insecticide for fruit tree red spider mite developed in research by Boots Pure Drug Co., Ltd., has now been described in the literature (*Chemistry & Industry*, 1953, **45**, 1206). Its true name is *p*-chlorbenzyl *p*-chlorphenyl sulphide, and it would seem not only to have a very high toxicity to red spider mite eggs and infant larvae, but to have a specific toxicity, so specific that it can be said that 'it has not been possible as yet to demonstrate any insecticidal effect to the eggs, immature stages, or adults of any insect.' It is not often that a substance is discovered so ideally shaped to fit an urgent and serious gap in pest control. There will be few growers of fruit who are not aware and apprehensive of the growing menace of the red spider mite. There is little doubt that other modern insecticides, especially DDT, have reduced the populations of predatory insects which formerly kept red spider mite numbers in check. Parathion has been much used as a late spray for red spider mites but the new British insecticide or acaracide has the advantage of possessing 'a very low order of toxicity to humans.'

Valuable Chlorination

BOTH stomach poison and ovicidal effects are exerted by the substance, and it has been observed to have appreciable persistence. Adult red spider mites are apparently unaffected, but this is not a weakness—rather, it has been the weakness of other insecticides aimed at this pest that the eggs endure although the existent adult generation is killed. Because 'Chlorparacide' attacks the hatching and larval phases of the pest's life cycle, it takes from two to three weeks for an active infestation to be effectively checked. Fortunately the substance is not phytotoxic for most crops attacked by red spider—there is, however, as with most chlorinated insecticides, some phytotoxic risk with the *Cucurbit* crops. Further communications of a detailed nature are promised, but students of this important and complex field of applied chemistry will be grateful that so much information has been released already. Once more the value of chlorination in developing a synthetic insecticide has been demonstrated; for while the acaracidal properties of benzyl phenyl sulphide were slight, the introduction of chlorine into the two *para* positions of the nuclei enormously increased these properties.

Straws in the Wind

FOR far too long we have been accustomed to having brought to our notice announcements of increases in the price of one commodity or another. Too often has one increase been followed automatically and immediately by another, as surely as night follows day. Indeed, no longer do such announcements come to us as shocks and we have almost ceased to wonder where it will all end. Lately, however, there have been unmistakable signs of the gloom being dissipated. There have actually been notifications of decreases in selling prices. So hardened had we become to being told of increases, these latest announcements seemed at first sight almost too good to be true. Only last week we had the pleasure of recording that it now costs less to buy tungsten ore, antimony and antimony products. Borax Consolidated Ltd., are the latest senders of good tidings. They point out that the nationalisation of road transport and steadily increasing costs of labour, coal and power have meant that in order to keep prices stable during the past two years not only have they had to maintain production at full capacity, but they have been compelled to absorb substantial cost increases themselves. Since freight is a large element in their prices they have been pegging away at the shipping lines for reductions. Their latest approach has met with welcome success, with the result that they are able to announce that their UK schedule price delivered has been reduced for all products by £1 a

ton. This, surely, is a matter for commendation all round. May it prove to be the turn of the tide.

Take Up the Cudgels

THAT old matter has been raised again — this time by HRH the Duke of Edinburgh, speaking recently at Edinburgh University—of the specialising student's lack of general education. In most cases 'specialising student' implies a student of a technological subject, and in all cases 'general education' means education in what are called the 'humanities.' There is, in fact, every reason these days why the humanities should include a large proportion of science and technology, and, in this light, the average science student is infinitely more generally educated than the 'arts' student. Visit any common room, refectory or buttery bar, and you will find science students discusing the music of Beethoven, the plays of Shakespeare and Shaw, the paintings of Matisse, or the latest Foreign Problem — but will you find students of law, English, history or economics arguing about the Special Theory of Relativity, the nature of the virus, the relation of mass to energy? Those whose interests are specialised in the fields of Greek poetry or mediæval history have decided that any familiarity with scientific matters is unnecessary to a 'general education'—is it not time that one of our leading academicians deplored the narrow mindedness and ignorance of the 'arts' student?

Newcomer

SUGGESTIONS made in *Chemistry & Industry* (11 April) and in these columns (9 May) are now to be realised in a new service on the part of the Chemical Society. To fill the cavity caused by the final dissolution of *British Abstracts*, a monthly classified world list of 'Current Chemical Papers' is to be published, beginning in January. Although this is not intended as a substitute for an abstracting service, entries will include titles of papers (expanded where necessary), the authors' names, and the reference to the original journal, and will be classified into the principal branches of pure chemistry under some twenty different headings. The publication date will normally be mid-month, and it is hoped that chemists will then know what papers have been published, and where, within a few weeks of their appearance —a major development. While mourning the passing of *BA*, we yet believe that the new publication is of greater use and importance, and feel sure that, at 25s. a year (to Fellows), it will enjoy great popularity. Another new service is announced at the same time: a reprint scheme for papers published in the *Journal*. Good luck to both ventures.

Sulphur Extraction in Russia

NEW methods of producing sulphur and sulphuric acid from anhydrite and pyrites have been described in the USSR. Broadly, the process method can be called briquette fusion. Briquettes of anhydrite, pyrites, coal or some other form of carbon (about 15 per cent of the amount of pyrites will be coal), and alumina as kaolin will, on heating in a wet stream of oxygenated air provide break-down products such as sulphur, the sulphur oxide gases, iron sulphide, etc. Fusion, in fact, is not quite reached, temperatures being kept around 900° and certainly below 1150°. Grinding and compression is required to form the briquettes. The yield of sulphur increases with reduction of the proportion of anhydrite present, and also with rising temperatures of heating. Increasing the coal/pyrites ratio also improves the yield of sulphur, or, in other words that perhaps more precisely express the economic aim of the process, the extent of anhydrite dissociation. Processes of this type clearly stand or fall by the amount of sulphur and sulphur oxides that they win from the anhydrite; the extraction of sulphur in useful forms from pyrites can be readily accomplished in other ways. None of the various processes based upon these principles has been worked out on a large or pilot-size scale as yet. Good results of economic promise have been claimed on the basis of laboratory tests. Clearly there are many variations—the proportions of pyrites, anhydrite, coal, and alumina in the briquettes, the temperature of treatment, the presence or absence of moisture in the air stream.

Starting-Up a Phosphoric Acid Plant*

by SVEN and ROLF NORDENGREN†

A MODERN phosphoric acid plant, making use of phosphate rock and sulphuric acid as raw materials, and producing, in addition to phosphoric acid, calcium sulphate in the form of dihydrate, may be designed in different ways, but the work of different designers will have much in common. The chemical process is the same, as are the conditions necessary for making calcium sulphate crystals which can be readily filtered. These conditions will necessitate the same temperatures in the digesters and the same range of concentrations for the mother liquor. It will be necessary in addition to circulate a certain amount of phosphoric acid in the process, usually by adding wash liquid but also by circulating sludge.

As a modern phosphoric acid plant works continuously and is wholly mechanised, every plant will have an apparatus for the automatic weighing of ground phosphate and also means for measuring sulphuric acid and the circulating phosphoric acid in a continuous or intermittent way. If the phosphate is weighed and the acids are measured intermittently in portions, accuracy will be increased, which will be favourable to the formation of the calcium sulphate crystals and indirectly to the filtration speed.

Main Reaction in Digesters

The main reaction takes place in digesters, which are usually three in number, each fitted with an efficient agitator. From the third digester (or from a fourth vessel, acting as buffer between the two main parts of the plant, the digesters and the filters) the sludge is removed for filtration.

In order to obtain a product of concentration about 30 per cent P_2O_5, the filtration should be performed on a horizontal filter. There are different types of horizontal filters, the rubber belt filter, the tray-belt filter and the disc filter. We do not intend to discuss the merits of these varying types, as the problem of starting filtration, although in varying degree, will show the same difficulties.

There may be a difference in design in the method of mixing the raw materials and the circulating phosphoric acid, and a difference in the quantity of sludge or even in the quantity of phosphoric acid circulating in the process. We do not think that this will influence the conclusions which we have arrived at regarding the starting up of a phosphoric acid plant.

Intermittent Weighings

Nevertheless, we should like to stress that our statements refer to a plant of a simple design, well known to us. Both the weighing of phosphate rock and the measuring of acids are carried out intermittently. The phosphate is mixed with the circulating acid, which has a concentration of 18-20 per cent P_2O_5. This mixture is poured in portions into the first digester, where the sulphuric acid is added, as later described. From the third digester the sludge is conveyed to a fourth vessel acting as a buffer and from there to the filter or filters, either of the rubber belt or of the tray-belt type.

The capacity of these filters should be large enough to give a certain margin for the time of filtration, so that the digesters will work all the time while the filters operate only part of the time. Using high grade Morocco or Pebble phosphate, the first filtrate from the filters will have a concentration of 30-32 per cent P_2O_5, the second 18-20 per cent and the third of about 5 per cent P_2O_5. The second filtrate is returned to the process as circulating acid in a quantity ranging from 1.2 to 2.0 litres per kilo of phosphate rock, which means that the proportion of P_2O_5 in the circulating phosphoric acid to the quantity of P_2O_5 in the product will be from 0.9 to 1.5.

There are always difficulties connected with the starting of a chemical plant. One plant is very seldom a direct replica of another, having features of its own which have to be discovered. Its mechanical devices should be tried out very carefully before the actual start takes place. It should be checked that all parts needing acid-proof protection have such protection and that there is no leakage from vessels or pumps; this should be ascertained by working the plant with water. It is much easier

* Read at a technical meeting of the International Superphosphate Manufacturers' Association held in Cambridge on 15 & 17 September.

† A/B Forenade Superfosfatfabriker.

and will save much trouble if this is carefully checked beforehand.

The production of phosphoric acid according to the dihydrate method is indeed no difficult process but requires a certain amount of control. There should be a means of measuring the temperature of the sludge and the concentration of its mother liquor at all vital points and also of determining the specific gravity of the filtrates. There should be a laboratory filter ready for speed tests and a microscope to study the form and size of the crystals. There should be a possibility of carrying out daily analyses of the P_2O_5 in the raw material, of the P_2O_5 and SO_3 in the product, and of the total and water-soluble P_2O_5 in the gypsum cake. Indeed these latter analyses should be made on average samples of the gypsum cake for every eight hour shift during the starting period.

Diaries Must Be Kept

Diaries should be started from the beginning and someone should be appointed always to keep them up to date. In these diaries should be entered notes regarding temperatures and concentrations made hourly by the workers, results of filter tests, daily analyses and quantities of raw materials; the yield of attack and the total yield, calculated on the basis of analyses of insoluble and water-soluble P_2O_5 in the filter cake, should be noted every day. Once a week a balance of the ingoing and outgoing P_2O_5 should be established so as to trace hidden losses of P_2O_5. No phosphoric acid plant can be put into action with good results if these matters are not properly attended to.

The staff necessary for the supervision of the plant should be appointed before the actual start. A phosphoric acid plant generally works for 24 hours, six days a week. The number of workers for each shift depends on the size and design of the plant, but at least during the starting period there should be one foreman for each shift and a chemical engineer, whose only task should be to keep the plant in running order. These persons should not be troubled with carrying out analyses or writing reports. There should also be skilled workers at hand to be called in for minor repairs, if necessary.

If the art of making phosphoric acid is new to the works, where the plant has been installed, the starter of the plant will have a two-fold task: he will have to start the plant with unskilled labour and have to teach everybody his special duty. This means in fact, that the plant will not work well until the whole personnel has been properly trained. The same difficulty will arise also when starting other chemical plants, which will account for the delay often encountered in these industries in arriving at normal conditions. Buyers of plants do not always recognise this fact. We have had to tell them: buying a phosphoric acid plant is like buying a piano; you will have to learn how to play it.

A phosphoric acid plant can be started with water instead of with circulating phosphoric acid, but it will be easier to reach normal conditions if phosphoric acid is available.

The start can be arranged as follows. The first digester is filled about one third full with water or phosphoric acid. The water or acid should, if possible, have a temperature of about 80°, which will greatly facilitate the start, even with water. The automatic feeding apparatus is put into operation at its highest speed in order to increase the temperature as rapidly as possible. A mixture of ground phosphate rock and water or phosphoric acid is fed into the digester in portions, and at the same time the corresponding quantity of sulphuric acid is added via a leaden pipe at the bottom of the digester.

The best crystals are obtained at a temperature of about 80° with a mother liquor of about 30-32 per cent P_2O_5. It is evident that a lower temperature and a lower concentration of mother liquor will give smaller crystals, less easily filterable. Starting with water, the crystals will probably give a sludge with such low filtration rate that it will be necessary to stop the feed before the filtration is started.

Starting on Water

If the plant is started on water, the filtration will result in a phosphoric acid of a comparatively low concentration. It will probably not be possible to wash out all phosphoric acid at this first filtration so there will be a certain loss.

The next step will be to start the reaction again by one third filling the emptied first digester with made acid, heating it if possible, and then starting the feeding as before. When starting the plant, the quantity of circulating acid or water should be about 2

litres per 1 kilo phosphate rock. This time the crystals will be better and the filtering easier. The same procedure should then be repeated until an acid of 20 per cent P_2O_5 is obtained. A continuous process should then be attempted, with simultaneous reaction and filtration.

The main difficulty is to obtain satisfactory crystals as soon as possible and to maintain them in a satisfactory condition. The improvement in the size of crystals is dependent on the rise in temperature, the latter depending on the heat of reaction. The quantities of raw materials which must be treated per hour to give a sufficient rise in temperature and the quantities needed to maintain the temperature at about 80° can easily be determined. The automatic feeders can be regulated accordingly, and with such phosphates as high-grade Morocco or Pebble at least, the result will be satisfactory, easily filterable crystals.

Feeding in such proportions will only be possible if all the sludge produced can be filtered. As mentioned before, a certain loss of phosphoric acid may be permitted at the start, but should not be allowed under normal conditions. The reaction and the filtration are dependent on each other: the crystals must be satisfactory enough to allow quick filtration, and the filtration rapid enough to allow a high temperature to be reached by rapid feeding.

This is rather unfortunate. If anything goes wrong with the filter so that filtration has to be stopped for a few hours, the buffer vessel will be filled up and the feeding of raw materials has to be stopped. Then the reaction temperature falls and when the feeding starts again the crystals formed will be of smaller size. The reaction speed will be lessened and the filtration speed slowed down. Soon the feeding has to be stopped again with a still lower temperature and still smaller crystals as a consequence. When this stage has been reached the plant must be stopped and then started again.

Temperature Important

There is no need to have this difficulty. If the temperature in the first digester is always kept at about 80°, the crystal growth will not depend on the feeding speed. This can be arranged by a heating and a cooling device.

If steam is available, a steam coil should be installed in the first digester. This coil should be made of steel or copper, covered with homogeneous lead. If heated air is available, for instance from the cooling of pyrites furnaces, a Dow-therm installation could be used. The air heats a liquid with a high boiling point and this liquid circulates through the coil in the digester.

