The Chemical Age

VOL LXVIII 31 JANUARY 1953 No 1751

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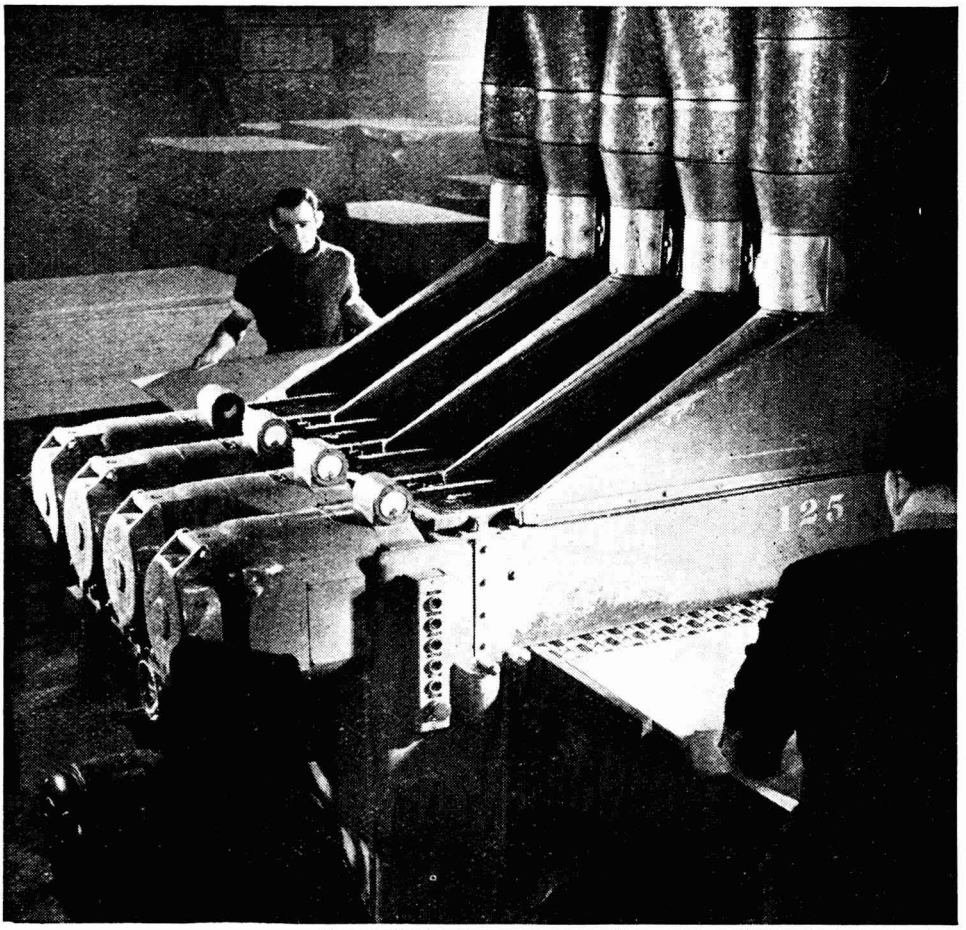

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ANTI-CORROSION No. 5

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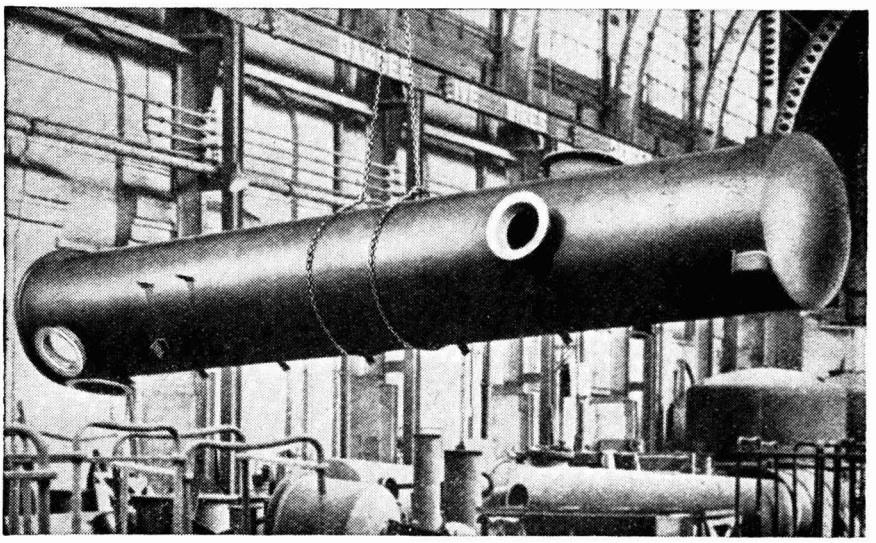

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The
Chemical Age

Established 1919

The Weekly Journal of Chemical Engineering and Industrial Chemistry

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Telegrams: ALLANGAS FLEET LONDON · Telephone: CENTRAL 3212 (26 lines)

Volume LXVIII **31 January 1953** **Number 1751**

Chemicals in Food

WHEN questions of toxicity are raised, it is appropriate that they should be referred to pharmacologists. For that reason an article in the current issue of *Endeavour* (1953, **12**, 45, 43) by Professor A. C. Frazer, who occupies the Chair of Pharmacology at Birmingham University, deserves the widest attention. Far too much of the suspicion that is directed towards food chemicals is wildly unwarranted, based mainly upon prejudice. A substance is a chemical—*ipso facto* it will be harmful. Food treated with chemicals is no longer natural—*ipso facto* it will be less nutritious.

As Professor Frazer points out, there is no distinction so far as toxicity is concerned between the synthetic and natural substances. Synthesis itself does not breed toxicity; and many natural substances are highly potent poisons. Some foods themselves are not harmless, and some people are alarmingly allergic to foods that others particularly enjoy. If this is not enough to justify open-mindedness on the subject of food chemicals, let it be realised that 'the general level of health of the people of Britain has improved over the same period as that in which food additives have been so extensively used.' Nevertheless the tendency to make use of chemical additives is expanding, and no sensible person would agree that open-mindedness should be pursued to the extent that the public is a laboratory animal *en masse* and that toxic risks, where they exist, must be found out from experience. Proposed food additives should be tested by pharmacological methods and, if satisfactory, their employment should be approved by those responsible for public health.

The pharmacologist, when called upon to act as an umpire, must insist upon a specified standard of purity. Clearly, when tested approval has been given to a particular substance new and unassessed risks may be involved if products of lower purity standards are subsequently incorporated with foodstuffs. An official list not unlike the 'British Pharmacopoeia' may be necessary. A second point that is emphasised in the pharmacological approach is the matter of dosage. Professor Frazer points out that for most common drugs the general dose-ratio for ineffective, effective, toxic, and lethal responses in man is

1:10:100:1000. Dosage, too, is directly related to body-weight, so that one-tenth of the amount of a drug that produces an effect in an adult will produce the same effect in an infant. A food additive substance must be used at a dosage-rate that can be classified as 'ineffective,' and there must also be a margin of safety in the limits permitted. Toxicity tests are carried out with food additives and it seems already to be generally accepted that the dosage levels examined should be up to 100 times the amount likely to be consumed in food. There is, however, no clear agreement as to how the results of such tests should be interpreted. What should be the criterion? No toxic effects from the 100-fold dose? Or rejection if toxicity is suspected at all, even though none has been demonstrated at the 100-fold dosage level? Professor Frazer contends that 'if the substance causes no effects at the 10-fold dosage, and significant effects in less than 50 per cent of the experimental animals at the 100-fold dosage, the standard dietary dose should be regarded as acceptable, since it is clearly less than one-tenth of the ineffective dose and one-hundredth of the E.D.50 (the effective dose).' Further, if any significant effect is shown to occur at the 10-fold dosage, or in more than 50 per cent of the animals at the 100-fold level, then the actual effective dosage level should be determined, and from that a safe level of dietary dosage should be worked out.

The opponents of chemicals in foods will never accept such an approach, rationally based though it is upon the long and proven experience of experimental biology. If at any dosage level a substance has toxic effects, its safety at much lower levels will not be conceded. It seems more important to secure acceptance from that larger section of the public which is unprejudiced and which is willing in technical matters to be guided by committees of disinterested experts. Professor Frazer's proposed system of standards ignores neither long-term effects nor the hazards of cumulative effects. The former are covered by carrying animal-toxicity tests through several generations; the latter by observing whether indications of cumulative effects are given, in which case the amount of the substance eliminated per day is measured and new non-cumulative safety levels of dosage can be calculated.