The Dow-therm liquid should never be allowed to circulate through a leaden coil in the digester. The lead will break sooner or later and the liquid will be lost.

There are other difficulties with a Dow-therm installation. The freezing point of the liquid is as high as +10° so that at lower atmospheric temperatures the circulation must be kept going. If the circulation pump stops, the liquid will freeze in the pipes and cause a great deal of trouble.

Electrical Heating Best

In a plant of normal size having its digesters isolated, no additional heat will be needed when the plant is functioning normally; when starting the plant after the week-end stop, the amount of heat to be added will be small. Consequently we propose that the heating should be done electrically, even in countries where the price of power is comparatively high.

In a plant with a comparatively high production, the temperature may rise too high so that the sludge has to be cooled. At a temperature of about 85° the formation of unstable hemihydrate will commence. This hemihydrate will take up water on the filter, forming dihydrate and causing the cake to harden. The cooling may be effected in different ways. The simplest will be to blow in air from a ventilator through a pipe 200-300 mm. diameter immersed to about 100 mm. in the sludge of the first digester.

It should be noted that the temperature should be taken in the overflow from the first to the second digester.

In each shift a man should be employed solely for the regulation of the temperature during the starting period, maintaining it as constant as possible at about 80°, which has been found to be the optimum value for the phosphate rock used. It will be possible to do without this man if an automatic temperature control is arranged.

We have been asked if sludge from the last digester should be returned to the first digester. Our answer has been that inferior crystals give rise to inferior crystals and satisfactory crystals to satisfactory crystals.

If the crystals are inferior the sludge should not be returned. If the crystals are satisfactory they will be better still if they grow on crystals already formed.

If a quantity of sludge is returned from the last to the first digester, the surface of the crystals available for precipitation of calcium sulphate is enlarged and at the same time the sulphuric acid added in the first digester is dispersed throughout the system. By this circulation the temperatures in the digesters can be kept at about the same level, which will improve the yield of attack.

For starting after the week-end stoppage, we recommend having the first digester half filled with sludge, which should be previously heated to 80°. This necessitates the agitator in this digester running over the week-end.

Causes of Frothing

Great difficulties have arisen from the formation of froth to such an extent that it was believed, for some time, that certain phosphates were unsuitable for the production of phosphoric acid.

Frothing has two causes: the gases developed during disruption, carbon dioxide and hydrofluoric acid, and the organic matter in the phosphorites, which increases surface tension. Phosphates rich in carbonates and organic matter such as Gafsa and other North African phosphates will develop more froth than other phosphates.

It is known that phosphates rich in organic matter have been calcined in order to destroy this before they have been used as raw material for the making of phosphoric acid.

There is no need for such measures. Effective de-frothing can be arranged in the following way: on a vertical shaft immediately above the surface of the first digester is placed a rapidly rotating device of almost any shape. Its simplest form will be a vertically placed circular loop made of an $\frac{1}{2}$ in. acid proof steel rod. The diameter of the loop can be about 300 mm. This device effectively destroys all froth on the surface of the digester even if Algerian or Tunisian phosphates are being used.

By the measures proposed by us we have succeeded in dividing the plant into two parts working separately. With a temperature control there is no longer the need for speeding up filtration in order to maintain the temperature of the sludge. On the contrary, the feeding can be regulated to follow the filtration speed, keeping the buffer vessel empty for emergencies. If a longer stop in the filtration becomes necessary, for instance for the changing of the filter cloth, the feeding can be stopped for a long time and then started again, and the crystals will still be satisfactory.

This will greatly facilitate filtration, which is the difficult part of the process. Crystals formed of the same materials in the same proportions at a constant temperature will also result in a constant filtration speed. Once the most suitable thickness has been achieved, the thickness of the filter cake should also be kept constant, which can be attained by a back-flow for the sludge brought on the rubber-belt filters and a device for constant feeding for the tray-belt filters.

This means that with a constant speed of the rubber belt or the tray-belt, the mother liquor will be sucked off at about the same point and the same will occur with the wash liquids, so that there will be no necessity for shifting the point for adding the wash liquids or their volumes. In this way it will be much easier to arrive at an almost complete removal of the cake by washing.

The means of regulating the filter are: speed of belt, vacuum, thickness of cake, point of adding wash liquids, volume of wash liquids. The higher the filtration speed, the thicker the cake should be, which will facilitate a satisfactory removal by washing. There are plastic cloths, which will permit a sludge temperature of 80°. A high temperature will give a high filtration speed. If steam is available, it will pay to heat the wash liquids.

On rubber-belt filters the thickness of the cake is limited as the up-standing edges of the rubber belt have a maximum height of 100 mm. If the sides of the belt are turned up so that the belt forms a trough, the washing in the centre will be less satisfactory as compared with the sides. For a complete washing-out the tray-belt filter is preferable The surface of the cake should always be covered with liquid.

Intelligent Care Needed

Supervision of the filtration needs intelligence and care, and the workers should be selected on this basis. Sampling of the gypsum should be performed in such a way that the analyses will show the actual loss.

There is a loss of P_2O_5 that is inevitable.

The disruption of the apatite molecule in the dihydrate process is never complete. The yield after a 10-12 hours' reaction will be about 96-97 per cent. Theoretically the efficiency of removal can be 100 per cent but in reality there will be a small quantity of water-soluble P_2O_5 left in the cake. The daily total yield will be shown by the analyses of the cake and should be noted in a diary.

The weekly balance of P_2O_5, in and out of the plant, will show a lower yield than shown by the daily analyses in most plants. We have found that such hidden losses will sometimes surpass the losses shown by the analysis of the cake so that the total yield becomes only 80-90 per cent.

There is only one way of preventing these losses, namely never to allow any spill-water to escape from the plant. The floors of the plant should be covered with acid-proof asphalt and drainage arranged, by which all spill-water is conveyed to a well lined with lead in the ground-floor. There should be no outlet from this well. Its content should be pumped up to a vessel above the filters and used as a wash liquid. The wash liquids on the filter would then be three: 5 per cent filtrate, liquid from the well, and pure water.

Careless Workers

If the well is not properly attended to, it will fill up and the ground floor be flooded. This, at least, will catch the eye of the worker. It may seem to our audience that this would be a rather drastic measure. We have found, however, that negligence and unwillingness to follow the instructions given are the worst enemies of a phosphoric acid plant. In an Italian installation inspected by us, a well had been arranged in the bottom floor but this well had had an overflow to a near-by river. We found the well filled up to the over-flow with a liquid containing 20 per cent P_2O_5 passing out through the over-flow to the river and then out to the Mediterranean. This was attributed to 'something being wrong with the filters.'

As already mentioned, low-grade North African phosphates such as Gafsa have been considered unsuitable as raw materials for the production of phosphoric acid, the main difficulty being frothing. With the de-frothing device already described, frothing will give no trouble, but the acid should be dispersed on the surface of the first digester. If added at the bottom, the whole digester will be filled with a bubbling mass of froth.

The gypsum crystals can be formed in a size to permit filtration, but the temperature limits are narrow and a few degrees below the optimum temperature will affect the crystals. A temperature control, with means of heating or cooling the sludge, will be an absolute necessity. The plant should be started on a high grade phosphate and when the crystals are satisfactory, this phosphate can be substituted by a low grade.

DDT-Resistance & Alternatives

A MEETING on insect pests and insecticides organised by the World Health Organisation was held in Rome recently. Professor P. A. Buxton, of the London School of Hygiene and Tropical Medicine, who led the British delegation and presided over the meeting, said the solution of the problem of the resistance of disease-transmitting insects to insecticides was likely to come from 'a broad advance in insect physiology and biochemistry.'

One conclusion reached by the meeting was that, with the exception of the housefly and possibly three or four species of mosquito 'chemicals are now available which will control species that have shown resistance to DDT.' Lindane is being successfully used against DDT-resistant lice in Korea; bed bugs can be most effectively attacked with Lindane, and fairly effectively with Dieldrin; and dog and cat fleas are becoming resistant to DDT, but 'good control out of doors has been obtained with Malathon.'

Statistics issued by the Secretariat of the International Rubber Study Group show that world production of natural rubber totalled 140,000 tons during September, a decrease of 7,500 tons compared with the previous month. At the same time, world consumption rose from 112,500 tons to 132,500 tons. These figures brought world production of natural rubber for the first nine months of this year to 1,265,000 tons and world consumption to 1,170,000 tons. World production of synthetic rubber also fell in September from 75,000 tons to 67,500 tons. Consumption showed no change at 65,000 tons.

Imports of Fertilisers

Restrictions Relaxed

ACCORDING to a Board of Trade announcement on 13 November, certain organic fertilisers may now be imported from any country without separate import licence. They are: alfalfa meal; dried blood; dissolved bone; bone, hoof and horn meal; bone powder; dried spent hops; guano; lucerne meal; steam bone meal; and tankage.

Urea and urea formaldehyde resin fertilisers, and leather scrap and waste, may already be imported without separate licence if consigned from and originating in any country or territory other than Albania, Argentine, Bolivia, Bulgaria, Canada, Costa Rica, Cuba, Czechoslovakia, Dominican Republic, Ecuador, El Salvador, French Somaliland, Germany (Russian Zone), Guatemala, Haiti, Honduras, Hungary, Japan, Korea, Liberia, Mexico, Nicaragua, Panama, Persia (Iran), Philippines, Poland, Roumania, Tangier, United States of America, Union of Soviet Socialist Republics, Venezuela.

Will Consider Applications

The Board of Trade is prepared to consider individual applications to import these fertilisers from the countries listed above. Licensing arrangements for the import of meat meal, meat and bone meal, whale-meat meal, whale-meat and bone meal, liver meal (including whale liver meal) and fish meal described in Notice to Importers No. 550 remain unchanged. Individual applications to import any organic fertilisers other than those listed above will be considered separately.

Applications are invited for Open Individual Licences to import the following potassic fertilisers from any country or territory other than those listed above:—potassium chloride (including kainite and similar crude potassium chlorides) and potassium sulphate. Each holder of an Open Individual Licence will be required to make monthly returns (including nil returns) to the Ministry of Materials and will be told how such returns should be made.

The following inorganic fertilisers are admissible under Open General Licence if consigned from and originating in any country or territory other than those listed above: liquid ammonia; basic slag; calcium cyanamide; Chile nitrate of soda; mineral phosphates of lime (phosphate rock); sodium nitrate. The Board of Trade will in future be prepared to consider individual applications to import any of these six fertilisers from the countries listed above. The Board of Trade will also consider individual applications to import other inorganic fertilisers not covered by the arrangements detailed above.

Applications for the individual licences and the Open Individual Licences referred to above should be submitted on Form ILB/A (Revised) to Board of Trade, Import Licensing Branch, 43 Marsham Street, S.W.1. A separate application form should be submitted for each fertiliser.

Importers are reminded that:—(a) under the Importation of Carcases (Prohibition) Order 1926, bone, hoof and horn meal, bone powder, dried blood, dissolved bone, and steam bone flour may not be imported from the Continent of Europe except under licence from the Ministry of Agriculture & Fisheries or the Ministry of Agriculture for Northern Ireland; (b) under the Diseases of Animals Acts, imports of alfalfa meal and lucerne meal into Great Britain are prohibited from all countries in which foot and mouth disease exists. Similar restrictions apply to the importation of alfalfa meal and lucerne meal into Northern Ireland.

Boron Products Cheaper

AN immediate reduction in the price of their boron products by £1 a ton has been announced by Borax & Chemicals, Ltd.

The revised UK prices per ton of their main products, on the basis of free delivery to customers' domicile, are:—

	Borax	*Boric Acid*
Pyrobor (dehydrated)—		
Paper bags	£57 10s.	—
Hessian bags	£58 10s.	—
Refined Pentahydrate Borax—		
Paper bags	£47 10s.	—
Hessian bags	£48 10s.	—
Commercial—		
Granular—Paper bags ..	£37 10s.	£66 0s.
Hessian bags ..	£38 10s.	£67 0s.
Crystal—Hessian bags ..	£41 0s.	£75 0s.
Powder—Hessian bags ..	£42 0s.	£72 10s.
Powder extra fine—Hessian bags	£43 0s.	£74 10s.
BP Grade—		
Granular—Hessian bags ..	£47 10s.	£80 0s.
Crystal—Hessian bags ..	£50 0s.	£87 0s.
Powder—Hessian bags ..	£51 0s.	£84 10s.
Powder extra fine—Hessian bags	£52 0s.	£86 10s.

Surcharges for small quantities as previously.

Research at Courtaulds

Research Director Describes some Typical Problems

WORK in the Research Department of Courtaulds Ltd. was described by the Director of Research, Mr. A. H. Wilson, F.R.S., at a meeting of the Royal Society in Burlington House on Thursday, 12 November.

Although the interests of the company and its associates embrace all aspects of man-made textiles (said Mr. Wilson), the main effort is the production of fibres, either as filament or as staple. The scientific problems encountered have much in common with the heavy chemical industry, but there are important differences, due firstly to the fact that the reactions generally take place in the liquid phase in highly viscous solution; secondly, to the nature of the starting material, which is ill-defined and of a high complexity; and thirdly, to the mechanical problems involved in the extrusion proceses.

This means that large-scale experimentation is always necessary, since there is no guarantee that up-scaling, even from the pilot-scale, will give a workable process or a worthwhile product. Moreover, the fibre produced can only be tested fully by weaving into a cloth or garment.

Development research therefore begins with production of fibre from a 'single-end' spinner; about 100 lb. a week are needed for trials. If this stage is satisfactory, the process goes into a semi-industrial scale for two or three years to give the product a complete try-out.

Expenses of Research

It is obvious that this will be an expensive business. Mr. Wilson quoted some average figures for the annual cost of research:

Total annual research expenditure	£900,000
Cost of small-scale work	750,000
Semi-commercial scale	600,000
Recovered by sale of semi-commercial product	450,000

The Research Department is de-centralised into six independent sections, four of which are concerned with semi-commercial activities. The total staff consists of 200 graduates, 450 technical staff, and 400 operatives.

After describing the difficulties encountered by the industry after the war, when a very high rate of capital investment was necessary, Mr. Wilson described five typical research problems to exemplify the work carried out in his department.

When the postwar expansion began the demand for woodpulp for viscose production could not be met by supplies from Scandinavia, and dollar restrictions prevented buying from the US. It was suggested that a Commonwealth source might be found and eventually the *Eucalyptus saligna* from Natal was found to be fairly suitable.

Sulphonation of Lignin

Treatment of wood to make woodpulp consists in the solubilisation of the lignin by sulphonation. Two groups are present in lignin capable of sulphonation; one sulphonates in weakly acid solution, and is blocked by strong acid; the other sulphonates in strong acid. Sulphonation is carried out by boiling the wood in sulphite solution, and to preserve weakly acidic conditions the calcium or sometimes the ammonium salt is employed.

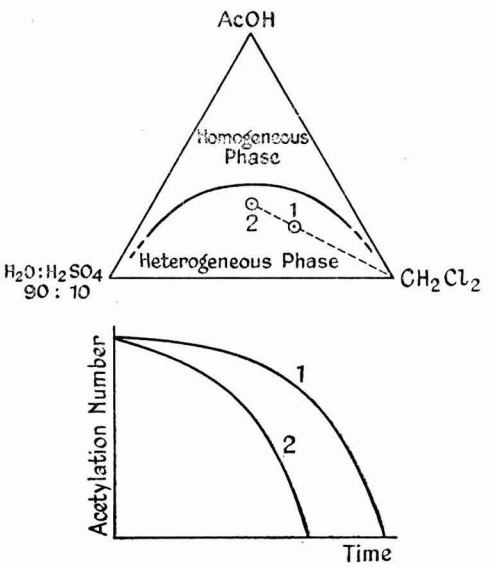
When *E. saligna* was cooked under conditions suitable for spruce pulp, a badly digested product was obtained. It was concluded that the compact structure of the wood meant that the basic ions diffused too slowly into the material to maintain the weakly acidic conditions necessary. To maintain the process as an economic one it was necessary that the cooking time should not be prolonged, or the temperature raised unduly. Eventually a reasonable process was developed.

A plant is now being constructed in Natal which will have a yearly output of 40,000 tons.

In the production of acetate rayon a similar shortage of raw material—this time of acetic anhydride—had to be overcome. Before the war, this reagent was derived from ethyl alcohol and was even then in short supply. With the development of oil refineries, however, it was suggested that cheap acetone derived from propylene should prove a suitable raw material.

$$CH_3.CO.CH_3 \rightarrow CH_2.CO + CH_4$$

$$CH_2.CO + CH_3.COOH \rightarrow (CH_3.CO)_2O$$



Phase diagram and rate curves for hydrolysis of cellulose acetate

The first reaction may be carried out on the laboratory scale by passing acetone through a heated copper or silica tube, but this was obviously unsuitable for industrial scale plant. It was found that a satisfactory material for the cracking tube was 25/20 Cr/Ni steel, which could be heated to 650-700°. Unfortunately, this particular steel was a very good catalyst for all the undesirable reactions in thermal cracking.

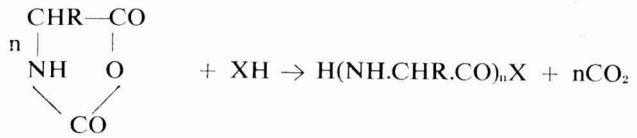
Finally, as a result of much research, suitable inhibitors were found for these side reactions. An additional difficulty was then discovered: the ketene selectivity (i.e. the percentage of the products which represented the main reaction) decreased with increase in the percentage of acetone converted. A compromise was decided upon: 25 per cent conversion, giving about 70 per cent ketene.

In the preparation of cellulose acetate the usual procedure is to acetylate all available groups and then hydrolyse about one in six. Since a single hydrolysis unit costs about £500,000, any means of improving the efficiency of hydrolysis is obviously worthwhile. Depolymerisation also occurs, since the solution is acid, and therefore the rate of hydrolysis should be as rapid as possible.

In the hydrolysis solution are methylene chloride, acetic acid, sulphuric acid and water, as well as cellulose acetate. It was found that the rate of hydrolysis increased with time, and this was interpreted as indicating that the hydrolysis took place in the heterogeneous phase. Phase diagrams were therefore plotted for the system $H_2O:H_2SO_4$—AcOH—CH_2Cl_2 when $H_2O:H_2SO_4$ was 90: 10, and it was found that the hydrolysis did indeed lie in the heterogeneous region. A more rapid hydrolysis would occur in the homogeneous region, but would be accompanied by other undesirable reactions such as depolymerisation. If, however, the system were moved nearer to the boundary of the homogeneous phase—along the line through the methylene chloride axis and the system point—a greater rate of hydrolysis would be obtained. In other words, removal of some of the methylene chloride (in practice, half) from the liquor before hydrolysis, would have the desired effect.

One of the recent pieces of work carried out has been concerned with the production of suitable grades of rayon for use in motor tyres. The elastic characteristics can be altered considerably by the conditions under which the fibre is drawn. Stretching in hot dilute acid gives a considerable increase of extensibility. If the fibre is then treated in $ZnSO_4$ solution, some of this extensibility may be sacrificed to increased tenacity, and the result is a high-tenacity fibre which still has good extensibility, and which is comparable in properties to cotton or flax.

The last piece of research described by Mr. Wilson concerned the synthesis of polypeptides. It has not yet proved possible to produce a synthetic fibre with a protein structure, like wood or silk, but recent work has shown that fibrous polypeptides with a degree of polymerisation greater than 500 may be obtained by reactions of the type:



Investigation of these fibres, which could be obtained in a crystalline form, was carried out by X-ray or polarised infra-red diffraction. It was found that spectra corresponding to the theoretical α and β structures were obtained.

Fertiliser Technology Research

Mr. F. G. C. Fison tells of Company's Extension Plans

A MAJOR extension of the research activities of Fisons Ltd. and the need for a substantial increase in Government expenditure to educate the farmer, where necessary, in the use of fertilisers, are among the subjects dealt with by Mr. F. G. C. Fison, chairman, in his review of the company's activities for the year ended 30 June last. The review has been circulated with the accounts. The annual meeting will be held at Felixstowe on 7 December.

Alluding to the extension of research activities, Mr. Fison says:

'A farm of some 400 acres has been purchased at Levington, six miles from head office. Here will be carried out field trials of new fertilisers and other agricultural chemicals. The farm will be equipped with all facilities for the testing of new fertilisers, and of the best methods of using them.

'Levington, however, will be more than an agricultural testing station. Plans are in hand for the erection on the farm of a comprehensive block of research laboratories, mainly devoted to fertiliser technology, but capable of pioneer work in any aspect of chemical and biological research necessary to keep the company in the forefront of progress. I should, perhaps, give you an assurance that there will be no unnecessary duplication of the work going on at any of the Government research stations. Steps have been taken to make our plans known to the Agricultural Research Council and to ensure that good relations will be maintained with experimental units operated by the Ministry of Agriculture.

To Head Advisory Services

'The research work of the station will be closely linked with our advisory services and Dr. R. Stewart, the director of the station, will also be the head of the advisory services.

'The work at Levington will be reinforced by a subsidiary station in the West Country and by the organisation of special tests, where necessary, on various farms throughout the country. The full scheme will, of course, take some years to complete.'

Referring, earlier in his review, to the uncertainty in the mind of the farming community in regard to Government agricultural policy, Mr. Fison says he does not think there is any justification for the farmers' fears of some return to the 'cheap food policy' of the inter-war years. He goes on:

Usage Below Optimum

'It would be most unfortunate, both for the country as a whole and for the individual farmer, if he were to follow his natural inclination, and to reduce his investment in fertilisers as part of a general policy of retrenchment. On the majority of farms in this country, the usage per acre of fertiliser is substantially below optimum. . . . The Government is well aware of the value of fertilisers to the farmers and the national economy, and has encouraged their use by substantial subsidies. I do not think that this is the most effective method, as changes in government policy in this respect have an extremely unsettling effect, however temporary, on the farmer and the fertiliser industry.

'I think the sphere in which the Government's initiative would be best exercised would be in a substantial increase of expenditure to educate the farmer, where necessary, in the value of fertilisers. Such education, if carried out intensively, is very expensive, and to further increase our own expenditure in this direction would inevitably lead to increase in selling prices, which would be liable to criticism and misinterpretation.

'I do not think the Government will seek to evade its responsibilities under the Agricultural Act of 1947, but the formulation of plans to implement the policy requires goodwill and a broad outlook on both sides. More important still, in my view, is that the national organisations representing the farmers should carry public opinion with them, or no government, whatever its complexion other than a totalitarian government, can in the long run pursue a policy which has not the support of the mass of the people.'

Sales for the years, says Mr. Fison, were £26,441,000 against £21,975,000 in the previous year. Those figures included the sales

of Fisons Chemicals Limited (£3,442,000). The consolidated trading profit of the group was £2,413,485 compared with £1,602,958 for the previous year.

Recalling that last year he referred to the serious effect upon industry of the present burden of taxation and to its crippling effect upon development in the chemical industry, Mr. Fison says that this year they had to provide for taxation no less than £1,650,303, compared with £808,885 last year. Included in that figure was an estimate of £316,000 for Excess Profits Levy against a provision of only £3,000 last year. The Excess Profits Levy continues in operation until 31 December, 1953, so that for the year in which they were now trading half their profits will be subject to that tax.

Satisfactory Horticultural Trade

As in the previous year, a substantial contribution to their profits came from their interests in Corby Basic Slag Ltd. and Nitrogen Fertilizers Ltd. Their horticultural trade also showed a very satisfactory expansion in sales and profits.

The year under review was characterised by improvements in the terms on which certain of their major raw materials are purchased. The indices of their raw material purchases declined over the year from 214 to 184. Those reductions were in part the result of reductions in freight, but also were due to an easing of the supply position, and to strenuous efforts on their own part to obtain better terms from the producers.

The sulphuric acid supply position had been favourable during the year, and although they were large buyers of sulphuric acid as well as producers, they welcomed the de-control of sulphuric acid prices which took place.

Mr. Fison continues:

'One aspect of Government policy instituted by the previous Government and perpetuated by the present Government is entirely unsatisfactory to us, and we believe to industry in general. That is the use of sulphur for acid production as a so-called "balancing factor" to make up any deficiency of short supply left after all other sources of production have been fully utilised.

'We are large consumers of sulphur, and although we were accorded in the past year fair and entirely equitable terms according to the policy laid down, I do not think that the policy itself is sound. The alternative raw material for the major part of acid production is pyrites, largely from Spain.

'At present prices acid made from pyrites is entirely uncompetitive with acid produced from sulphur, and the fact that the former material has been given official preference has resulted in acid prices being higher than was necessary.'

Referring to the exploratory work carried out by I.C.I. Ltd. and Fisons in N.E. Yorkshire, Mr. Fison says this has proved the presence of extensive deposits of potassium salts. Methods of working the deposits were under consideration with a view to making the potash available for British agriculture.

Training of Metallurgists

AN informal discussion on 'The Training of Metallurgists for Industry', organised jointly by the Institute of Metals and the Institution of Metallurgists, will be held at the Royal Institution, Albemarle Street, London, W.1, on Friday, 27 November, from 10.30 a.m. to 12.45 p.m., and 2.15 p.m. to 4.30 p.m. The chair will be taken by Professor F. C. Thompson, president of the Institute of Metals. The morning session will be devoted to a discussion of education in schools and colleges, and in apprentice schools, while the subject for the afternoon session will be practical training in the works, during and after qualification.

Wartime Regulations Transferred

The use of preservatives in certain foods, until now permitted under Defence (General) Regulations, will in future be controlled under permanent legislation by means of the Public Health (Preservatives, etc., in Food) (Amendment) Regulations, which operate from 11 November in England, Wales and Northern Ireland and from 16 November in Scotland. These regulations will continue to permit the addition of preservatives to certain dehydrated vegetables, jams and citrus fruits, and will also permit, until the end of rationing only, the continued addition of borax to margarine. These provisions, except that concerning the addition of borax to margarine, will be examined by the Preservatives Sub-Committee of the Food Standards Committee.

Redox Resins

Interesting Possibilities in Oxidation & Reduction

COMMENTING in a prophetic vein upon the potentialities of the chromatographic method which he had just developed, Tswett visualised new procedures in which the processes of adsorption were replaced by chemical interactions. In this way he anticipated methods which have become part of general laboratory practice nearly half a century later. However, one class of substance covered by his conjectures has only recently been realised. This is the 'electron exchange' resin first suggested by Cassidy in 1949.

The concept of an 'electron exchange' or 'redox' resin was defined as a highly polymeric material capable of reversibly exchanging electrons with a contiguous phase, or in other words, a substance capable of taking part in reversible oxidation-reduction reactions with solutions in contact with it. Such a substance may consist of a hydrocarbon chain or network carrying residues which are capable of accepting or donating electrons.

The substance chosen by Cassidy for his preliminary experiments was polyvinyl hydroquinone. The starting material was coumarin, which was hydrolysed with sodium ethoxide to *o*-coumaric acid (*o*-hydroxycinnamic acid). This was then oxidised to the 2,5-dihydroxy cinnamic acid with potassium persulphate and the product decarboxylated by subliming under reduced pressure.

Preparation of Final Polymer

The final polymer was prepared by heating the monomer under reduced pressure without the addition of a catalyst, and was in the form of an amber solid, soluble in acetic acid, slightly soluble in hot water and insoluble in benzene.

A solution of the polymer in 90 per cent aqueous acetic acid could be titrated with oxidising agents such as bromine or ceric sulphate, but in no case was it found possible to oxidise all of the groups present. The reaction could be followed potentiometrically by using a bright platinum electrode coupled with a standard calomel electrode, but the procedure was complicated by the fact that on addition of oxidant the solution became orange in colour and gave a precipitate of the oxidised polymer. When this was reduced and re-oxidised it was found that loss of activity had occurred. More satisfactory results were obtained when the polymer was kept dispersed by the addition of the protective colloid, albumen, but the oxidation of the albumen introduced a further complication.

Despite these drawbacks, however, the soundness of the original proposition was proved and recently (*J. Amer. Chem. Soc.*, 1953, **75**, 1610) a paper has been published by Cassidy and his co-workers describing a more successful series of experiments. The previous unsatisfactory nature of the polymer was found to be due to its low molecular weight corresponding mainly to the dimer and trimer and to the consequent presence of two groups with different sensitivity to oxidising agents.

High MW Polymers

Polymers of high molecular weight were prepared by protecting the hydroxyl groups of the monomer with acetyl or benzoyl radicles, polymerising the esters in the presence of benzoyl peroxide and saponifying the resulting material. Copolymers with styrene and its homologues were also prepared by this method and insolubility in all solvents was conferred upon the resins by cross-linking with divinyl benzene.

The linear polymers were soluble in 90 per cent aqueous acetic acid but were precipitated from solution on oxidation as before. Suitable material for chromatographic experiments was prepared from these polymers by impregnating filter paper with the 90 per cent acetic acid solution and drying, or by coating filter-aid by precipitating the polymer upon it from an acetic acid slurry diluted with water.

Reversible oxidation-reduction procedures were carried out with the impregnated filter papers by adding a drop of the reagent to the centre of the paper and streaking the annular concentric zones with an identifying reagent. In this fashion ferric chloride was reduced and the ferrous ion identified with α,α'-dipyridyl, α-nitroso-β-naphthol and potassium ferricyanide.

Potassium ferricyanide itself was reduced by the polymer to ferrocyanide, identified with ferric chloride and cupric sulphate. In neutral solution the polymer reduced a solution of iodine in potassium iodide to iodide but the oxidised polymer when treated with acidified potassium iodide solution was capable of oxidising the iodide back to free iodine.