At a time when the whole problem of chemicals in food has become dangerously confused this precise and independent approach is surely of the greatest value. When there is apprehension about the toxicity of food chemicals, the branch of science that has long estimated toxic effects should provide both the rules and the referee.

On Other Pages

The annual subscription to THE CHEMICAL AGE is 42s. Single copies, 1s.; post paid, 1s. 3d. SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3954/5). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784/5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited.

Notes & Comments

Fertiliser Analysis

THE Organisation for European Economic Co-operation will leave one mark upon the sands of time even if its aims are finally unrealised. Its documentary publications are first-class. The latest,* a survey of methods used for fertiliser analysis in OEEC countries, brings together information that can hardly have been collected between single covers before. The official methods used in 14 countries are given in fully adequate detail. The underlying OEEC objective is to develop greater uniformity so as to facilitate international trade in fertilisers; certainly, it is not helpful when on either side of a boundary line different systems of measuring plant-food values are used. Nevertheless, it is easy to over-simplify this issue. There is a great deal of room for optional methods and empirical decisions in laying down methods of fertiliser analysis, and variation should not be readily condemned. As in soils, so in fertiliser materials, it is the amount of available nutrient that matters, not the total amount of nutrient present. In the laboratory that distinction must be drawn by a solvent that imitates the soil's extractive powers. Yet soils themselves vary in those powers. It is possible for a country with one climate to find that an arbitrary solvent X gives more faithful results than solvent Y; while in another country with a different climate Y is better than X. Against this agronomic argument it can be said that the main purpose of fertiliser analysis is commercial, to set standards for statement and to prevent fraud, genuine or unintentional. But even then, the component that is measured has to be isolated from the material by using some arbitrarily chosen solvent and by employing that solvent under fixed conditions of time and agitation. Uniformity may be useful for Europe and international trade in fertilisers; but within individual countries, uniform methods could reduce agreement between soil and laboratory results. The differences introduced if some uniform system was established would certainly be small; but so, now, are the differences between the results from the multiplicity of methods officially used. None of this detracts from the value of the document itself, which presents facts rather than argument. It should be added to the reference library of all agricultural analysts; and at present it is particularly valuable here with our own very elderly official methods soon due for revision. Not many of the 14 countries presented methods of such distant coinage as those of Britain.

* *'Fertilisers—Methods of Analysis Used in OEEC Countries,' HMSO. pp. 184. 4s. 6d.*

The Coal Problem

THE chemical industry is still predominantly dependent upon coal. Not all our technological advances have altered that basic and age-old fact. It is disquietening, therefore, to witness a steady accumulation of evidence that our future prospects for coal production —or coal productivity—are worsening rather than improving. Next winter could easily see another fuel crisis. With most of the other important raw materials of industry in potentially better supply, new trouble with coal and coke could be much more disastrous than our previous post-war fuel crises. Then we still traded in a world market that was a seller's market. Now we trade in a buyer's market. Assessed in terms of output per man, productivity in the coal industry is dropping by about 1 per cent. This may well be a measure of one of the industry's most serious problems, the high age-group balance in mining. The worst feature, however, is the definite drop of productivity at the coal-face. This is a real measure of decline, and not a measure that is partially

distorted by the number of men in training or in work that is not directly productive.

Will Exceed Exports

NO reasonable person can criticise the granting of a second week's annual holiday for coal-miners; but this reform, proper enough and far from premature, will henceforward cost up to 4,000,000 tons of coal a year. More serious loss of output hangs in the balance of wages argument, for if Saturday work ceased this would cost 10,000,000 tons; and it is clearly the mood of the miners to link their acceptance of a six-day week with satisfaction in pay negotiations. These two losses—one real and the other always a possibility—add up to a greater sum than our total export tonnage of coal and to a sum that is also greater than the increase in total output achieved in 1949-1952. Nothing is more vitally needed in our nationalised coal fields than a sound and homogeneous wages policy. Its present heterogeneous character is the heritage of an industry with few memories of good health, and every note of discord today carries with it a malignant overtone from the embittered past. A new system for wage assessment that removes acute geographical anomalies is the essential foundation for better human relations in coal-mining. Nevertheless, the problem of our fuel supplies is not wholly a problem of production. We are not making nearly enough national progress towards better utilisation. The pace at which technical methods for economy are introduced is still too sluggish.

IN THE EDITOR'S POST

Chlorophyll De-bunked

SIR,—We have noticed on page 123 of your 17 January issue an article under the heading 'Chlorophyll De-bunked' which refers to a speech made by a Dr. Corwin, who is a member of the Department of Chemistry, Johns Hopkins University, Baltimore, Maryland, and we presume that the material on which you have based your article was not from a verbatim report of his speech. It appears that Dr. Corwin was very considerably mis-reported in certain sections of the American Press, as a result of which the Public Relations Department of Johns Hopkins University issued the following correction by Dr. Corwin, which was dated 17 December:—

'As a result of a technical report presented by me before the New York Section of the American Chemical Society, on 5 December, 1952, on the subject of chlorophyll, certain misconceptions have arisen which I wish to correct.

'I did not state that chlorophyll is toxic. Such a statement would be at variance with the experience of the human race over thousands of years. Neither did I state that the commercial products containing copper or other metal derivatives of chlorophyll now on the market are toxic.

'I know of no experimental evidence which would provide a basis for a statement that these chlorophyll derivatives are unsafe.

'While acknowledging the existence of numerous published scientific reports on the effectiveness of chlorophyll for healing and deodorising, the point I made was that, in my opinion, many phases of the use of chlorophyll need further statistically controlled investigation.'

Yours faithfully,

C. R. G. YOUNG.

Managing Director,
Ashe Laboratories, Ltd.

Editor's note:—It was not suggested in THE CHEMICAL AGE *that Dr. Corwin had said that chlorophyll was toxic or chlorophyll derivatives harmful. All that was said was that he had 'made a forthright attack upon the odour-suppressing claims of chlorophyll preparations.' The statement issued by the Public Relations Department at Johns Hopkins did not deny that Dr. Corwin had attacked manufacturers' claims. It made it quite clear that he doubted their reliability. Like Dr. Corwin and many others on both sides of the Atlantic we would like to see a thorough study made of many of the claims now being made for chlorophyll. If it does the things that are claimed for it, where is the scientific evidence?*

Chemical Industry in the U.S.A.

Accomplishments & Prospects Surveyed

ABUNDANT output at generally lower prices continued as the keynote in American chemical manufacturing during 1952. As a variety of new developments were added to existing product lines for industrial and home use, chemical prices fell back an average of 3½ per cent from the previous year.

At the same time, production reached a new level. The Federal Reserve Board's index put industrial chemical production at a record 574 in October (1935-39: 100), well ahead of last year's October index of 556 and the World War II peak of 412. This was stated by Charles S. Munson, president of the Manufacturing Chemists' Association, Inc., and chairman of the board of Air Reduction Company, Inc., in a wide survey of the achievements and future outlook for the U.S. chemical industry, issued at the end of last year.

Physical growth went hand-in-hand with rising output as the industry passed the mid-point in its current $6,000,000,000 expansion programme. Spending reached a peak of $1,500,000,000 for the year, with South and West profiting most from the new construction. Texas, Louisiana, Oklahoma and Arkansas together were on the way to getting more than $706,000,000 worth of chemical plants, counting only those that were covered by rapid amortisation certificates.

Raw Materials Factor

The South-west's supply of raw materials, especially petroleum and natural gas was an important factor in this geographical trend away from the middle-Atlantic states, traditional leaders in chemical production. The area also had access to low-cost water transportation to Eastern markets.

Thanks to growth and rising production, the industry had overcome nearly every serious shortage in chemicals. Supplies of sulphur and chlorine were back to par, and there had been marked improvement in ammonia and benzene—though the long coke-oven shutdowns of the steel strike still affected benzene consumers.

Chemical companies actually wrung some good from the shortages, inconvenient as they were. The tight sulphur situation, for example, stepped up the search for new sources and better processing and conservation methods. As a result, substantial amounts of sulphur were now being recovered from natural gas and refinery gas containing hydrogen sulphide, and more might be obtained from smelter gases.

Plentiful Output

Of more direct interest to the buying public was the plentiful output during the year of such consumer lines as drugs and synthetic textiles. In these fields, supply caught up with and, in some cases, surpassed demand. Sales efforts accordingly were intensified.