These purely qualitative tests were supplemented by quantitative experiments carried out using normal chromatographic technique and a column of polymer-coated filter-aid. The column could be taken through several oxidation-reduction cycles using buffered iodine in potassium iodide solution and acidified potassium iodide as the reagents. There was a small but steady loss in activity with each cycle. The column could also be oxidised with acidified potassium dichromate but did not give satisfactory cycles with ferrous and ferric ions.

Possibilities Suggested

The possibilities which have been suggested for these types of resins include their addition to solutions to provide a means of stabilising the potential without at the same time contaminating the solution. The chromatographic method of oxidising or reducing a solution by passing it through a column of the 'redox resin' has the advantages of short contact time and no contamination. There are interesting similarities between such columns and the columns of the Schafer silver reductor and the Jones reductor, the first of which has been used to reduce ferric ions to ferrous without disturbing the acidity of the solution. Another interesting aspect of the phenomena is that since the resins absorb or release protons to the solution the degree of oxidation and reduction may be adjusted by adjusting the *p*H of the solution.

The results which have been published, although in many ways incomplete, suggest that this is a most fruitful field for investigation both in the production of new types of 'redox resins' and in the preparation of more satisfactory grades of the materials described. Other types of resins which have been suggested are polyamides containing the mercapto groups, resins containing haemin groups and photographic chemicals which are cyclic acetals prepared from aldehydes and polyvinyl alcohol, coupled with colour developing substances.—J.R.M.

Fixing Coal Prices

Independent Supervision Suggested

MODIFICATION of the present practice whereby the price of coal supplied to the two competing industries, gas and electricity, is fixed by the National Coal Board alone, is advocated by Dr. F. M. H. Taylor in a paper, 'Conservation of the Nation's Fuel & Power Resources,' which he is to present to the Institute of Fuel on 24 November.

His reason for suggesting the modification is that the present practice permits the Coal Board to control the economic development of both the gas and electricity industries, which in many respects compete with raw coal.

Dr. Taylor, who was formerly prominently associated with the research department of the then Gas Light and Coke Company and is now chairman and managing director of Thermocontrol Installations Limited, contends that it would be in the national interest that the coal price structure should be subject to independent supervision, e.g. by a Fuel Advisory Committee, which would ensure stable prices, the true economic development of electricity, gas and coke, and therefore the gradual elimination of the 'smog' nuisance.

The Government's present policy of improving financial incentives to industrialists installing fuel economy plant is commended by Dr. Taylor, and the problem of marginal coal, produced and sold at a loss in order to satisfy the excessive demands of the more wasteful fuel users, is clearly set out as one of the most pressing problems of the day.

There is a need, claims Dr. Taylor, for the publication at intervals of the types and grades of coal and the quantities which the Coal Board expect to produce in the subsequent 5- or 10-year period, to ensure that installers of expensive plant may know in advance the fuel they can expect to receive. The constant and reliable supply of fuels to users installing special plant is necessary to avoid scrapping such plant and loss of confidence by industry generally.

After many years of extensive exploration, a small indication of oil has been found in the Calabar province of Eastern Nigeria by the Shell D'Arcy Petroleum Development Co.

Alginates : Colloids from Seaweed

by R. W. MONCRIEFF, B.Sc., F.R.I.C., F.T.I.

ALGINATES are chemicals of considerable and growing importance, derived entirely from seaweed. All of the brown seaweeds, the wracks and the tangles, which are so abundant on rocky coasts, contain alginic acid. Wet seaweed, straight from the sea, is about nine-tenths water, but when it has been dried it may contain anything from 15 to 40 per cent of alginate on the dry weight. The alginate is present in the seaweed as a mixed salt of sodium, potassium and calcium.

Harvesting is carried out mainly in three countries, in America on the Californian coast, in the United Kingdom and in Norway. There are other countries where small quantities of alginates are produced, but these three are the main ones.

In America, the giant kelp *Macrocystis* is the raw material; this huge sea plant is secured by its holdfast to some rocky part of the sea bottom and with main stem and fronds may attain a length of 150 ft. The fronds, 50 ft. or more long, float on the surface of the sea, and they are harvested as required by a boat with a cutting mechanism. The weed is always there readily available and just as much as is needed can be taken.

In the United Kingdom the giant kelp does not grow. It has been suggested that it should be introduced round our Scottish coasts where it is thought that it would flourish, but the proposal has been rejected by Governmental departments on the ground that, once started in this country, no one knows where *Macrocystis* might stop, and that it might overgrow our estuaries and harbours. Those indigenous seaweeds which are most useful for the extraction of alginic acid in this country are the *Laminariae,* of which *L. digitata, L. cloustoni* and *L. saccharina* are all abundant, and the rockweed *Ascophyllum.* The *Laminariae* grow with stems some 3 or 4 ft. long, rather thicker than a good walking stick and with fronds usually some 2 ft. long. At spring tides, they can often be seen poking their tops or crowns above the sea.

In Norway, *Laminariae* are used as they grow prolifically on the western coast. The variety, *L. digitata,* is especially abundant and is harvested on a large scale. This variety, *L. digitata,* has an important advantage in that it is easy to bleach. Casual inspection of the weed thrown up almost anywhere along the west coast of Scotland will show that it is a mixture of varieties, and when the weed has been lying on the beach for a few days, it can be seen that there are a large number of ribbon-like pieces, some 2 in. wide, which have been bleached white or colourless by sun and air; all the other weed is still brown and dark;

A 'cast' of Laminaria. Sheep and cattle can often be seen feeding on the weed

the bleached ribbons are the fronds of *L. digitata.*

Methods of extraction vary from one factory to another; some dry the weed first, others use it wet, and so on, and such apparently slight differences as this may make very considerable differences to the properties and utility of the alginates extracted therefrom.

Extraction from Weed

The weed is washed to remove salt, it may be dried and ground or milled and then digested with a hot soda solution. This extracts the alginic acid as sodium alginate which thickens the liquor. Thereafter it is quite a difficult problem of chemical engineering to free the thick solution from particles of weed detritus, from sand and from pigment. Sometimes the difficulty is dodged, albeit expensively, by greatly diluting the viscous solutions with large volumes of water, so that they thin and are easy to work. Pigment can then be removed by filtration, settling or centrifuging. Decolorisation is never complete by any of these methods, and it is usual to bleach the alginate with chlorine, hypochlorite, or a similar compound.

When once the solution of sodium alginate has been purified and clarified, the alginate is isolated by converting it into an insoluble form, either by:

(1) adding hydrochloric acid and precipitating alginic acid;
(2) adding calcium chloride and precipitating calcium alginate which is insoluble, and then converting the calcium alginate to alginic acid.

Although (2) seems to be more roundabout than (1), there are certain practical considerations to recommend it, and in most cases it is probably the preferred method. Whereas direct precipitation of alginic acid gives a jelly which is difficult to dry and to manipulate, the calcium alginate precipitate is fibrous and easy to work.

The alginic acid, prepared by either method, is converted into the appropriate salt by churning it round in a mixing machine with the alkali. Thereafter it is necessary only to dry, mill, and sift to have the saleable product, usually in the form of a nearly white powder.

The two outstanding fundamental characteristics of alginates from which all their industrially valuable secondary properties derive, are their highly (linear) polymeric nature and their powerful hydrophilic qualities. These two characteristics derive in turn from the chemical constitution of alginates. Chemically, alginic acid is very similar to cellulose and similar to pectin; whereas the side-group in cellulose is a primary alcohol, in alginic acid it is a carboxyl group, and alginic acid is thus poly-β-glucuronic acid. As would be expected from the presence of this group, sodium, ammonium, potassium and magnesium alginates are all soluble in water.

There may well be a hundred or more β-glucuronic acid units in a molecule of fairly high grade sodium alginate—the molecular weight of one of the rings is 198, that of a long molecule containing 100 such units would be about 20,000, and it is quite likely that some of the molecules in a good quality of sodium alginate may be so long that their molecular weight is 200,000.

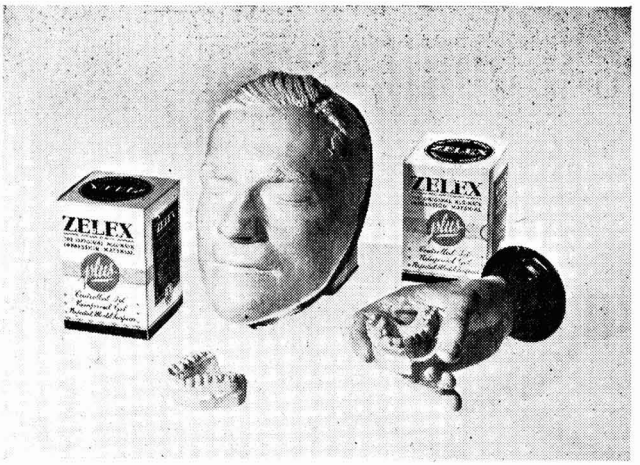
The first property that comes from this highly (linear) polymeric chemical structure is that of fibre-forming. The second property that is of importance is the high affinity of the alginates for water, and this is due to the abundance of hydrophilic groups, such as hydroxyl-OH and carboxyl-COOH, in the molecule. Alginates of the alkali metals are very readily soluble in water. This solubility, together with their polymeric nature, means that alginates will be powerful thickening agents, and that their molecules will entrain large numbers of water molecules and will thereby stabilise aqueous systems. The thickening and stabilising properties bring suspending qualities that are of value to industry.

Propylene Glycol Ester

One or two esters of alginic acid have also been made; the ester which has been made on the biggest scale is propylene glycol alginate. Alginic acid is extremely difficult to convert into esters by the usual reactions, but it so happens that it reacts very readily with propylene oxide to give the propylene glycol ester.

The ester is useful industrially because it has an organic oil-like head (the ester group) and a long hydrophilic tail (the remainder of the alginate molecule), and is therefore a good emulsifying agent for oils and water.

The linear polymeric nature of the alginates means that they should form fibres, and a fibre is actually manufactured by Cour-



Alginate-based dental impression material gives remarkable accuracy of detail, even in re-entrant areas

taulds Ltd. A viscous solution of sodium alginate is made and this is squeezed through a spinneret into a coagulating bath of calcium chloride solution. As the sodium alginate solution encounters the calcium chloride it is rapidly converted into insoluble calcium alginate which is precipitated in filament form. The filaments are drawn up continuously, run together, washed and dried, and wound as yarn on to a bobbin. This yarn looks like any other continuous filament rayon, but it has two unusual properties. These are:

(1) It is soluble in very weakly alkaline solutions, even in ordinary soap solutions. It cannot, therefore, be washed, and is accordingly unsuitable for most of the traditional uses of a fibre.

(2) It is flameproof. If a calcium alginate fabric is held in a hot flame it does not flare up or flame itself, but just chars locally.

So far as concerns the non-flam character, alginate dresses can be dry-cleaned without trouble, so that for party frocks (which are particularly susceptible to the fire risk) alginate fabrics have something useful to offer.

The alkali solubility, which is so serious a disadvantage for ordinary purposes, has surprisingly enough been turned to good account in the hosiery trade. Here socks are knitted in a long string and a few courses of a draw-thread are run between the end of one sock and the beginning of the next; later this thread has to be withdrawn by hand. Nowadays, these few courses are knitted in calcium alginate yarn, so that when the socks are being finished, the alginate yarn dissolves away, leaving perfect welts to the socks.

Various other uses have been suggested for this 'disappearing thread'; it has, for example, been used as a heavy scaffolding for an extraordinarily light fabric, the scaffolding enabling the very light fabric to be woven, and then subsequently being washed out.

More than half of the ice-cream sold in the US nowadays is stabilised with alginate. The quantity used is only small, from one-quarter to one-half ounce of alginate (usually sodium alginate) per gallon of ice-cream mix, but it can make all the difference to the quality of the ice-cream. It prevents the formation of any ice-crystals, it prevents separation of the mix into two layers before freezing, it gives a smooth texture to the ice-cream, and it gives some resistance to heat-shock—the ice-cream does not melt too rapidly in a warm room. Furthermore, if such special attributes as extra creaminess in the mouth, or particularly long delayed melt are required, these can be achieved by the use of specially selected alginates preferably used along with trisodium phosphate crystals.

Similarly, a small quantity of alginate included in 'ice lollies' ensures that flavour and colour persist till the end; presumably the long alginate molecules mix themselves up inextricably with the flavour and colour molecules and the water molecules, so tying them all together. Sherbets are also stabilised with alginates.

When dentists are making dentures, they have to make an impression of the mouth

and it is necessary that this should register the finest detail and should not distort on setting or drying. Most dentists today use an impression material which is based on a filler, calcium sulphate and sodium alginate. When this is pasted up, calcium alginate is formed, but quite slowly, and it gels as it forms. The gelling takes place in the patient's mouth and the gelled impression can be withdrawn after a minute or two even from re-entrant areas.

The 'mould' is not a hard plastic cast, but a tough elastic jelly. No heating is required as it commonly is with other dental moulding powders, and impressions can be taken with the minimum of inconvenience and discomfort to the patient. The reproduction of detail, e.g., on the upper palate, has to be seen to be believed, and this accuracy contributes to comfort in wear of the finished dentures.

Hæmostatic Properties

All soluble alginates are hæmostats. A touch of an alginate on a shaving cut and bleeding stops at once. Post-extraction cavities which continue to bleed can be plugged with a tiny piece of calcium-sodium alginate 'wool'; bleeding is arrested and the plug of alginate does not need to be removed because the body will slowly absorb it over a period of two or three weeks. The more sodium and the less calcium there is in the mixed calcium-sodium alginate, the quicker does absorption by the body proceed. The hæmostatic and absorbable qualities of alginates have also found application in branches, other than dental, of surgery. Dressings for wounds are made from alginates, and sometimes an alginate film may be used to cover a wound; it promotes recovery because it protects the wound from contamination, but at the same time allows it to 'breathe'.

One last application must be mentioned because it affords one of the biggest outlets for alginates. Electric welding rods consist of a thick metal wire coated with a flux which consists largely of silicates. The rods are extruded and if there is a little alginate in the flux the rods extrude easily and smoothly; if there is no alginate present, they are difficult to extrude. The alginate makes what would be a very difficult process into an easy one, and its inclusion also assists in the smoothness and regularity of burning of the rod during welding.

Control of Food Chemicals

CHEMICAL substances used in the course of manufacture of foods to improve their flavour or texture will be more widely controlled if the Food & Drugs Amendment Bill becomes law.

Power already exists to make regulations prohibiting the use of prescribed substances in food. This power is expressed more fully in the new Bill, which was introduced in the House of Lords on 10 November, and its efficacy is improved by the granting of powers to the Secretary of State and the Minister of Food to call for information from manufacturers of food chemicals about the nature of their products and the experiments they have carried out to establish whether they are harmful or not.

This information, it is expected, will assist the Medical Research Council and other research organisations to determine what food chemicals are harmless and what restrictions are necessary in the case of others.

The Bill also clarifies the powers of the Secretary of State and the Minister of Food regarding the control of materials used in the manufacture of apparatus and utensils employed in the preparation of food, with a view to preventing poisoning from metallic contamination.

Exemption from KID

THE Board of Trade are considering the question of the renewal for the period 19 February, 1954, to 18 August, 1954, of the exemptions from Key Industry Duty as set out in the Safeguarding of Industries Exemption Orders, namely, the Nos. 6, 7 and 8 Orders, 1953, and in any further exemption orders which may be made prior to 19 February, 1954, under Section 10(5) of the Finance Act, 1926, as amended by subsequent enactments. Lists of the articles covered by these Orders exempting them from KID until 18 February, 1954, were published as Statutory Instruments 1953, Nos 1246, 1357 and 1574. Any communications arising out of this announcement should be addressed to the Industries and Manufactures Department, Division 1, Board of Trade, Horse Guards Avenue, London, S.W.1, as soon as possible and in any case not later than 5 December.

Limestone & Agriculture

The Backbone of Britain?

THE twice-yearly luncheon of the Limestone Federation was held in London on Tuesday, 10 November, when a number of distinguished guests were present.

Professor Sir James Scott Watson, C.B.E., M.C. (Director-General, NAAS, Ministry of Agriculture), proposing the toast of 'The Limestone Federation,' said:—

For 16 years we have had a lime subsidy and we have been hoping the overdraft would be gradually paid off. We were rather late in starting and we have not gone on fast enough, and in the meantime we have had to fight down certain prejudices on the part of the farmer. If I may mention two, we found when we started to advise farmers to use more lime that there was a strong prejudice in favour of burnt lime—either burnt lump lime or burnt ground lime. There were many indications in the old books that that was sound, but it was only accidental. The fact was that burnt lime fell into a minute state of sub-divisions and much of it was too coarsely ground, and it was only when we could produce a more finely ground material that we could attack this prejudice and get around to ground limestone as the standard material.

I am not sure we are absolutely right for the whole of the circumstances now. I think Professor Robinson, a distinguished soil chemist whose loss to agriculture we deeply regret, came to the conclusion that if you had a reasonable amount of really fine material in your product, that would be quickly available, and the more coarsely ground material would come into solution as time went on.

Co-operation Good

On the whole, we have had very good co-operation between the various parties concerned. The Government has been very willing to keep on paying the lime subsidy. It is the first thing of its kind, and it was started because we feared in the years before the war that the war might come, and it would be a bad case if we had the job of liming all the land then. The lime subsidy has gone on ever since and the Government has been happy.

We in the National Agricultural Advisory Service have, of course, made enormous numbers of soil analyses and have been doing *p*H's and lime requirements and that sort of thing, and we have given a great deal of specific advice about the quantities of lime that are necessary and should apply in particular cases, and I am sure, if I may blow my own trumpet for a moment, we have greatly helped to put the available lime that the farmers hold to the best possible use.

Compromise Necessary

We have got to keep on and on, putting on more lime. I have made a rough calculation that a reasonable objective would be—I am talking of the United Kingdom—about 7,000,000 tons a year for seven years, and we shall be more or less straight. If we do it faster, that would be all to the good; but you would be all too soon out of a job. So, we must compromise and think of both parties, and I think a seven-year programme is the sort of ideal we should face. In the long run, you have to remember that the demand for lime should be bigger than in the past. We are hoping farmers will use more and more lime and sulphate of ammonia.

Replying on behalf of the Federation, Mr. Harold Fletcher, J.P., said:

In common with the Ministry of Agriculture I know I can say in respect of the Limestone Federation that we certainly have this in common: that we are concerned with basic things and basic material; we are concerned with the very stuff of which this country of ours is made, because our product is of the earth itself, and this rock on which our Federation is based is, in fact, the cornerstone of many of the basic industries of our country.

Because of that, we are a proud industry and a proud Federation, with a pride that does not stem from arrogance or vain glory, but rather from the fact that we feel our industry is useful and is able, through service, to make a contribution to the growing prosperity and wellbeing of this country. Our activities are widespread, geographically, and our 280-odd members are interspersed roughly from the South West of

England down in Devon up to the North East coast and on into Scotland, and are producing annually upwards of 16,000,000 tons of this very important material.

The uses of limestone are manifold. They touch such industries as chemicals, coal mines, iron and steel production, civil engineering and road construction, buildings, railroads, glass manufacture, sugar refining and a host of others, but although these are important, and many of those I have not mentioned are important, I know I can say on behalf of my fellow members of this Federation that nothing that we do gives us greater satisfaction and pride of achievement than our service to agriculture in the supply of materials.

In the ten years from 1941 to 1951, approximately 34,000,000 tons of carbonate had been applied to the soil under the lime subsidy scheme, but in 1951, after that 34,000,000 had been applied, we were told there was still a deficiency of 28,000,000 tons of carbonate, and that did not take into account the need—a need which will have to be met sooner or later—of rough grazing, marginal land, and so on.

Net Gain Slight

If my arithmetic is right—it is not often, but I hope this is—there has been an average annual application of roughly 3,400,000 tons of carbonate a year and an annual loss over the same period of 3,100,000 tons arising from natural causes of removal —that is rainfall and the lime taken out by crops. So, on the ten-year average, we have only moved forward at a rate of 300,000 tons a year towards eliminating the original deficiency of 31,000,000 tons. Latterly we have been doing better, and in the second half of the ten-year period the average usage of liming materials has been 4,100,000 tons.

Producers of agricultural lime have invested very large sums of money in the erection and maintenance and development of plant for the production of this material and for the transport and for the application of agricultural lime to the soil. They have in fact created and developed a completely new branch of the limestone industry on a scale which has made it possible for the various types of agricultural lime products to be sold at very moderate charges. I have no doubt that if the original attainment can be maintained, the industry, by the replacement of plant and the modernisation and mechanisation of methods will continue to ensure that agriculture continues to receive its lime as cheaply as possible.

We are glad to acknowledge the support we have received from the organisation of which Professor Sir James Scott Watson is the distinguished head—the National Agricultural Advisory Service—the organised farming bodies such as the NFU, and by such interested bodies as universities, agricultural colleges, research bodies and, I would add, the publicity department of the Ministry which, with great respect, we suggest could push the lime story a little further. If we all get down to this job we may be able to convince that minority of farmers as to the full significance of that symbol *p*H which we know is of the greatest importance in the matter of the correct state of acidity or alkalinity of the soil.

Paraffin Wax Dearer

SHELL-MEX, Ltd., have announced an increase in some of the prices of paraffin wax. Ex store/works prices now operative are:

CATEGORY "A" SCOTCH WAXES ONLY, PRICE PER TON

Grade (°F. Melting Point)	*Ex-store* London, Liverpool and Manchester (minimum 1-ton lots)	*Ex-works* Pumpherston (minimum 1-ton lots)
100/105	—	£64 10s.
106/110	—	£64 10s.
110/115	£67 0s.	£64 10s.
115/117	£67 0s.	£64 10s.
117/120	£67 0s.	£64 10s.
120/125	£67 0s.	£64 10s.
125/130	£68 0s.	£65 10s.

CATEGORY "B" OTHER QUALITIES, PRICE PER TON
Ex-store/works

Grade (°F. Melting Point)	Minimum 1-ton lots	Smaller Quantities
125/130	£76 15s.	£77 10s.
130/135	£77 15s.	£78 10s.
135/145	£79 0s.	£79 15s.
140/145	£81 5s.	£82 0s.
145/£50	£86 5s.	£87 0s.
150/155	£96 5s.	£97 0s.
Scale	£63 14s.	£64 9s.

India's Gift to Ceylon

India's gift of 100 tons of Sindri ammonium sulphate to Ceylon under the Colombo Plan has been formally handed over to the Ceylon Government. The Indian High Commissioner, Mr. C. C. Desai, presented a token bag to Sir John Kotelawala at the Ceylon Prime Minister's office in Colombo.

Heavy Chemical Industry & Production

Progress Made by ABCM Committee

THE report of the Heavy Chemicals Productivity Team which visited the United States in the spring of 1952 was published early in 1953 and received much favourable comment in the technical, national and provincial Press. It was widely distributed and to date close on 9,000 copies have been issued by the British Productivity Council and the Association of British Chemical Manufacturers in this country and the USA.

The Association of British Chemical Manufacturers and the Association of Chemical & Allied Employers in co-operation with the trade unions had previously set up a Joint Steering Committee with wide terms of reference to supervise the distribution and study of the report and to ensure consideration of it with a view to the implementation of the recommendations, where appropriate, by the industry and its member firms.

As a first step, a series of area meetings was held at Birmingham, Bristol, Glasgow, London, Manchester and York to which every interested firm in the area was invited and at which over 1,100 senior representatives were present. In every case there was a large attendance and a vigorous discussion. Members of the team were present to answer questions. The primary object of these meetings was not to discuss in detail the 20 recommendations in the report, but to ensure by question and answer that the intentions of each recommendation and the reasons for it were fully understood. Firms were recommended to take such steps as they thought necessary to ensure that the report was not only brought to the notice of the personnel in their works, but was actively studied and discussed with a view to the implementation of the recommendations, in so far as they were feasible in each case.

Local Area Committees

It was also agreed at each area meeting that a local area committee should be set up to give whatever assistance and guidance firms might desire and in every possible way endeavour to ensure that the maximum benefit was derived from the report. These committees have now been set up and have commenced to carry out their functions. Four of the members are nominated by firms from the management and technical side of the industry and three by the trade unions primarily interested; two team members are attached to each committee to assist in elucidating any points which may need clarification.

Abbreviated Version

As the team's report is a substantial document requiring much time for its study, there was unanimous agreement that a short pamphlet setting out the salient points in popular language and attractively illustrated should be prepared for distribution by firms to all levels in the factory. This pamphlet is now in the Press and will shortly be available from the Association of British Chemical Manufacturers, 166 Piccadilly, London, W.1 (6d. per copy).

In parallel with the above action the two Associations have been giving attention to the recommendations which are directed to them and considerable progress has been made in many cases. As an example, the Association of British Chemical Manufacturers was recommended to investigate and advise their members in the use of work study in the British heavy chemical industry. A very successful two-day Work Study Conference was, therefore, organised at Buxton by the Association of British Chemical Manufacturers at the beginning of October in order that top management might be made aware of what exactly work study means and what it can do to increase productivity in the interests of the worker, the company and the nation.

The chemical industry is greatly indebted to the generous co-operation of Imperial Chemical Industries Ltd. who made available the services of their work study organisation and of their senior executives who gave short papers and held discussions during the conference and in this way placed a great deal of practical experience of work study in chemical factories at the disposal of the entire industry. At this conference, which was probably unique for any industry, there was an attendance of over 500, of

whom nearly 200 were directors or higher. The papers and discussions are being printed and will be on sale from the Association of British Chemical Manufacturers in the near future.

Progress reports on the action taken to fulfil the other recommendations in the Heavy Chemicals Productivity Team Report will be issued from time to time.

Brazing Stainless Steels

New Process in Controlled Atmosphere

IT is essential, when making brazed joints, that the surfaces to be joined are kept clean so that the brazing metal may wet them freely; the necessary cleanliness may be achieved either by the use of flux or by brazing the component in a controlled atmosphere. Fluxes usually have the disadvantage that they need to be completely removed after brazing to prevent subsequent corrosion. On the other hand, brazing of stainless steel in a controlled atmosphere has not always proved consistently satisfactory.

A technique whereby the brazing of stainless steels can be carried out in a standard furnace provided with a controlled atmosphere has now been developed by The General Electric Co., Ltd. The process is suitable both for copper-brazing stainless steels and for brazing components using Nicrobraz alloy as the filler metal.

The protective atmospheres most widely used in the process are burnt town gas or burnt ammonia. The brazing of metals which are not easily oxidised, such as steel, may be carried out in these atmospheres, using filler metals such as copper or copper alloys. However, when components of the stainless steel type are to be treated it is necessary to maintain close control over the quality of the atmosphere within the furnace chamber. Traces of oxygen, water-vapour or carbon dioxide will form an oxide film on the surface of the components which prevents the liquid brazing metal from alloying with the exposed surfaces and a sound joint being made.

Similar considerations apply when the brazing alloy itself is readily oxidised, as is the case with certain high temperature brazing alloys such as Nicrobraz. If a very dry hydrogen atmosphere is used and if treatment is carried out in a metal container, the surfaces are kept clean and brazing is satisfactory.

A GEC vertical cylindrical furnace with gas tight container has given excellent results when used for the process. It has effective loading dimensions of 17 in. diameter by 4 ft. 10 in. deep and can be used for all types of brazing in the temperature range 700°-1,180°. The holding time at high temperature is short; for most filler metals 10 minutes is sufficient but when Nicrobraz is used a suitable holding time has been found to be 30 minutes.

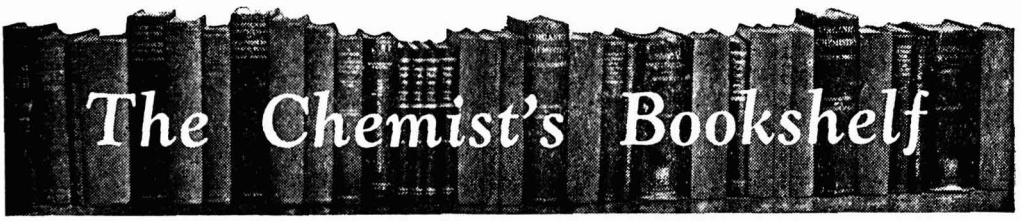
Lubricants for Metal Working

AN informal discussion on 'Lubricants for Metal Working Operations in the Non-Ferrous Metals Industry', arranged by the Metallurgical Engineering Committee of the Institute of Metals, will be held at the University, Edgbaston, Birmingham, on Wednesday, 6 January, 1954, from 10.30 a.m. to 4.30 p.m. The chair will be taken by Mr. W. J. Thomas, M.I.Mech.E. Members and visitors who desire to do so may obtain lunch (4s. 6d., including coffee) in the University Refectory, provided that they notify the Secretary of the Institute (at 4 Grosvenor Gardens, London, S.W.1) to that effect. Visitors will be welcome. Tickets are not required.

Lecture to Cosmetic Chemists

Opening the winter session of the Society of Cosmetic Chemists, Mrs. Evelyn Forbes, Beauty Editor of *Vogue*, gave a very successful lecture on 'Some Aspects of Cosmetic Advertising' to an audience of 140, on 4 November. The Society's annual dinner and dance will be held on 22 January at St. Ermin's Hotel, Westminster.

We regret to record the death, which occurred suddenly in Colchester Hospital recently, of MR. HAMILTON BRINSLEY BUSH, managing director of W. J. Bush & Co., Ltd. He was the second son of Mr. A. W. Bush and grandson of Mr. William John Bush, who founded the business in 1851 in a little shop in Bishopsgate, London. The business was formed into a company in 1897. The late Mr. H. B. Bush became a director in the 1930's.