One important evidence of the more balanced supply-demand picture was the decreasing emphasis on controls, with attention turning to rapid completion of expansion goals for the nation's mobilisation programme. In this mobilisation, the basic importance of chemicals to defence and to all manufacturing was increasingly recognised.

Of some 200 expansion goals set up by the Defence Production Administration for defence-essential materials, 56 were for chemicals. In addition, rapid amortisation certificates issued to the chemical industry for new plant and equipment represented a solid 10 per cent of the total for all industry.

As chemical consumers (ranging from heavy industry to light housekeepers) enjoyed the benefits of rapid growth and greater output at lower prices, men and women in chemical plants for their part received a record high in wages.

Average hourly earnings were up 75 per cent since 1945, as the Bureau of Labour Statistics reckons it, and average weekly earnings for September, 1952, in chemical and allied products stood at $71.38 as against $68.43 for the same month of the previous year. With this rise, the industry's wage levels continued their traditional position above the average for all manufacturing.

Rising wages were, however, one of many factors which added to the financial problems of the industry. The year was marked by generally increasing sales and declining profits, at a time when needed expansion called for more capital to plough back and

not less of it. A major problem was the excess profits tax, with its 82 per cent take of the very earnings which must help pay for growth.

A recent report showed for example that 33 chemical companies had a 10 per cent decline in net income for the first nine months of 1952 compared with the same period the year before. Their 1951 net, in turn, was 14 per cent below that for 1950. It was difficult to see anything but serious consequences in a continuation of this downhill course (said Mr. Munson), with its telling effect on capitalisation of new products and on the confidence of outside investors.

Building Cost Effects

Increasing building costs so familiar to all manufacturers continued to make present depreciation allowances absurdly small. Making up the difference between what was allowed and what was needed constituted another drain on the earnings that remained available for new construction, after the EPT had taken its toll. The chemical industry had a singularly thorny depreciation problem because its fast pace in research and development meant equally speedy obsolescence of plant and equipment.

In spite of these handicaps, growth was not allowed to suffer, nor was progress in the industry's community responsibilities. New devices and techniques for the abatement of air and water pollution appeared continuously, as the Manufacturing Chemists' Association and individual companies stepped up their efforts in these fields.

Plant safety efforts in the industry improved on an already good record by reducing the frequency rate of injuries 11 per cent during the first eight months of 1952 compared with the same months of 1951. An even sharper cut was made in severity rates, which fell by 14 per cent.

To encourage still further effort in this direction the Manufacturing Chemists' Association had planned an intensified safety programme, involving enlargement and reorganisation of its safety and medical committees; broader collection and dissemination of statistics and general information on safety, and direct steps to improve fire prevention and fire fighting.

Over the past year, the industry had also worked successfully for greater public understanding of the industry as a whole. The growing appreciation of the rôle of chemicals in defence and civilian industries was one significant reward in this effort, while the sounder approach to pollution abatement problems was another. There was evidence, too, of increasing public realisation of industry's need for a better corporate tax policy.

As one phase of its public information programme, the industry, through MCA, was making positive moves toward building up the nation's reservoir of trained scientific manpower—a critical need not only for the industry itself but for national growth and security over the long term.

Noting the decline in chemical and chemical engineering graduates predicted through 1955, the MCA had called on all its member companies to work with science teachers and guidance counsellors in plant community schools with the aim of giving students a better understanding of career opportunities in chemistry.

This programme for the long-range recruitment of qualified scientific talent was a significant symbol of the industry's confidence in the future. However, somewhat less might be spent for new construction in 1953 than in 1952, and production might not mount as it had in the past because some of the supply lines to consumers were fairly well filled at the present.

But the chemical industry had before it a prospect of jobs that were only just beginning to be done. This was the industry that must help the more efficient use of natural resources, taking advantage of those that had seemed unfeasible for use in the past. This was the industry that must process wastes to increase wealth, that must lengthen the life of materials now used with coatings and preservatives, that must nurse more food from limited fertile land, that must help solve the mysteries of disease, and that must comb the sea and the earth and the soil for new resources which were as yet unknown.

Top Research Sponsor

As the top sponsor of research and development in the manufacturing field, the American chemical industry looked to a continuation in 1953 of its traditonal flow of new products, new processes, and new knowledge of how to put the elements together in serviceable combinations.

The only logical course was expansion, and the nation could look forward to a continuing of that course in 1953.

Triple Superphosphate Production

'Solid' & 'Liquid' Processes Compared

A NOTICEABLE re-awakening of interest in triple superphosphate was referred to by J. J. Porter and J. Frisken, B.Sc., M.I.Chem.E., of Fisons, Ltd., in a paper read before a meeting of the Fertiliser Society held in London on 22 January.

Under the title 'The Manufacture of Triple Superphosphate' the authors gave a comprehensive survey of various aspects of the subject, from which the following report has been abstracted:—

Triple superphosphate, also known at various times as double, treble or concentrated superphosphate, is the product obtained by the treatment of phosphate rock with phosphoric acid. Depending on the grade of rock used and other circumstances the product usually contains from 40 per cent to 49 per cent water-soluble P_2O_5. In appearance it is of a greyish-white colour and resembles ordinary (single) superphosphate. The main source of soluble phosphate in these two products is the same, that is monocalcium phosphate, and they differ principally through the presence in single superphosphate of calcium sulphate.

Production of triple superphosphate first began in Germany in 1872 with the object of utilising the Lahn phosphate deposits which were owned by two large chemical companies.

First British Plant

Within a few years of these two German plants starting operations, probably about the year 1875, Edward Packard & Company built at Bramford, Suffolk, a plant which was exactly modelled on that at Wetzlar. This was almost certainly the first plant to make triple superphosphate in Great Britain, and it continued to do so until about 1923. Curiously enough the main application for the product was not as a fertiliser but as a clarifying agent in sugar purification and for this purpose it was regularly shipped in kegs to the West Indies, South Africa, India, and other sugar-producing areas.

In the early days the main problem both in Europe and in the U.S.A. seems to have been the difficulty of establishing manufacture on an economic basis.

During the period 1926-1930 considerable development was taking place in the field of phosphoric acid manufacture. Although the process had become capable of continuous operation by the introduction of the Dorr system of continuous countercurrent decantation working along with drum filters, and many plants of this type were in fact built, there was still the serious limitation that the maximum strength of acid obtainable by this method was 20 to 22 per cent P_2O_5, and plant costs were still considerable.

Nordengren's Contribution

Efforts to improve both the process and the plant were being actively pursued by two groups. These were of a Swedish group, the AB Kemiska Patenter, headed by Mr. Sven Nordengren and co-operating with the German Lurgi interests; and a Swiss company Kunstdunger Patent Verwertungs AG (known as KPV), which was a combination of the Dorr interests and Mr. Frans Lijenroth.

Nordengren and his associates at Landskrona studied processes involving the production of anhydrite (an autoclavic process) and of hemihydrate instead of gypsum. These led directly to the development of a special belt filter known as the Landskrona or Lurgi filter, which represented a great advance and was eventually adopted in many plants both in Europe and America.

The KPV group on the other hand eventually evolved the Dorrco Strong Acid Process, which by employing recirculation of the reaction products enabled acid of 32 per cent P_2O_5 to be produced together with gypsum of rapid-filtering characteristics. This process was first adopted by the Consolidated Mining & Smelting Co. at Trail, British Columbia, which went into operation in 1931. This plant was also notable for the first introduction of the Dorrco process for the direct production of granular triple superphosphate.

These two Dorrco processes were subsequently used in an American plant, the Southern Acid & Sulphur Co. (now Mathieson Chemical Co.) of Houston, Texas, which came into operation in 1945; and they were again selected by Fisons, Ltd., for its new factory at Immingham, Lincolnshire, which

first produced triple superphosphate in 1951.

Reaction between phosphoric acid and phosphate rock is by no means simple. The chemical constitution of phosphate rock is itself complex, and varies according to the source of the material. It is now generally considered that the principal constituents are the series of compounds known as apatites, which have the empirical composition $Ca_5(PO_4)_3X$, where X may be OH, $\frac{1}{2}CO_3$ Cl or F. In many rocks the fluorine content exceeds that required for fluorapatite $Ca_5(PO_4)_3F$, and it is presumed that most of the excess is present as calcium fluoride CaF_2 and that this is occluded in the apatite crystal lattice.

Various Impurities

In addition nearly all phosphate rock contains as impurities varying amounts of organic matter, silica, iron and aluminium oxides, calcium carbonate, and so on; the latter impurities also react with phosphoric acid causing a number of side reactions. Wet-process phosphoric acid itself contains impurities which still further complicate the chemistry of the reaction. Ignore for the time being, however, these side reactions and consider only the action of pure H_3PO_4 on $Ca_5(PO_4)_3F$.

A wide variety of products is possible from this reaction according to the temperature and concentration of acid used. The following products have all been reported:

$Ca(H_2PO_4)_2$ monocalcium phosphate
$Ca(H_2PO_4)_2H_2O$ monocalcium phosphate monohydrate
$CaHPO_4$ dicalcium phosphate
$CaHPO_4\ 2H_2O$ dicalcium phosphate dihydrate
$Ca_3(PO_4)_2$ tricalcium phosphate
$Ca_3(PO_4)_2H_2O$ tricalcium phosphate monohydrate
$Ca_4P_2O_9$ tetracalcium phosphate
$Ca_4P_2O_9 4H_2O$ tetracalcium phosphate tetrahydrate
$Ca_{10}P_6O_{25}$ decalcium phosphate (oxyapatite)
$Ca_{10}P_6O_{25}H_2O$ decalcium phosphate monohydrate (hydroxyapatite)
$Ca_2P_2O_7$ calcium pyrophosphate
$Co(PO_3)_2$ calcium metaphosphate

There is also the possibility of formation of calcium fluophosphates.

Precise conditions governing the formation of these various salts are difficult of experimental determination even in pure $CaO\text{-}P_2O_5\text{-}H_2O$ systems because of the insolubility of the salts and in the extremely long time necessary for attainment of equilibrium, particularly in the lower temperature ranges.

Under the practical conditions which obtain in the manufacture of triple superphosphate the principal constituent of the product is monocalcium phosphate. Since in Britain water-solubility is the present basis of sale of triple superphosphate as of single superphosphate, and since monocalcium phosphate is the only one of the above compounds which is appreciably water soluble, it is clear that the present objective of the British manufacturer must be to achieve the maximum proportion of monocalcium phosphate in his product consistent with economic factors.

This objective does not apply with the same force to his counterparts in U.S.A. or other countries which trade on a citrate soluble basis. The main alternative salt which is liable to formation is dicalcium phosphate, which is insoluble in water but citrate soluble, thus ranking as 'available.'

General conclusions from the phase rule studies illustrated by the authors are that the higher the concentration of acid and the lower the temperature of reaction the more probable it is that monocalcium phosphate will be formed. For several reasons, however, it cannot be expected to obtain quantitatively accurate results in this way from present knowledge.

Firstly, there is the question of impurities in both rock and acid, which are bound to affect the equilibria, although to an unknown extent. Then there is the time factor. The phase diagrams represent equilibrium conditions, but it is known that some of the reactions are very slow and that equilibrium may not, in fact be reached. This may well be the main reason why the actual proportion of dicalcium to monocalcium phosphate in the product is generally considerably less than the phase diagrams would indicate.

'Solid' or 'Liquid'

Actual methods of manufacture may be broadly classified as 'solid' and 'liquid' processes.

In the solid processes the concentration and temperature of acid are so chosen that setting occurs very rapidly. Typical methods in this category have been developed by the Etablissement Kuhlmann in

France, and the Tenessee Valley Authority (T.V.A.), in the U.S.A. In both cases the acid and rock are subjected to a very short period of intense mixing, after which the slurry is discharged on to a conveyor belt where setting takes place. The speed of reaction is such that by the time the material is discharged from the conveyor belt it is in a sufficiently solid state to be broken by a disintegrator and be placed on the curing pile.

Most novel feature of the Kuhlmann triple phosphate process lies in the mixer, which is quite a small cylindrical vessel equipped with a high-speed stirrer. The function of the latter is not only to mix the the reacting materials intimately but also to entrain air and so 'emulsify' the mix, and finally, to project the slurry through an outlet slit at the bottom of the mixer. From there it falls as a thin layer on to a conveyor belt on which setting occurs.

The T.V.A. process is broadly very similar to the Kuhlmann. Having thermal process acid available however a higher concentration can be employed than might be economically justified if wet process acid had to be concentrated, and the normal range of strength is 54 to 58 per cent P_2O_5. The acid is also preheated to a temperature of 55 to 65°C. Both these factors, that is higher strength and higher temperature, have the effect of shortening the fluid time and introducing rapid setting.

Another point of difference between the two plants lies in the type of mixer employed. After a period of experimenting T.V.A. developed their own mixer. It takes the form of a small conical-shaped bowl into which the acid enters through four nozzles which direct it tangentially round the walls, so creating a vortex. The rock is introduced through a central vertical spout extending just below the acid nozzles, and the natural turbulence is said to provide thorough mixing during the few seconds the materials take to pass through, without the use of any power-driven device.

No Drying Necessary

Mixed slurry then falls on to a belt conveyor which is stated to provide a retention of 45 seconds. Setting is said to occur in about 20 seconds. In this process no drying is necessary, and the disintegrated material passes direct from the reaction belt to storage, where however a relatively long period of curing is necessary, the preferred time being 16 weeks.

Apart from these two processes which are perhaps the most eminently suitable of their type, it is possible to make triple superphosphate in conventional Den equipment such as is used for making single superphosphate.

The Dorrco Method

The only liquid process in operation known to Messrs. Porter and Frisken is the Dorrco method employed by Fisons, Ltd., at Immingham.

One of the most valuable features of this process is that it produced in one operation an excellent granular product which substantially requires no further curing. Acid of 38 per cent P_2O_5 is mixed with rock at a temperature of the order of 90°C. and a supply of fluid slurry is thus obtained. This is used to add successive layers to recycled undersize granules which circulate through the drier and screening system until they are built up to the required size. Oversize material is disintegrated and added to the undersize. The proportion of recirculated material may be 15 to 20 times that of the product, although at Immingham it is possible to keep rather below this. The granule so produced is almost perfectly spherical and much harder than that produced by any other process known to the authors.

A typical analysis of the product made by this process at Immingham from Morocco rock is as follows:—

	Per cent.
Total P_2O_5	50.8
Citrate Insoluble P_2O_5	1.0
Available P_2O_5	49.8
Water soluble P_2O_5	47.5
CaO	22.5
F	1.9
Free H_2O, on ground sample dried at 100°C for 2 hours	2.4
Free acid, as P_2O_5, extracted with dioxanacetone	3.3
Free acid as P_2O_5, by water soluble extract titrated to ph 4.5	6.6
SO_3	3.2
Fe_2O_3 } Al_2O_3 }	1.5
SiO_2	0.5

The bulk density of the granules is approximately 60 lb./cu. ft.

A comparison was given in the paper of the economics of the 'liquid' process with the alternative of first using the Broadfield Den 'solid' process to produce a powder material and subsequently granulating as a separate step.

From experience Messrs. Porter and Frisken concluded that:—

(1) In the 'solid' process there is a slight but appreciable economy in phosphoric acid, no doubt arising from the lower temperature at which the reaction is conducted, and hence the lower degree of attack on the impurities in the rock.

(2) The above economy is partly offset by the necessity for using a more concentrated phosphoric acid in the 'solid' process. At Fisons it was found desirable to use acid of 46 per cent P_2O_5 as compared with 38 per cent.

(3) Comparing very broadly the overall costs of the two processes as they might be conducted at Immingham, there is no marked difference between the two. A different conclusion, however, might well be reached in different circumstances where availability of existing plant compared with the necessity for spending fresh capital might well affect the issue.

(4) Comparing the physical properties of the two granular products the 'liquid' process is markedly superior. It results in a much harder granule of more regular shape, as would be expected from its mode of formation, and accordingly is likely to prove more satisfactory to the customer.

New Systemic Insecticide

NC.7 Introduced to Hop Growers

FIRST public reference to a new systemic insecticide, NC.7, was made by Dr. W. E. Ripper, F.R.E.S., managing director of Pest Control, Ltd., Bourn, Cambridge, in a speech at a luncheon given to hop growers in Bromyard on 13 January.

Work on improving old and developing new systemic insecticides and fungicides was being continuously carried out by the company, said Dr. Ripper. One of the latest insecticides was NC.7 which was claimed to have an even more pronounced crop stimulating effect than Pestox 3.

Trials of NC.7 would be made this year in customers' fields so that they could form an opinion of its merits for themselves. If it met with the expected approval of the leading hop growers in the west, the company intended to use the new insecticide for a year or two in its contract service before releasing it on the market.