QUANTITATIVE ANALYSIS. By W. M. MacNevin and T. R. Swift. Harper and Brothers, New York; Hamish Hamilton, London. 1952. Pp. ix + 247. 30s.

This is a pleasant little introduction to quantitative analysis which approximates in standard to Intermediate requirements in this country. Gravimetric analysis is dealt with first, and the gravimetric course consists of half a dozen basic experiments. Close attention has been paid to the detailed descriptions of apparatus and experimental methods, and the directions are clear and easy to follow. There are rare omissions, such as the use of the term 'policeman' without a prior description of this adjunct, but such omissions seem to be the exception. It is perhaps not entirely excusable that the use of porous porcelain or sintered glass filter crucibles is nowhere described—a marked contrast to the up-to-date character of some of the experimental work described later in the book. Nowadays students ought to be introduced to these filters at an early stage.

The course on titrimetry is more extensive than the gravimetric section, as is usual at this stage, and the components of the course have been well-chosen to give a representative introduction. The rational approach may be instanced by the inclusion of a semi-micro Kjeldahl determination as a suitable exercise.

Approximately the final third of the book is devoted to other analytical determinations which are not beyond the capabilities of the beginner, but which are not always regarded as suitable for inclusion in an elementary course. The photometric (or colorimetric) determination of iron and of *p*H, the potentiometric determination of the latter, and the electrolytic determination of copper are selections which seem reasonably obvious. Less expected, but all the more praiseworthy on that account, are the inclusion of experiments using an ion-exchange resin for the determination of sulphate and using ethylenediaminetetraacetic acid in a water analysis. These, particularly if presented properly by the instructor, should help to make the student aware that new and striking developments in analytical chemistry are not a thing of the past.

The book, in other words, contains most of the ingredients of the normal course, excellently presented, and has a few novel titbits in addition. The rather high price may prevent its wide use by students in this country, but there can be no doubt of its value to teachers of analytical chemistry who wish to get a little bit off the beaten track.—CECIL L. WILSON.

ABSORPTION TOWERS. By G. A. Morris and J. Jackson. Butterworths Scientific Publications, in association with Imperial Chemical Industries, Ltd., London. 1953. Pp. xi + 159. 30s.

This monograph describes the methods used within Imperial Chemical Industries, Ltd., for the design of packed towers for absorption and stripping with particular reference to the absorption of soluble gases. The treatment is essentially practical, the aim of the book being to provide the engineer 'with the methods and data needed to enable him to design full scale towers which are both technically and economically satisfactory.' A brief introductory chapter in which the two film theory is stated and equations for coefficients and other terms are defined is followed by chapters on laboratory absorption equipment and packings. Chapter IV then describes the design of packed towers using absorption coefficients and Chapter V the use of the transfer unit method. Subsequent chapters deal with mechanical features of design, economic factors, absorption with chemical reaction, and the final chapter is devoted to illustrative design calculations. There are two appendices, the first dealing with economic gas rates and the second with the physical properties of the more common gases. A bibliography and glossary of terms used are provided.

The authors prefer the use of absorption

coefficients for design purposes and in general recommend the use of a falling film tower for the determination of gas film coefficients and a standard disc tower for determination of liquid film coefficients. Individual film coefficients determined in this manner are multiplied by a packing factor and the overall coefficient for the system then calculated. The 'packing factors' for several packings of various sizes are tabulated thus facilitating design by this method. The height of a transfer unit for gas and liquid films are also tabulated for the same packings. Throughout the text tables of data are given such as installed cost of packing, wetting rates, economic rates, etc., which are based upon experimental and full scale plant determinations and are published in this book for the first time. The values given have been selected as the best values and have been in use for design purposes within Imperial Chemical Industries, Ltd., for some time. They may be used therefore with confidence. It is hoped that the publication of this data may encourage other companies to permit the publication of design and test data on other types of packing.

A number of design calculations are worked out in detail in the final chapter. These will be of the greatest value to students and to design engineers to whom the text is particularly recommended. For the student some additional reading will be necessary, particularly if he is to understand the use of the transfer unit method, but this is not a serious disadvantage for adequate theoretical treatments are given elsewhere. A minor criticism is that hydrocarbon systems are not mentioned; a chapter on the methods used in hydrocarbon absorption and stripping design calculations would have been of interest particularly to the student. These however are adequately dealt with in other texts and since such processes usually employ bubble cap towers their omission from this monograph is perhaps justified.

The book is well produced, clearly printed with excellent figures and contains so much hitherto unpublished data that no design engineer can afford to be without it.—F.M.

ANTIBIOTICS. By F. A. Robinson. Pitman, London. 1953. Pp. xviii + 132. 15s.

Nobody can deny the great value of the monograph. With more space than the general textbook, with much more space than the review article, it presents in a neat, handy form the important features of possibly hundreds of specialist papers. But the temptation to write a monograph is also great; the developments of a few years are sufficient excuse for the publication of a new version, when they would be considered scant justification for a new edition of a comprehensive treatise.

And so, where there are many monographs, one does not differ greatly from another. As the author of this book himself says: 'The antibiotics have been well catered for . . . . and a number of excellent monographs have already appeared. . . .' The present book may now be added to that number, but those who already possess two or three will find little new material in it.

This is not to deny that this is a very good monograph. The author has worked for three of the most prominent companies in the field and has been connected with the industrial preparation of antibiotics since early 1942; he can certainly claim to know what he is writing about.

However, this is a book most suitable to general knowledge of the subject. The limitations of space have prevented the inclusion of references, and the reader who wishes to proceed farther in his reading will have to turn to one of those other monographs for these. He who reads this monograph alone will nevertheless discover that he is familiar with most of the antibiotics, including such substances as bacitracin and actithiazic acid, their production by surface or deep culture, their spectra (bacterial), and their applications.—B.I.

Analysis of Aluminium

THE British Standards Institution has just published Part 5 of BS. 1728, 'Methods for the Analysis of Aluminium and Aluminium Alloys.' This British Standard Method for the absorptiometric determination of copper is intended for use with alloys containing smaller percentages of copper than those covered in BS. 1728, Part 1 (of the order of 0.01-0.3 per cent). The method specifies the reagents used, recommended methods of sampling and test procedure. Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1 (price 2s.).

HOME

Watches for Workers

Aluminium watches had been presented to seven employees of the Northern Aluminium Co., in recognition of 25 years' service.

Change of Address

The address of the head office of G. E. Simm Machinery, Ltd., and G. E. Simm (Engineering), Ltd., will be changed from 1 December to 27 Bromgrove Road, Sheffield, 10 (Tel.: Sheffield 62225, 62451, 62981). Branch office addresses will remain as now.

Science & Industry

The Esso Petroleum Co., Ltd., is to endow a public lecture in Southampton University each year for the next seven years on some aspect of the relationship between science and industry. These lectures will be known as 'The Fawley Foundation Lectures' and the first will be given next year. The company's big oil refinery at Fawley, near Southampton, is well known.

New Scottish Factory

The new Cape Asbestos Ltd. plant at Stirling is timed to start production in December as a result of excellent progress in construction and equipping. The plant will manufacture Rocksil, an insulating material, using dolomite from Argyll and silicaceous clay from Stirlingshire. The site occupies 3½ acres, with ample ground for expansion, and the project has cost in the region of £250,000.

Advice on a Career

Upwards of 150 school boys and careers and science masters from London grammar and public schools attended a meeting organised by the Institution of Chemical Engineers at Caxton Hall on Wednesday. Professor M. B. Donald, Ramsay Professor of Chemical Engineering in the University of London and chairman of the Institution's Education Committee, gave a brief talk on the profession and the opportunities it offers. Mr. E. Le Q. Herbert, general manager of Shell Refining & Marketing Co., Ltd., then introduced the film 'The Stanlow Story. Afterwards the boys' questions were answered by a team of chemical engineers.

Vinyl Emulsion Polymers

Members of the Plastics & Polymer Group of the Society of Chemical Industry have been invited by the London Section of the Oil & Colour Chemists Association to attend a lecture on 'Vinyl Emulsion Polymers and Their Use in Coatings' by C. E. Hollis and J. H. W. Turner, at Manson House, 26 Portland Place, London, W.1, on 25 November at 7 p.m. This recently developed polymer application is of rapidly increasing importance.

New Pharmaceuticals

New Glaxo preparations featured at their stand at the London Medical Exhibition included a stabilised injection of streptomycin sulphate (containing 50 per cent streptomycin base in 2 cc. snap-top ampoules and in 10 cc. vials); cytamen 250 (250 micrograms vitamin B_{12} per cc.—boxes of six), and a new triple antigen diphtheria-tetanus-pertussis prophylactic 'Glaxo.' Supplies of all three products will be available commercially on 30 November.

'Anxiety at Steelworks'

At a Scunthorpe inquest last week on two men found dead after they ascended a gasholder at Normanby Park steelworks to inspect the seals, it was suggested that a pocket of gas from an adjoining blast furnace had been held over the holder by fog. A third man involved, who recovered in hospital, said he thought the gas escaped from the holder. The coroner said the case had caused much anxiety at many steelworks and no doubt would lead to thorough investigation by them.

Sulphur Shortage?

The possibility of a sulphur shortage this winter was mentioned recently by Dr. G. I. Higson, chairman of I.C.I.'s Billingham Division, when he told the division council that another plant to use anhydrite was to be built. He added that Billingham extensions would provide 350 further jobs, including 290 in the new nylon plant due to be ready in December; ammonia plant extensions by next May would account for 16 new jobs; and 44 would be provided by the new sulphuric acid plant to be ready next August.

• OVERSEAS •

Italian Cement Works

Large modern Portland-cement works are being constructed at Coroglio, near Naples. Built by the Cementir Company, of Rome, and financed partly by the Cassa del Mezzogiorno, the new plant will start operating in January, producing about 420,000 tons of cement a year.

Pharmaceutical Code

The Indian Council of Scientific and Industrial Research has issued the first volume of the Indian Pharmaceutical Code. First of its kind in India, the book has been compiled on the lines of the British Pharmaceutical Code and the United States Dispensatory.

Zinc Oxide in USA

Output of zinc oxide in the USA rose 3 per cent to 15,500 short tons during August, but was 6 per cent below the monthly average rate of output for January-July, according to the Bureau of Mines, Department of the Interior. Total stocks of zinc oxide rose 2 per cent to 22,600 tons on 31 August.

USA Sulphur

The USA domestic sulphur industry produced 450,790 long tons of native sulphur and 29,545 tons of recovered sulphur (of a purity of 97 per cent or greater) during August, according to reports of producers to the Bureau of Mines, US Department of the Interior. Producers' stocks of native sulphur increased and at the end of August stood at 3,037,323 tons.

Italian Pharmaceutical Industry

The Italian pharmaceutical industry has reached a high degree of development and the value of its yearly output can be reckoned at about 85,000,000,000 lire. Four large factories produce yearly about 24 tons of synthetic chloroamphenicol, a large percentage of which is exported. Four other factories produce about 400 tons of sulphamides yearly and there is a large production of vitamins. About 2,000,000,000,000 units of penicillin and about 1½ tons of streptomycin are produced monthly.

British Guiana Bauxite

A message from Georgetown, British Guiana, states that Demarara Bauxite Co. mined an all-time record of 3,088,290 tons of crude bauxite during 1950-52. In the same period the company spent £250,000 on exploration.

Oil from Shale

The Foster Wheeler Corporation of New York has signed a contract with the National Petroleum Council, Sao Paulo, Brazil, for the construction of a distillery to produce 10,000 barrels of oil daily from shale. Raw material from the Taubaté-Tremembré region will be used.

'The Desert Shall Bloom . . .'

What was formerly desert country in the south-east corner of South Australia is now ideal sheep-grazing land, thanks to the use of superphosphate, copper, zinc and molybdenum. A merino ram from this area was recently sold for 1,000 guineas, for export to New Zealand.

USA Rubber Controls

The USA Government has been urged by Mr. John L. Collyer, president of the B.F. Goodrich Company, to revoke a directive which requires that rubber consumption controls be reimposed in the US if the use of general purpose synthetic rubber (GR-S) falls below a rate of 450,000 long tons a year. Mr. Collyer said many natural rubber producers believed that the directive had the effect of limiting the demand for natural rubber in the US.

Use of Fertilisers in India

The establishment of a national fertiliser association to develop the use of fertilisers in India has been recommended by the Development Council for Heavy Chemicals (Acids and Fertilisers). Recently the Council considered the possible manufacture of barium salts in India, and in view of the abundance of the necessary raw materials and potential demand for such salts, recommended that those taking up the manufacture of barium products be fully encouraged.

PERSONAL

MR. R. WOOD has been appointed a director of James Bridge Copper Works, a wholly owned subsidiary of Wolverhampton Metal Company, and MR. L. E. OLDRIDGE has been appointed to the boards of both companies as an alternate director.

MR. D. R. COLLINS has been appointed chairman of J. C. & J. Field, Ltd., soap and candle makers. He succeeds Mr. M. G. T. Rice, who resigned from the board last month Mr. Collins became managing director of the company last September after it acquired control of D. R. Collins, Ltd., perfume and cosmetic makers.

At a recent board meeting, MR. GEORGE H. TURNER, sales manager, was elected to a seat on the board of R. Cruickshank, Ltd., the West Bromwich, Birmingham, chemical manufacturers and electro plating engineers. Mr. Turner joined the firm nearly 25 years ago and has been closely associated with all activities of the business. His many friends in the trade will be pleased that he has been recognised in this way.

MR. JOHN FARRAR HARDWICK, son of Mr. W. Roscoe Hardwick, has rejoined Huson & Hardwick, analytical and consulting chemists, Liverpool, as a partner. Mr. J. F. Hardwick left in 1941 and during the intervening years has gained wide experience in oil refinery technique and chemical manufacture. He is a B.Sc. of Liverpool University (Honours School, Chemistry), a Fellow of the Institute of Petroleum and an Associate of the Royal Institute of Chemistry.

HER MAJESTY THE QUEEN has been graciously pleased to approve recommendations made by the Council of the Royal Society for the award of the two Royal Medals for the current year as follows:—To SIR PAUL FILDES, O.B.E., F.R.S., for his classical researches on growth factors for bacteria and for laying the foundation of work leading to a rational approach to chemotherapy; and to PROFESSOR N. F. MOTT, F.R.S., for his eminent work in the field of quantum theory and particularly in the theory of metals.

DR. DONALD PARKINSON, manager of the compounding research division at Fort Dunlop, is to receive the Colwyn Medal—highest award of the Institution of the Rubber Industry—for 'conspicuous scientific and technical services to the industry.' He joined the Dunlop Rubber Co. after serving on the geological staff at Queen's University, Belfast, from 1925-27, obtaining his Ph.D. degree in 1925 and his D.Sc. degree in 1936. He had previously graduated at Birmingham University with first-class honours in geology. His published work has comprised papers on rubber physics and technology, and in particular he has described research on the reinforcement of rubber with carbon black.