Development of Pestox for the benefit of hop growing not only as a means of killing the aphids and red spiders, but also through the stimulation of growth, was traced by Dr. Ripper. Since its introduction, four years ago, increased production had enabled the price to be reduced, while the strength of the active ingredient had been increased so that a lower concentration could be used.

Parathion, which was also made and supplied by the company, had two disadvantages. The first, a short-term one was that its effect was spent in about a fortnight which meant more frequent spraying was necessary. It was also toxic, for unlike Pestox 3 and other Schradan products which were absorbed, Parathion remained on the surface of the leaves, and, in hot weather, could be sufficiently volatised to cause illness if inhaled from four to seven days after spraying.

The long-term disadvantages were that it was not selective, and that its application also killed the beneficial insects which in this or next year would otherwise be helping to keep pests under control.

A new Agriculture (Poisonous Substances) Bill had been introduced to deal with the precautions necessary when using all poisonous insecticides. It was realised that such legislation was bound to come. Precautions for an important chemical like Pestox 3 had therefore been worked out years ago, and these would be demonstrated early in May.

With regard to systemic fungicides, concluded Dr. Ripper, although good progress was being made, he could not make any announcement at present. In the meantime details had been worked out of how to combine copper and other fungicides with Pestox 3, and he hoped that by its use there would be a good 1953 hop crop.

Aluminium Dampcourse

A new use in Australia for aluminium is its incorporation in a dampcourse for buildings. The metal strip is coated on both sides with salt water, lime and bitumen. The bonding of the bitumen is such that it will not flow in extreme heat, nor become brittle and flake off in extreme cold. The composite aluminium-bitumen strip will remain flat when rolled out on a course, and can be bent or hammered into position without damage. The material is said to resist corrosion, including attack by sulphur-bearing acids.

Rubber in Chemical Engineering

Development Leads to Unexpected Applications

IT has been remarked that rubber, in an engineering sense, is not a specific material but a large group of materials having a widely varying characteristics.

The method by which these characteristics are altered depends upon the mix, involving a wide variety of additives to the raw latex, obtained from the rubber tree or, more often, to the raw rubber prepared from the latex which consists of a serum containing fine globules of rubber. In its primary state rubber is a somewhat intractable substance sensitive to temperature changes. The effect of cold upon raw rubber is mainly a gradual hardening. A temperature of 5°C. is sufficient to cause this, at 0°C. it becomes rapid. Thawing is slow unless the temperature be raised above the critical point of 33°C. while the surface becomes sticky and flows at a temperature of about 220°C. This is chemical decomposition and recovery does not take place.

Because of the foregoing and other reasons the raw rubber is masticated between steam heated rollers and mixed with ingredients of which the most important is sulphur because this enables vulcanising to be undertaken. The manufactured product is of two main varieties. Hard rubber, such as vulcanite or ebonite, and soft rubber. It is the range of properties possessed by the last named in particular that are proving so valuable in solving many mechanical problems in chemical engineering.

Variations Remarkable

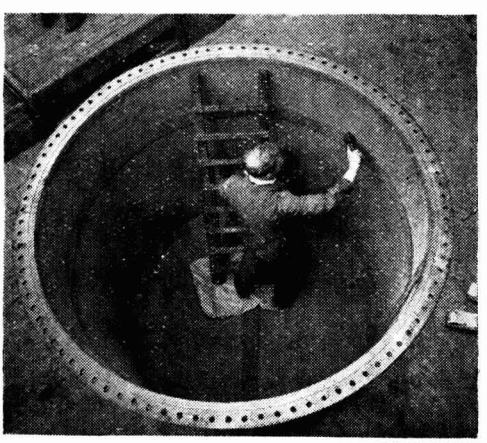
Variations in the performance of soft rubber brought about by additives are remarkable. For example, a breaking strain of 2,133-2,844 lb. per sq. in (1,500 to 2,000 grm. per sq. mm.) with an elongation of 900 per cent prior to failure, is normal with 'pure' rubber but suitable compounding can increase the tensile strength by 50 per cent. At the other end of the scale by reducing the rubber content elongation under strain is negligible and the material resembles leather for which, rubber in this form, acts as an alternative. The additives used in such cases may cost more than the rubber and must not be confused with adulterants.

Between these extremes are many hundreds of grades of soft rubber suitable for a wide variety of purposes.

Before turning to some modern applications it is important to point out that many of these have been made possible because rubber can be bonded to metal. While this is feasible with aluminium it is difficult but it bonds readily to brass and it is usual to plate ferrous metals with this alloy before bonding is attempted. This is done normally in a bath of copper and zinc cyanides at 40°C. and made alkaline by the addition of sodium carbonate to a *p*H of 10. The brass is deposited at a current density of 5 amperes per sq. ft. using brass anodes of 70 per cent copper content and 30 per cent zinc.

Good bonding is obtained only when the face centred cubic structure of brass is present. This particular formation has the peculiarity that it is possible to obtain a surface consisting of only one element in a solid solution of two elements even when that element is in such small proportion as 25 per cent atomic (that is, one atom to three atoms of the other element).

In some cases adhesives are used in place of a vulcanised bond. These may be of the rubber hydrohalide or tri-isocyanate. Considerable experimental work was carried out on the latter in Germany during the war.



Lining a tank for HCl with rubber at the works of Wilkinson Rubber Linatex Ltd.

This led to the development of 'Desmodur R' better known in this country as 'Vulcabond TX.' The compound is produced from triamino-triphenylmethane which is a dyestuff base.

Bonding Resins Used

Thermosetting resins of the phenol formaldehyde type are used for bonding vulcanised rubber to metal. A new development being investigated in this connection is stated to give good results by using a reactive product of formaldehyde with resins derived from natural rubber in the presence of a condensing agent.

There are other ways in which rubber may be bonded to metal but the particular method is usually dictated by the service required. The applications to chemical engineering are numerous, rubber being a particularly valuable medium for countering various types of depreciation which, in the form of rapid corrosion, is often pronounced in factory plant of the chemical industry. This form of attack is due to the presence of electric currents which flow from one point of the metal to another and then complete the circuit through the liquid in contact with the metal. It is because rubber forms an effective method of insulation that it is so valuable in overcoming trouble of this kind.

Success in any given instance depends upon the resistance of the rubber to the particular chemical being handled. While tables are available showing the type of rubber most resistant to particular liquids and the maximum temperatures permissible, problems may arise due to certain impurities present at specific stages of manufacture.

It frequently happens that the presence of these other agents may have a more potent influence than the main chemical. Therefore, when conditions of this kind are unavoidable and there is no available data, it is advisable to make tests by submerging strips of metal covered with various mixes of rubber in the solution to be handled and heated to operational temperature. In the subsequent examination the rubber is stripped from the metal which should be clean and uncorroded with no signs of penetration. The type of bond used is important and thermoplastic material should not be employed if fairly high temperatures are involved.

A further factor in the matter of resistance to chemical action is the type of filler used. Some of these have reinforcing properties such as gas black, while others are in the nature of adulterants of which typical examples are ground barytes or slate dust. In practice it is the effect of these additives upon the mechanical properties of the rubber which are of greater importance than their influence upon penetration in many cases.

Another aspect of selection is whether or not hard or soft rubber should be used for a specific purpose. The former has a smaller coefficient of thermal expansion than the latter and, in broad terms, it is more resistant to chemical attack. On the other hand soft rubber is far more resistant to damage from abrasion and is less liable to crack and chip, moreover soft rubber coatings can be used in temperatures up to 110-130°C. and even 150°C. for short periods whereas hard rubber tends to soften at 60-70°C.

Some idea of the life of tanks lined with rubber is afforded by the fact that a chemical manufacturer has two 10-ton wooden tanks for the storage of hydrochloric acid. In 1925 they were lined with sheet rubber $\frac{1}{4}$ in. thick and they have been in constant use ever since with only one minor repair.

Important Compound

A compound that has assumed important commercial proportions is chlorinated rubber which is available under various trade names. It is a stable product that is insoluble in water, petrol, alcohols, glycerol and mineral oils. The rubber hydrocarbon molecule contains unsaturated double bonds, thus it will take up chlorine gas in similar manner to its acceptance of sulphur during vulcanisation, indeed the chlorine content can be so much as 64-67 per cent of the weight of the rubber treated.

Among its advantages as an additive to paints and other liquids is the fact that it does not increase viscosity excessively when mixed with linseed oil and the cellusolves. A chlorinated rubber film is resistant to acids, including nitric acid of 1.4 specific gravity, hydrogen peroxide, alkalis and so on. Paints having a chlorinated rubber base are roughly 10 times more resistant to water vapour than those having an oil base. In tests recently conducted by the British

Admiralty the merit of chlorinated rubber paints was proved in no uncertain manner. Such paints are unsaponifiable, non-inflammable and remain unaffected by sunlight, they can also be applied in a moist atmosphere. In addition they retain their elasticity while giving a hard finish. Added resistance to blows and cracking is secured by adding finely divided quartz or carborundum.

Replaces Spindle Oil

Experiments have been made in the use of rubber latex as a lubricant, an emulsion in a paraffin solvent being used to replace light spindle oils. It would seem that this field of endeavour is worth more intensive investigation.

Another development that shows great promise in certain branches of chemical engineering is a rubber which conducts electricity and thus reverses the quality of insulation for which it is so useful in many other fields. This is done by using a special mix in which a particular type of finely divided carbon is used. Unlike most additives the particles do not become individually insulated but provide millions of submicroscopic electrical paths so closely spaced that there is a uniformly conductive area. The effect of passing electric current of say 220 volts through the rubber generates heat. Two wattage densities are used at present namely 17 watts and 22 watts per sq. ft.

In regard to the temperatures obtainable there is absolute safety for even if the thermostat is out of commission the standard panel cannot reach a temperature of more than 120°F. Tests made with this form of rubber have included a sustained temperature of 200°F. for 11 weeks. The result was to make the rubber somewhat brittle, but in no other respect were its qualities impaired, in particular the resistance remained constant, thus proving that there is no increase in the consumption of current after long periods of use.

These heating panels are invisible and can be made to form part of a ceiling, wall or floor, but usually the first named. Rubber heating units of this type are proving specially valuable in the presence of volatile liquids, explosives and so on when manufacture and other forms of handling are highly dangerous, if not impossible, with most other types of heating.

Turning to the purely mechanical aspects of rubber development the lining of pipes, valves and cocks with this material is generally familiar practice when dealing with corrosive liquids. In this connection important progress has been made in the covering of centrifugal pump rotors. In certain instances the duty is such that rubber without a metal centre has been used successfully. The inner surfaces of the casing are, of course, similarly protected. In one instance in which rubber has been used in this way the pump was operated without any replacements over a period of nine months, whereas the life of metal in precisely similar circumstances was no more than two weeks.

Owing to its extremely low co-efficient of friction when lubricated with water, rubber is an ideal bearing surface for shafting carrying a moderate load, moreover resistance to abrasion is remarkable. When pumping liquids in which sand and other gritty substances are present rubber is usually the complete solution to bearing troubles. A soft variety is used for this purpose and the bearing surface is grooved to allow an adequate flow of water.

Development work in many directions is serving to emphasise the importance of rubber even in seemingly unfruitful fields.

Heat-Resistant Paints

AUSTRALIAN heat-resistant paints have been used by the Railways Department of New South Wales in an extended test on the protection of locomotive fire doors.

In the extreme temperatures of locomotive furnaces, these doors are invariably burnt away, and represent considerable expense because of their high degree of wastage.

After tests of the paint on these doors for a period of over 10 months, the Department states that the butyl titanate paint greatly reduces damage to the doors.

The paint was first developed by Australian chemists of the Commonwealth Scientific and Industrial Research Organisation in 1945. It is an excellent electrical insulator, and can be used for the manufacture of heat-resisting plastics. It is manufactured from the comparatively rare mineral rutile and ilmenite, which occur in the heavy beach sands of New South Wales and Queensland.

German Trade Marks

Arrangements for Disposal

AT the outbreak of war in 1939 there were over 4,000 trade marks on the United Kingdom Register of trade marks, the proprietors of which were German enemies. Except in certain special cases, these marks remained on the Register during the war in the names of the German proprietors and have since been vested in the Custodian of Enemy Property for England.

Subject to the protection of British and other Allied interests, it is now intended to clear the Register of such of these marks as need no longer remain registered, and to return most of the remainder to the former German proprietors or their successors in title. A Board of Trade announcement made on 28 January indicates the procedure which will be followed to achieve these ends and sets out the action to be taken by the former German proprietors or by others interested in particular marks or desirous of objecting to their return to the former German proprietors. The marks will be treated individually; the Custodian will consider each case on its merits and makes no general promise that any particular mark will be cancelled or returned.

Provisions for Objections

Broadly speaking, the procedure is that the former German proprietors of certain categories of marks, or their successors in title should, if still interested in their marks, request the assignment of the marks to them by the Custodian. An opportunity will be given to British and other Allied interests to object to any such assignment before the Custodian acts on the requests.

If a *prima facie* case is made out against the return of a mark to the former German proprietor or, in any case, if the mark in question was registered in Part A of the Register since September, 1932, the Custodian failing an acceptable agreement between the parties concerned will not assign the mark to the former proprietor. But the latter can in such a case attempt to recover the registration by applying to the Registrar of Trade Marks for re-registration of the mark, and the Custodian will consider cancelling the existing registration to allow the application to proceed.

Full details are given in a notice published in the Trade Marks Journal and the Official Journal (Patents) of January 28, 1953.

Detergents Warning

Water Board Anxious About Future

THE water examination committee of London's Metropolitan Water Board, in a report presented at a meeting of the board on 23 January, said that while it has no real evidence for believing that the board's water was in any immediate danger from the presence of synthetic detergents, it could not but view the future with anxiety. Representations were to be made to the appropriate Government department suggesting the desirability of research.

The committee said that the increasing use of detergents was causing foaming in the upper waters of the River Lea and this had occurred recently as far down the river as Lensford Mill, which is only about 12 miles above the board's intake. Experiments at sewage works had shown that purification processes did not remove all types of detergents, for cases had been reported of foaming of rivers as the result of the discharge of well-purified effluents.

'It is not possible to ascertain with any reliability whether the concentration of detergents is increasing or whether it may even be approaching the level at which it might render the water unsuitable for supply purposes,' the report stated. Were the sewage effluents of the new satellite towns being constructed in the catchment area to be received into the Lea 'it would be quite reasonable to believe that the water derived from the river would be frothy, not only about 10 miles below the discharge of the effluent from Luton as at present, but also in the board's works and even possibly in the taps in their consumers' premises.'

Erecting New Facilities

The Harvey Aluminium Company is erecting new facilities at their Oregon works, consisting of a reduction plant, an alumina plant and a bauxite development. Cost of the project will be $65,000,000 and the factory will add 54,000 tons to present annual production.

Measurement of Viscosity

Expressing Rheological Properties of Greases

EXPERIMENTAL work on the measurement of viscosity is described in two reports which have been included in the latest volume of Selected Government Research Reports.* E. B. Clarke, B.Sc., and E. W. J. Mardles, D.Sc., F.R.I.C., describe experiments carried out, mainly with penetrometers, with a view to finding suitable methods by which the viscosity, at any prescribed rate of shear, can be expressed in correct units and in which the degree of accuracy can be assessed. In a subsequent report the same authors discuss the method of using the moving plate viscometer and indicate its various uses. Both reports are based on RAE Notes which were prepared in 1948 and have not previously been made public.

In the standard method of determining the consistency of greases and petroleum—I.P.50/42, A.S.T.M.: D217-38 T (modified)—a 90° penetrometer cone with a special tip, of 150 gm. weight, is used and the penetration in tenths of a millimetre is recorded after five seconds. The interpretation of the results in C.G.S. units has not been attempted, and all that the test decides is whether the degree of penetration for one material is greater or smaller than that of the other, no idea of the viscosity (or consistency) in physical units being given. There is, however, a scale of 'consistencies' in terms of arbitrarily numbered grades, which is quite widely accepted.

Consistency of Greases

In specification D.T.D. 419 the consistency of greases is given empirically as the depth of penetration, using tapered rods. At 18°C. the penetration is by a steel rod 55 gm. weight, $\frac{1}{4}$ in. diameter of the striking end, falling from 10 in. above the grease; at −10°C. the penetration is by a steel rod falling from 30 in. above the grease, and at 100°C. the penetration is by an aluminium rod 18 gm. weight $\frac{1}{8}$ in. diameter, falling from 10 in. above the grease. In these tests the grease is deformed at different rates of shear and by different stresses. It is difficult to attempt comparison of any rheological properties of the same grease at different temperatures by such tests, knowing that these properties vary with the conditions of test.