Obituary

MR. ARCHIBALD HAMILTON, formerly chairman of Archibald H. Hamilton & Co., Ltd., paint and varnish manufacturers, Possilpark, Glasgow, has died at the age of 65. When his health broke down a few years ago he ceased to be as active as formerly in the business, which was founded by his father.

Chief analyst with Imperial Chemical Industries, Ltd., Billingham-on-Tees, until his retirement last year, MR. WILLIAM CHARLES HUGHES, has died at Norton, Stockton-on-Tees, aged 65. He started his career in 1905 with Brunner Mond, Ltd., and later joined Synthetic Ammonia and Nitrates, Ltd., which afterwards became part of the I.C.I. organisation.

The death has occurred suddenly at Keswick of MR. ANTHONY WILSON, who was prominently connected with the lead mining industry. A member of the Institute of Mining Engineers and the Institute of Mining Metallurgy, he had been managing director of Thornthwaite Lead Mines, the Carrick Fell Tungsten Mine and the Threlkeld Lead Mine, all now disused. At one time he was chairman of the Lead and Zinc Mining Association. He was a director of the Weardale Lead Co. at the time of his death.

Publications & Announcements

PUBLICATION No. 53 by Whessoe Ltd., is entitled 'Design and Construction in Steel Plate.' The brochure is designed to survey the extent of Whessoe activities in the oil, gas, chemical, steel and other industries, and is based upon the theme indicated by the title. The introduction takes the form of a brief survey of the Whessoe organisation, with a pictorial representation of the layout of the rebuilt shops at Darlington. After this are described and illustrated the various forms of capital plant which the company manufacture, from storage tanks of every size, including vapour conservation applications, by way of heat exchangers, refinery plant, pressure vessels, and various forms of processes and storage methods, to tank fittings manufactured under licence from the Shand & Jurs Co. Copies of the publication are obtainable from Whessoe Ltd., Darlington.

* * *

A Handbook on Die Castings for the Use of Service Designers and Inspectors, sponsored by the Advisory Committee (Die Castings), Ministry of Supply, has been compiled by Mr. F. D. Penney of the Ministry's Armament Design Establishment and is published by HMSO at 6s. It is intended primarily to assist the designer to appreciate the advantages and limitations of die casting processes, assess the suitability of a particular component for production as a pressure or gravity casting, choose the best materials available, and to give guidance in designing the component in order that full advantage may be taken of the potentialities of the process and the materials chosen. Fully illustrated with photographs and line drawings, the handbook also contains tables giving data on compositions, physical and mechanical properties of die casting alloys, on limiting sizes and recommended tolerances.

* * *

ONE hundred and thirty-two chemicals, not included in their 1953 catalogue, have now been added to the current stock of L. Light & Co., Ltd., of Poyle Trading Estate, Colnbrook, Bucks. From these it is possible only to pick a few at random, amongst which may be noted: biurea, cocarboxylase, desoxycorticosterone acetate, emulsin, hyaluronic acid, lithium borohydride and nitrourea.

COMMERCIAL production of hexamethylenetetramine was recently started by Mathieson Chemical Corporation at its Morgantown, W. Va., plant. It is now offering the technical grade, granular material in car-load quantities, packaged in moisture-resistant drums and bags. With the coming into production of its Morgantown unit, Mathieson becomes one of the USA's major producers of hexamethylenetetramine, the principal uses of which are as a convenient source of water-free formaldehyde in the manufacture of phenolic resins and as hardening and insolubilising agent for proteins. It also finds important use as a stabiliser in plastics and as a vulcanisation accelerator in rubber.

* * *

UNPUBLISHED reports from American sources, recently acquired by the Technical Information & Documents Unit of DSIR, include 'The Cleavage of Optically Active Secondary Butyl Ether' (North Western University); 'Electrolytic Reduction of Simple Nitrate Esters' (Ballistic Research Laboratories); 'Water Vapour Sorption by Aluminium Soaps' (Rensselaer Institute); 'Thioglycollic Acid, its Properties and Application'; and 'The Catalytic Vapour-phase Oxidation of Some Four-Carbon Hydrocarbons' (Yale University).

* * *

MANY cylinder seam failures in the past have been due to corroding characteristics in certain water supplies attacking plain brazed seams. To combat this menace, Cuprocyl Ltd., 230 York Way, King's Cross, London, N.7, introduced seams and welts with close controlled dimensional tolerances brazed with a silver-copper-phosphorus alloy rod. This method of construction is now employed on the whole of their domestic cylinder range. In view, however, of certain inherent limitations in the use of this filler rod, the whole jointing process must be controlled—in other words it is a craftsman's joint. This was borne in mind when the 'CL230' cylinder was designed. The company claim that this is the only domestic cylinder having seams mechanically formed to embody the well-proven principle of capillary attraction, thereby ensuring deep penetration of the brazing alloy into the joint.

BECAUSE so few people read lengthy Government reports, and because such reports quickly lose public attention, the National Smoke Abatement Society has published two small booklets of extracts from last year's Ridley Committee's Report on National Fuel Policy. Without comment, these quote all the paragraphs and recommendations relating to smoke prevention which, if adopted, would do a great deal to reduce Britain's smoke pall and the perils of lethal smog. One booklet deals with the domestic, and the other with the industrial aspects of the problem. Copies, 6d. each, may be obtained from the Society at Chandos House, Buckingham Gate, London, S.W.1.

* * *

WITH their wide variety of thermal, chemical and physical properties, carbon and graphite have long been of interest to the chemical and process engineer as a material for the construction of plant handling corrosive fluids. Their use, however, has been restricted because of the inherent limitations they suffer in their untreated form. The Morgan Crucible Co., Ltd., Battersea Church Road, London, S.W.11, developed Carbinert (impervious carbon and graphite) as the answer to the engineer's demands and it has been accepted as an ideal material for certain chemical plant. Interesting information regarding its properties for chemical engineering applications is given in a well produced brochure just issued by the company.

* * *

DETERIORATION of refractory linings of water-tube boilers is a well-known problem and their repair represents a large proportion of maintenance costs. Little comparative information is available about refractory mortars and XZIT (G.B.), Ltd., of 175 Piccadilly, London, W.1, recently carried out a series of tests on 'Brickseal Bond,' a refractory bonding material of their manufacture designed to increase the life of furnace linings. The tests were carried out by Mr. W. Killner, an accepted authority on furnace refractories. Six well-known brands of refractory mortars were tested alongside 'Brickseal Bond' mortar and the method was that laid down for bonding mortars in the American Society for Testing Materials' Standards on Refractory Materials. In this method, bonding strength is determined by cementing two half bricks together on the $2\frac{1}{2}$ in. by $4\frac{1}{2}$ in. face with a joint 1/16 in. thick. After drying, the joints are broken by applying a load, using a standard machine. Load tests to determine the modulus of rupture were carried out by a London firm of consulting engineers. The ASTM specification requires a mortared joint to have a modulus of rupture of not less than 200 lb./sq. in. and the tests showed that the 'Brickseal' mortar was the only one of the seven types which complied with these requirements.

* * *

CLEAN food is very much to the fore these days and the widespread interest in this subject makes all the more timely the appearance of a booklet entitled 'Crosfield Detergents in Bottle Washing,' issued by Joseph Crosfield & Sons, Ltd., Warrington. This describes, in a very readable manner, the processes used in the preparation of clean containers, such as bottles for holding milk and other carefully prepared foodstuffs. Most of the examples in the booklet come from the brewery and dairy trades—simply because of the predominance of these bottles in use—but similar methods are used for cleaning bottles and jars for packing many other commodities, and, moreover, for numerous everyday products from lubricating oils to furniture creams.

* * *

THE Soap Makers' Directory for 1953 has made its appearance and is obtainable from the editor, 15, 17 and 21 City Road, London, E.C.1, at a cost of 5s., post paid. This is the 56th edition and follows the same lines as previous publications, providing much useful information regarding the industry it represents. Its value is increased by the inclusion of a directory of the candle makers in Great Britain.

* * *

LATEST leaflet from the Cambridge Instrument Co., Ltd., 13 Grosvenor Place, S.W.1, is No. 311, describing a new Cambridge recording controller. This is a three-term, air-operated instrument designed for the automatic control of reagent supply, ensuring accurately stable *p*H values or conductivity units in effluents, boiler feeds and other industrial fluids, or for controlling oil or gas supply to furnaces, autoclaves, etc. The recorder is self-balancing, with a continuous chart 7 in. wide, and the instrument is capable of proportional, integral or derivative control, or any combination of the three systems.

Law & Company News

Commercial Intelligence

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

Mortgages & Charges

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

I. E. H. HODGSON, LTD., London, W.C., chemists. 7 October, £2,500 charge, to Reading & High Wycombe Building Society; charged on 938 Oxford Road, Reading. *Nil. 10 June, 1953.

O. M. SEMAN, LTD., Southall, chemical manufacturers, etc. 30 September, £3,000 (not ex.) charge, to Lloyds Bank, Ltd.; charged on land with factories, etc., thereon at Kingsbridge Crescent, Southall. *Nil. 21 October, 1950.

LOCKS CHEMISTS, LTD., Fordingbridge. 13 October, mortgage to Midland Bank, Ltd., securing all moneys due or to become due to the bank; charged on chemists shop, etc., at High Street, Fordingbridge, with fixtures. *—. 24 August, 1953.

Satisfactions

CHEMICAL ENGINEERING WILTONS, LTD., Horsham. Satisfactions, 21 October, of mortgage and debenture registered 6 November and mortgage registered 9 December, 1952.

Increases of Capital

The following increases of capital have been announced:—FORTH CHEMICALS, LTD., from £990,000 to £1,500,000; BRITISH CHEMOTHEUTIC PRODUCTS, LTD., from £100 to £6,000; PHOTO-CHEMICAL CO., LTD., from £200 to £1,300.

Company News

Catalin Ltd.

Mr. J. E. Currie, chairman of Catalin Ltd., states that part of the new plant has been installed and will give the industrial resin division added scope. With a view to broadening the company's base of products associated with the plastics industry, a controlling interest in Europlex Ltd. has been taken up. For the third quarter ended 30 September, net group profit, before taxation, was £8,749 and when added to the profit for the first six months of 1953 provides £11,984, as against £13,795 in the corresponding period last year.

Lightalloys Ltd.

Trading profit of £54,486 is reported by Lightalloys Ltd. for the year ended 28 June, 1953. This compares with £91,269 for the previous year. After deducting £10,782 for directors' remuneration and £12,228 for depreciation, £31,476 was left, subject to tax of £20,700. Dividend for the year is 17½ per cent, as against 20 per cent for the previous year. This decrease, says the chairman, Mr. J. C. Colquhoun, is due to lower turnover, coupled with downward trend of selling prices.

Cheshire United Salt Co. Ltd.

The directors' report of the Cheshire United Salt Co., Ltd., and its subsidiary, Palmer, Mann & Co., Ltd., for the year ended 30 June last, shows that while the consolidated net profit was £48,941, compared with £34,147 last year, the parent company's manufacturing profit was less than last year, mainly because of increased costs, which, in a definite effort to stabilise prices, have not been passed on to the consumer in their entirety. The results of the subsidiary company were most satisfactory, and after paying a higher dividend to the parent company, its carry forward of undistributed profits is increased from £8,645 to £25,457. Subject to approval at the annual meeting on 10 December, a final ordinary dividend of 6 per cent (less tax) will be paid, making 10 per cent for the year.

United Match Industries Ltd.

No deferred ordinary dividend is being paid by United Match Industries, Ltd., for the year ended 30 September last, whereas last year the dividend was 33⅓ per cent. The preferred ordinary dividend is 8 per cent, as against 9½ per cent last year. The net profit —before tax—was £10,088, compared with £12,877.

Next Week's Events

MONDAY 23 NOVEMBER

Royal Institute of Chemistry

London: Woolwich Polytechnic, S.E.18, 7.30 p.m. Dr. R. C. Tincknell: 'Synthetic Soil Conditioners.'

Leeds: The University, 6.30 p.m. Yorkshire Section annual meeting. Sir Harry Jephcott: 'Some Experiences of Food Legislation During the War.'

Stockport: Technical College, 7.15 p.m. Dr. M. O'Meara: 'The Fats Produced by Micro-organisms.'

Royal Society of Arts

London: John Adam Street, W.C.2, 6 p.m. Cantor Lecture. G. L. Bailey: 'Alloys.'

Institution of the Rubber Industry

Manchester: Engineers' Club, Albert Square, 6.15 p.m. E. G. Cockbain: 'Heat Sensitisation of Natural Rubber Latex.'

TUESDAY 24 NOVEMBER

Society of Chemical Industry

Liverpool: The University, 7 p.m. Jubilee Memorial Lecture. S. Robson: 'The Changing Pattern of Plant Design in the Basic Chemical Industries.'

Institute of Fuel

London: Institution of Mechanical Engineers, Storey's Gate, 5.30 p.m. Dr. F. M. H. Taylor: 'A National Fuel Policy.'

Burnley: Municipal College, 7 p.m. A. M. Wandless: 'Plotting the Properties of the Coal Reserves.'

Society of Public Analysts & Other Analytical Chemists

London: The Chemical Society, Burlington House, W.1, 6 p.m. Annual meeting of Physical Methods Group. Lecture by Dr. J. Haslam.

WEDNESDAY 25 NOVEMBER

Royal Institute of Chemistry

Dartford: Technical College, Lowfield Street, 7 p.m. E. J. Vaughan: 'Corrosion in Action' (films and exhibits).

Chemical Society

Glasgow: The University, 5.45 p.m. Centenary lecture by Professor A. Tiselius: 'Some Applications of the Separation of Large Molecules & Colloidal Tissues.'

Society of Chemical Industry

Newport (Mon.): Station Approach, 11.45 a.m. Bristol & South West Sections and Food Group. Leave for visit to Richard Thomas & Baldwins, Ltd., followed by meeting, Newport Technical College, 7 p.m. J. G. H. Huntley: 'Metal Containers for Food.'

Institution of Chemical Engineers

London: 2 p.m. Graduates' & Students' Section. Visit to S.E. Gas Board benzole plant.

Birmingham: The University, Edmund Street, 6.30 p.m. Graduates' & Students' Section. R. Walker: 'Fuel Economy in the Chemical Industries.'

Oil & Colour Chemists' Association

London: Manson House, 26 Portland Place, 7 p.m. C. E. Hollis and J. H. W. Turner: 'Vinyl Emulsion Polymers & Their Use in Coatings.'

THURSDAY 26 NOVEMBER

Royal Institute of Chemistry

Manchester: Gas Showrooms, Town Hall, 10 a.m.-8 p.m. Dalton Exhibition: 'Measurement, Use & Application of Radioactive Substances.'

Chemical Society

Hull: University College, 6 p.m. Professor M. J. S. Dewar: 'Aromatic Substitution.'

Nottingham: The University, 4.45 p.m. Dr. A. W. Johnson: 'Aromatic Character in Seven-membered Ring Systems.'