American Method

A method much used in the U.S.A. for paint pastes and other soft solids is to time the fall of a perforated disc or cone attached to a rod passing through guides through the material contained in a tall cylinder. In some forms of mobilometer the disc and rod carry a load required to give a rate of movement of, say, 1 cm./sec. and the load is recorded. Claims made that the standard instrument is capable of a precision of 2 per cent over a wide range of viscosity appear to be limited to Newtonian liquids, for Clarke and Mardles show that with greases and paints the rates of fall are not always proportional to the viscosity, a state of affairs found also with some Newtonian liquids.

Newton used the equation $\tau = \eta \frac{du}{ds}$ relating τ the shearing force on unit area of a plane surface, moving at a rate of u cm./sec. in a fluid and distant s cm. from a parallel plane. The proportionality constant η, known as the viscosity coefficient, is the ratio between the shearing force and the rate of shear du/ds (or D for short); with water, chloroform, alcohol and other so-called Newtonian liquids, the viscosity coefficient remains constant over a wide range of shearing rate when eddy formation effects are absent. It has been known for a long time that the viscosity of blood, paints, slurries, emulsions, and so on, is a variable function of the rate of shear and when a diagram is prepared relating the rate of shear, D, and the shearing force, τ, the straight line passing through the origin as found with a Newtonian liquid is not obtained.

A measure of the rigidity and consistency of a non-Newtonian material can be obtained from the D[illegible] curve, from the intercept and the slope of the curve respectively at any particular rate of shear. Reversible shear softening is indicated by the fall of apparent viscosity with increase in rate of shear, while a time-dependent variety of

* Vol. II, 'Lubricants and Lubrication,' HMSO Price 35s. net.

thixotropy is indicated by the continued fall with time at a constant rate of shear.

The main purpose of the investigation was to obtain, if possible, simple expressions for the rheological properties of greases and other soft solids in terms of stress/strain/time relations, especially D/τ relations, by using industrial viscometers and penetrometers of plates, cones, spheres and cylinders of different dimensions. The rheological properties as found with a 90° cone penetrometer should not be dissimilar from those found with a spherical penetrometer or with a rotating cylinder viscometer or any other form of viscometer. It was intended to test the same material using a wide variety of methods and to note the differences, if any, in the results obtained.

Used for Tests

Large batches of the same materials were used for the tests and samples were removed from the bulk when needed. It was possible to detect some heterogeneity in the greases as received; the rate of fall of a steel rod varied in different parts of the container and the rate of fall of a flat disc through a column of grease was uneven, but with the same batch of grease the same rheological constants within 20 per cent divergence were found by using a plastometer, a cylinder viscometer, different penetrometers, and by taking measurements of the force and time required to separate two plates with a grease layer between, similar rates of shear being used. With penetrometers the consistency results were similar whether a flat-ended cylinder, 90° cone or spherical penetrometer were used.

A large variety of industrial viscometers, plastometers and penetrometers are in use for control of manufacture and testing, and for specification purposes. The interpretation of the various empirical measurements in terms of some common unit may be possible by examining the method of measurement. It would be useful for comparative purposes to know exactly how these results could be expressed in C.G.S. units, and this problem was studied by varying the shape, dimensions and weight, and so on, of the penetrometer and observing the changes in the movement.

Depth of penetration or volume displaced per unit time, the rate of movement under different loads and other suitable measurements were recorded, sometimes over periods of time up to several weeks. The material under examination was packed in tall cylinders, surrounded by a water bath usually at 20°C., and the penetrometers, just touching the surface initially, were allowed to fall freely through guides.

In discussing the information resulting from this most interesting investigation, the authors point out that the problem of determining the viscosity of a thickened liquid is complicated by its variability with rate of shear, thixotropy, and/or reversible shear hardening, and other problems. Although the empirical results obtained by existing standard methods of test may be useful, it is desirable that any such methods should yield more extensive data, preferably in fundamental units with a known repeatability and accuracy. The yield value and elastic behaviour can be determined separately with simple apparatus; similarly the relation between volume of liquid displaced in a given period of time and weight of any penetrometer acting can be obtained without difficulty and with simple apparatus, and the results can be expressed in C.G.S. units.

First Approximation

As a first approximation apparent viscosities can be obtained by calibrating plunger instruments with Newtonian liquids of known coefficient of viscosity by the 'stepping up' method using plate penetrometers. The equation for a cylinder moving in a Newtonian liquid is known, but the cylinder disturbs the level during penetration. It was found that penetrometers (a) a short cylinder with a length the same as the diameter, (b) a sphere and (c) a rod, all of the same weight and diameter as the cylinder, moved at practically the same rate through a grease, the rod most slowly as the depth increased; the resistance to the rod was increased by the wall friction equal to $2\pi rs$.

Experiments were tried with penetrometers of different perimeters and the relative rates of movement with constant pressure (corrected for yield value) were worked out.

The rigidity (yield value) in gm./sq. cm. can be obtained by using light gauges of cross section 1 sq. cm. of increasing weight and nothing when the gauge no longer remains on the surface, but begins to sink after a period of time. The nature of the material in the test gauges affects the results, wood or varnish gauges sinking less readily

than aluminium ones. Results obtained with several greases are summarised.

A study of the penetration of a lime base grease by spheres and cones was undertaken with a view to comparing volumes displaced by the various penetrometers under similar rates of shear (as far as possible). The apparent viscosity of the grease at the rate of shear of 5 by 10^{-1} sec. is about 10^4 poises; from this information it is possible to find the I.P. Consistency No. of the grease, and vice versa, to give the real values to the I.P. Consistency Nos. From the data obtained there does not appear to be any linear relation between the I.P. Consistency No. and the actual viscosity under rates of shear obtained with the penetrometer.

The method of using volumes instead of depths of penetration may be of some convenience and importance in linking up results obtained with different instruments. Confirmation of the findings by other workers using different materials and methods is awaited.

Calibration of instruments by 'stepping up' from liquids of known viscosity appears to be essential since, although the dimensions of the instruments may be known, the calculations from equations of motion are limited to ideal conditions not found in practice. These equations are useful both in analysing data and serving as a norm.

Use of Moving Plate

Use of a moving plate (edge on) is recommended for measuring the viscous properties of a paste or soft solid, mainly because with the plate it is possible to express results in fundamental units. The plate also has some advantage over the cone or sphere because there is less disturbance of the system and the results are easier to interpret. In a uniformly dispersed paint the fall of a sphere is not in accordance with Stokes' law, for the sphere decelerates, presumably due to structural changes in the system. In the extreme cases, where the system has a decided yield value, the sphere may remain suspended before reaching the bottom.

In the second report examples are given of the various uses of the plate viscometer for measuring the flow properties of thick pastes such as a frozen lubricant, a grease, a soft wax, a thick varnish, and for detecting the presence of a settled pigment in a paint.

The complexity of flow of a soft solid with its attendant phenomenon of shear hardening or softening (termed thixotropy when time is reversible) is a consequence of the structure and heterogeneity of the material; in grease, for example, the structure is due to soap fibres, and in paint pastes to pigment aggregates. The flow behaviour can best be described by rate of shear divided by shearing stress, the so-called D/τ diagrams from which the yield value, the apparent viscosity at any rate of shear, orientation thixotropy and stress hardening can be obtained in C.G.S. units.

Consistency and flow properties of a paste from a powdered solid, such as a pigment, dispersed in a liquid, are functions of the concentration, the specific interfacial relation between solid and liquid, the shape and size of the particle, and any electrostatic charge. By means of the plate viscometer, changes in the consistency of a paste can be followed consequent on the additions of wetting agents or other materials, by noting the change of the plate velocity as it moves through the system.

The investigators studied the rheological behaviour of several worked greases; the rheological behaviour of petroleum jelly, starch paste, gun-cotton syrup, and so on; the rheological behaviour of varnishes, the drag on a plate moving at unit rate through paint and other pastes of suspended particles, thixotropy, the sedimentation and caking of pigments in paints and dopes, and the viscosity of lubricants and other liquids or pastes at low temperatures. The data resulting from these experiments are summarised in the report.