Sheffield: The University, 7.30 p.m. Dr. H. W. Thompson: 'Infra-red Spectroscopy & Chemical Problems.'

Society of Chemical Industry

Sunderland: Technical College, 7 p.m. R. C. Chirnside: 'Synthetic Crystals.'

Institute of Fuel

Nottingham: Gas Showrooms, 6.15 p.m. H. Bardgett: 'Some Effects of Carbonising Conditions on Coke Combustibility.'

Fertiliser Society

London: Geological Society, Burlington House, W.1, 2.30 p.m. Dr. E. G. Mulder: 'Fertiliser Investigations in the Netherlands.'

FRIDAY 27 NOVEMBER

Royal Institute of Chemistry

Cambridge: The University Chemical Laboratory, 8.30 p.m. Professor W. Baker: 'Some Aspects of the Chemistry of Phenols & Inclusion Compounds.'

[continued on page 1094

A GREAT RANGE-

Whether destined to be drifted down by helicopter or plummeted to earth in a shockproof case . . . to be carried by water or whirled away into the upper air, each seed in nature's great range is a perfect example of a container superbly suited to the needs of its contents. And though nature may have a lead on us in years of experience, we too have found successful solutions to many difficult container problems in the last 84 years. So many, in fact, that our standard range now includes almost every type of container in common use, from a half-ounce tin to a fifty-gallon drum! These may be plain, painted or lithographed to particular designs, and internal lacquers and linings are available to meet special needs.

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Manchester: Gas Showrooms, Town Hall, 10 a.m.-9 p.m. Dalton Exhibition: 'Measurement, Use & Application of Radioactive Substances.'

Manchester: Town Hall, 7 p.m. Eighth Dalton Lecture by Sir John Cockcroft: 'The Development of Radiochemistry & Radiation Chemistry.'

Chemical Society

Newcastle-on-Tyne: King's College, 5.30 p.m. Bedson Club Lecture by Dr. J. Kenyon: 'Contributions of Optical Activity to the Study of Some Chemical Reactions' (all C.S. fellows invited).

Southampton: The University, 5 p.m. Dr. E. A. Braude: 'Anionotropy.'

Swansea: University College, 5.30 p.m. Dr. J. S. Anderson: 'The Mechanism of Reactions Between Gases & Solids.'

Society of Chemical Industry

London: School of Hygiene & Tropical Medicine, Keppel Street, W.C.1, 7 p.m. Joint meeting of London Section and Fine Chemicals Group. A. L. Bacharach: 'Writing Wrongs.'

Institute of Metal Finishing

Sheffield: Grand Hotel, 6.30 p.m. Open discussion.

SATURDAY 28 NOVEMBER

Society of Public Analysts and Other Analytical Chemists

Liverpool: City Laboratories 2 p.m. Dr. R. L. M. Synge: 'Chromatography.'

Market Reports

LONDON.—A fair buying interest has been reported in the industrial chemicals market, and delivery specifications against contracts continue to cover good quantities. However, the past week has seen little change in the general conditions and prices for the most part are steady at recent levels, with perhaps a firmer tendency in the non-ferrous metal compounds. Most of the tar products are in good demand with a fair export inquiry for creosote oil and cresylic acid. Solvent naphtha, xylol, toluol and benzole are in good request, with supplies none too plentiful.

MANCHESTER.—Prices on the Manchester market for heavy chemical products during the past week have maintained a steady to firm undertone and actual changes on balance have been few. Borax and boric acid, fair buying interest in which has been displayed, are to be reduced by £1 a ton for all grades from the beginning of next month. This will be the first price change in this section of the market for nearly two and a half years. A steady demand for the alkalis and most other 'heavies' has been reported this week. The call for fertiliser materials is improving gradually, and most of the tar products are moving steadily into consumption.

GLASGOW.—The volume of business placed during this past week has been good with the off-take for the textile trade again high. Prices on the whole have been steady with some slight reductions. With regard to export, it is reported that there is little change in this market.

Linseed Oil Imports

SINCE 1 July, 1953, private traders have been allowed to import one ton of linseed oil (or three tons of linseed) for every two tons of linseed oil bought from the Ministry of Food.

The Board of Trade now announce the following changes:

(*a*) From 15 November, 1953, imports will be permitted at the ratio of one ton of linseed oil (or three tons of linseed) for every one ton of linseed oil bought from the Ministry of Food. This revised ratio will apply to future purchases up to 28 February, 1954, and retrospectively to purchases since 7 September, 1952.

(*b*) From 1 March, 1954, imports of linseed and linseed oil will no longer be related to purchases from the Ministry of Food and will be permitted under Open Individual Licence from any source.

Details of how to apply for licences are given in Notice to Importers No. 591, issued by the Import Licensing Branch of the Board of Trade.

Confidence in Nuclear Energy

When he opened new physics laboratories at the University of North Staffordshire, Keele, recently, Sir John Cockcroft, Director of the Atomic Energy Research Establishment at Harwell, said he was 'fairly confident' that nuclear energy would replace coal as the main source of Britain's industrial power.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 *inclusive, or a woman aged* 18-59 *inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order,* 1952.

CHEMICAL ENGINEER, University Graduate with some industrial experience, required for interesting research work on electrolytic applications, particularly the Mercury Cathode Chlorine Cell. Salary in accordance with qualifications and experience. Locality, Chester.

CHEMIST, Higher National Certificate standard, preferably with some industrial experience, required for general analytical work. Salary in accordance with qualifications and experience. Locality, Chester.

To **BOX No. C.A. 3279, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

CHEMICAL ENGINEER, preferably with some industrial experience, required for interesting development work in inorganic chemical factory. Starting salary in the range of £550 to £750 per annum. Reply in confidence, to **BOX No. C.A. 3275, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

FIRST-CLASS CHEMIST required by progressive Public Company in the North-West for research and development on synthetic resins and allied materials. Good Degree and previous experience desirable. Salary range, £1,000-£1,300 per annum. A Staff Superannuation Scheme is in operation. Applicants are requested to give details of their age, qualifications and previous experience **BOX No. C.A. 3277, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

JUNIOR PETROLEUM ENGINEER required by **KUWAIT OIL COMPANY** for service in Kuwait. Applicants must possess a Degree in Petroleum, Chemical or Mechnical Engineering, Petroleum Technology, Geology, Physics, Chemistry or Mathematics. Some previous oilfield experience an advantage. Age 23-30. Salary starting £790 per annum clear, plus generous allowances, Pension Scheme and kit allowance. Write for application form, giving brief details, before November 26th, quoting K.1764, to **BOX C/58, c/o 191, GRESHAM HOUSE, E.C.2.**

WANTED, TWO Graduate **CHEMICAL/MECHANICAL ENGINEERS** for Chemical and Mining Plant Division. Some sales experience would be an advantage. Age about 25-30. Salary according to qualifications and experience. **VICKERYS, LIMITED, 4, LAMBETH PALACE ROAD, LONDON, S.E.1** (Wat. 7041).

FOR SALE

CHANGE-PAN or **PONY MIXER,** 25 gallons, detachable pan revolves in opposite direction to agitators. Extra pans available. Self motorised. A.C. **WINKWORTH MACHINERY, LTD., 65, HIGH STREET, STAINES.** Tel.: 1010.

FOR SALE, approximately 8 tons **DDT POWDER.** Price 2s. 2d. per lb., ex-works. Apply **BOX No. C.A. 3276, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

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C.I. FILTER PRESS, 25½ in. square, by **MANLOVE ALLIOTT,** plate and frame type, 13 chambers, arranged for washing. Excellent condition.

TWO HYDRO EXTRACTORS, 72 in., by **BROADBENT.** (One new and unused.)

TWO "HORMANN" 30 cm. Stainless Steel **FILTER PRESSES.**

STORAGE BINS in stainless steel, cylindrical, with covers. 40/12/14/10 gallons capacity.

CANNON STEAM-JACKETED ENAMEL-LINED PANS, 10 and 25 gallons. All new and unused.

DOULTON 25-gallon **COPPERS** with lids. **NEW** and unused.

WELDED VESSELS of all types, in mild steel or stainless Fabricated to customer's specifications.

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HORIZONTAL CYLINDRICAL STORAGE TANK, 1,750 gallons capacity, 6 ft. diam. by 10 ft. long, welded construction.

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"MORWARD" "U"-shaped Trough POWDER MIXERS, any size up to 3 tons.

MIXERS—Horizontal or Vertical, jacketed or unjacketed. Several in stock.

JACKETED PANS in stainless steel or mild steel, with or without mixing gear.

TROUGH MIXER by **CHALMERS,** 3 cwt., stainless steel lined tilting trough.

TROUGH MIXERS by **GARDNER,** 3 cwt., stainless steel lined troughs.

ONE 500g. **JACKETED AUTOCLAVE** with detachable cover, 150 lb. in jacket.

500g., 300g. and 200g. **AUTOCLAVES** in mild steel riveted construction, with detachable covers.

HYDRO EXTRACTORS

Large selection in stock, 72 in. to 36 in., by **BROADBENT,** and 42 in. by **WATSON LAIDLAW,** all electric, underdriven, thoroughly reconditioned, complete with starters and guranteed.

PUMPS: A range of new **MONO** Pumps and several other 2 in. to 6 in. in stock. New and second-hand.

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MORTON, SON & WARD, LIMITED,
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FOR SALE
— 3 —
ALL WELDED CIRCULAR TANKS,
EACH 12 ft. diam. by 12 ft. deep by ⅜ in. plate.
CLOSED TOP.
CAPACITY, 8,250 gallons each.
MADEN & McKEE, LTD.,
317, PRESCOT ROAD,
LIVERPOOL, 13.

FOR SALE

600

PROCESS PLANT

PASCALL **PIN DISC MILL,** Type No. 1, motorised 400/3/50. Conical feed hopper approx. 24 in. diam. Permanent magnet of chute type. Discharge chamber enamel lined, with bagging outlet 5¾ in. diam.

No. 3 **KEK MILL,** comprising M.S. galvanised bin 48 in. diam. by 29 in. deep, tapering to two 8 in. diam. outlets. Grinding chamber 18 in. diam. Underdriven through enclosed gearing with bare shaft extension. Suitable for grinding fibrous materials.

Unused Vertical **MIXER** by Brierley, Collier, with stainless steel lined pan 18 in. diam. by 10 in. deep, jacketed 15 lb. w.p., with spiral-type agitator. Fast and loose pulley drive.

500 gal. **C.I. MIXING VESSELS,** 5 ft. diam. by 5 ft. deep. Anchor-type agitator, driven through bevel gears, and fast and loose pulleys.

Two **VERTICAL MIXERS,** 3 ft. 6 in. diam. by 2 ft. 6 in. deep, of ⅜ in. mild steel plate. Twin underdriven scraper agitators. Hinged cover with 12 in. diam. feed. Bottom side 5 in. diam. outlet. Motorised 400/3/50.

Three Peerless **MIXERS,** 80-qt. capacity, fitted integral motor, 400/3/50, with various whisks and beaters.

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50 Tons—2 in. by 2 in. Angles—12 ft.
10 Tons—¾ in. Reinforced Rods—15-20 ft.
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100 Tons—Alloy Round Bars, 2¾ in. to 5 in. diam. by 20 ft. (Nickel 0.2 per cent to 1 per cent).

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CHARCOAL, ANIMAL AND VEGETABLE horticultural, burning, filtering, disinfecting, medicinal, insulating ; also lumps ground and granulated; established 1830 ; contractors to H.M. Government.—**THOS. HILL-JONES, LTD., "INVICTA" WORKS, BOW COMMON LANE, LONDON, E. TELEGRAMS : "HILL-JONES, BOCHURCH LONDON." TELEPHONE 3285 EAST.**

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ONE—500 gallon Enamel Lined **STORAGE TANK,** ex-milk storage. Cork-insulated motor-driven agitator fitted. Mounted on adjustable legs.
One—800 gallon **DITTO.**
Full details of these and other Tanks on application to :—
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ONE **TORRANCE MICRO TWIN-ROLLER MILL.** Cast rolls, 14 in. by 8 in. Water cooled. Fast and loose pulley-drive.
TWO **DE LAVAL SEPARATORS, VEE-BELT DRIVE.** Good condition.
THOMPSON & SON (MILLWALL), LIMITED,
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FOR SALE

8 brand new jacketed **STERILIZING VESSELS,** 7 ft. long by 3 ft. diam., complete with fittings.
3 excellent **VACUUM OVENS,** complete with vacuum pumps, trays and belongings.
2—18 in. **KEK PLATE MILLS,** complete with feeders delivery bins, motors and entablature.
9 Worssam **ROTARY PRESSES.**
POWDER DRESSING or **SIFTING MACHINES,** various sizes.
1 Johnson **FILTER PRESS,** 36 in. square, plate and frame type, double inlet and enclosed delivery ports.
1 Johnson **FILTER PRESS,** 47 plates, 32 in. square, centre feed, bottom corner open delivery.
Wood **FILTER PRESS,** fitted 69 ribbed plates, 2 ft. 8 in. square, with top centre feed and bottom enclosed delivery channel.
24 in., 30 in. and 36 in. **HYDRO EXTRACTORS,** self-balancing, swan-neck type, self-emptying bottom, belt and motor driven.
Heavy cake **CRUSHING MILL,** 2-pair high, by Nicholson, for cake up to 3 in. thick, rolls 30 in. long, top with coarse teeth 9 in. diam. bottom with finer teeth 12 in. diam.
5 sets of A.A. **CRUSHING ROLLS** for linseed, cottonseed, etc., 48 in. long, belt driven, with feed hopper, side frames, baseplate and striking gear.
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1 No. 1A water-cooled **CIRCULATOR MILL.**
6—Excellent Nickel-lined Jacketed **TILTING PANS,** 60 gallons capacity and for 40 lb. working pressure.
1—**MICRO-PULVERISER,** size 2, complete with motors and all belongings.
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5—Excellent Porcelain **DISC MILLS.**
1—Aluminium **STILL,** steam jacketed, dished top and bottom ; approximately 4 ft. 8 in. diameter by 6 ft. deep.

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WORKING NOTICES

THE Proprietor of British Patent No. 579330, entitled **"PROCESS FOR CRYSTALLISING SALTS,"** offers same for licence or otherwise to ensure practical working in Great Britain. Inquiries to **SINGER, STERN & CARLBERG, 14E. JACKSON BOULEVARD, CHICAGO 4, ILLINOIS, U.S.A.**

THE Proprietors of British Patent No. 642906 relating to **"MANUFACTURE OF MOULDED ARTICLES FROM MATERIALS CONTAINING COLD-SWELLING STARCH,"** are desirous of entering into negotiations with firms in this country for the purpose of exploiting the above invention either by sale of the patent rights or by granting of licences to manufacture on a royalty basis. Inquiries should be addressed to **ABEL & IMRAY, QUALITY HOUSE, QUALITY COURT, CHANCERY LANE, LONDON, W.C.2.**

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