University of Technology

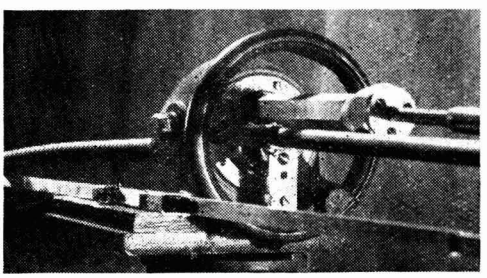
The claim put forward for the Manchester College of Technology to be chosen as the institution to be raised to university rank, in accordance with the Government policy, would be given every consideration, Lord Salisbury, the Lord President of the Council, told a deputation representing Manchester City Council on 16 January. Lord Salisbury, however, also reminded the deputation that the claims of other colleges of technology were being pressed on the Government, and that the considerable cost involved in raising the status of a technical college to that of a university was a matter for the Treasury.

Plant Inspection

Gamma-radiographic Equipment

GAMMA-RADIOGRAPHY, as a means of non-destructive testing, was at first considered as complementary to industrial radiography, but is now being regarded as increasingly important on its own merits, supplying as it does a simple means of inspection with a low-priced apparatus.

The γ-rays from elements produeed in atomic piles are capable of producing pictures on X-ray films of the internal structures of materials, such as castings and welded joints, and of the conditions pertaining within certain kinds of assemblies (c.f. THE CHEMICAL AGE, **67**, 795).



Pantraton IB with isotope guide

For inspection of chemical plant a gamma-graphic equipment must have certain features very different from those used in foundries or assembly shops. X-rays frequently have to be made in narrow tubes or high up in towers and welds have to be inspected deep inside boilers or pressure vessels and underwater or in parts immersed in chemicals or oils.

Safety of gamma-radiographic equipment for chemical plant has to be of the highest degree. Gamma-rays are not harmless and it is important that the shielding is calculated to be on the surface of the apparatus so that work nearby can go on irrespective of the radiographic inspection.

A number of British firms have produced equipment which is remarkable for its safety and versatility and γ-radiography will eventually become a routine method of testing for the majority of chemical and oil refining plants.

A specialised equipment for the chemical and petroleum industries is the Pantatron IB developed by Panta Instruments, Ltd., 26 Savage Gardens, London, E.C.3.

The Pantatron IB has a complete remote control whereby the isotope can be placed anywhere up to 60 ft. away from the operator, even underwater. Any ferrous metal from ½ in. up to about 10 in. in thickness can be inspected. A technical service is maintained to give advice if required.

Chemical Sales Management

SALES management was 'the ability to ensure the supply of the right goods to the right customer at the right place, at the right time, in the right package, in the right post, and for the right payment,' according to E. M. Fraser, sales controller, I.C.I., Ltd., when he spoke in Glasgow to the Incorporated Sales Managers' Association, Glasgow branch, on 'Organisation and Problems of Sales Management in the Chemical Industry.'

The chemical industry required low pressure salesmanship. Mr. Fraser said: 'If a doctor prescribed penicillin the customer could not be fobbed off with bicarbonate.' The industry demanded men familiar with manufacturing processes and needs in their area, the people involved, and who had a staff behind them experienced in the use of such products. There was a shortage of skilled sales personnel in the industry and most of the large firms had embarked on schemes for selecting and training and educating men to that end.

It was no use taking staff from another firm since that did not increase the total sales force in the industry. Training was lengthy and based on the theory that selling was a craft, demanding knowledge of the tools, the people involved, and backed by experience. I.C.I. had partly succeeded in filling the gap and in producing men as sales managers without whom all their efforts would otherwise be useless.

Useful Deposits

Large deposits of untouched coal and saltpetre have been found in the Baluchistan States Union, Pakistan. The new-found coal is located in the plains of Bhag, about fourteen miles from the Bailpat Railway Station in the Kalat District. Saltpetre has been discovered in large quantities at Mashkail in the Kharan District about forty miles from Nokundi Railway Station.

New Sartorius Balances

Three New Models Demonstrated in London

DURING the week ending 10 January an exhibition and demonstration of Sartorius balances was held at the premises of the Hudes Merchandising Corporation, Ltd., in Gloucester Place, W.1. The models shown illustrated the development of automatic weight loading mechanisms over the past years.

The simple analytical balance, in which all weights were added by hand and the rider adjusted by a sliding arm, was first replaced by the model which incorporated air damping of the swing and automatic weight loading of the fractional weights, these being lowered by cams operated by the rotation of an external dial. The use of a rider has been eliminated by mounting a scale upon the pointer and projecting a magnified image of the divisions upon a screen.

The next step in the process was to provide the balance with automatic weight loading of all the weights, so that the weighing process could be carried out without the necessity of opening the case. This fully automatic balance is, of course, satisfactory in every way, but it still retains the original conception of the double pan balance and is rather fussy in construction. An entirely new design of Sartorius balance has now been produced which is original in both construction and operation.

Simple Operating Technique

With this instrument several visitors to the exhibition found that with no previous knowledge of the operating technique they were able to weigh an object to four decimal places in under half a minute. A more practised operator could lower this time by at least a third, and even the most sluggish of analysts could comfortably carry out sixty weighings in the hour.

The new balance which makes this revolution in technique possible has been named the Selecta, and is quite unlike the conventional balance in appearance, being more reminiscent of a Victorian eight-day clock. The case is a vertical cylinder of die-cast aluminium having a detachable dome lid. The weighing aperture is closed by a revolving curved window which may be removed for cleaning. All controls and mechanisms are housed in a base which locks onto the case.

A single pan faces the operator, the beam being at right angles to him and carrying at the rear of the instrument the weight loading cams. To the right, at scale pan level, the image of the pointer scale appears upon an illuminated screen. On the left at the same level five numbers indicate the value of the weight upon the far end of the beam in grams and hundredths of grams. The last two decimal places are given by the illuminated scale. At either side of the case are the knobs which operate the weight loading cams and the beam and pan releases. The release has two positions and the robustness of construction was demonstrated by allowing a weight of some ten to twenty grams to fall upon the balance pan while the release was at its halfway position. After this severe treatment there was no appreciable change in the reading given for a specific load. A zero adjustment knob is also located at the base externally.

Method of Weighing

To carry out a weighing one merely places the object upon the pan and operates the release knob. This tilts a mercury switch in the base and switches on the pointer scale illumination. This consists of a 6 volt low amperage bulb operating from a built-in transformer. The weight loading knobs are rotated until the light goes out, indicating that the weights added are too heavy. The knob is rotated one notch backwards and the process continued until the final places can be read upon the pointer screen.

Aluminium and stainless steel have been used extensively in the construction and the conventional lacquer has been replaced by a porcelain enamel which is claimed to be extremely resistant to adverse conditions. The movement is air-damped and the suspension is from compensating riders.

At present there are three models of the Selecta available. The Standard weighs to 1/10 mg. and has a capacity of 200 g. The projection scale has 50 divisions each corre-

sponding to 1/5 mg. In the Rapid model some accuracy has been sacrificed to give speedier weighing and the reading of the fourth decimal place is carried out by means of a vernier upon the projection scale which has 100 divisions each corresponding to 1 mg. In the Semi-micro model the capacity has been reduced to 100 g. and thus it has been possible to read to a fifth decimal place by means of a vernier upon the projection scale which has 100 divisions each corresponding to 1/100 mg.

The drawback to the single pan balance which cannot make use of a tared or counterbalanced container has been eliminated by the use of a simple taring device. This consists of two cylinders and connecting rods which fit onto the weight side of the beam and can carry taring pellets up to a weight of 50 g. The price of these revolutionary balances is, despite the cost of importation, surprisingly low.—J.R.M.

Engineers Study Education

North Western Branch Holds A.G.M.

THE annual general meeting of the Institution of Chemical Engineers, North Western Branch, was held at Manchester on 23 January. The members were welcomed by the Lord Mayor of Manchester and the chairman of the branch, Mr. G. Brearley, thanked him for his hospitality. After the business meeting was concluded, an address, 'Higher Technological Education, a Review of the Controversy,' was presented by the Right Hon. The Earl of Halsbury.

The speaker limited his review to whole-time education in technological subjects. The controversy arose (he said) on the educational methods we should use in the U.K. to obtain more technologists. If the Government used more money to build and maintain universities, there was less money available for other purposes, therefore the method of expansion of technological education should be considered carefully.

The British Universities possessed a greater freedom of choice of branches of learning than other European universities, hence the technological education in the U.K. had grown, though slowly, within our universities and had kept pace with the demands of industry. In Europe and the U.S.A. institutions for the specialised training in technologies had been separated from the universities and the system had produced good technologists who often were specialists in narrow fields of activity. At present Europe and the U.S.A. were concentrating on giving the technologists more training in fundamentals and our present system of education was suited to such training. The British universities should aim at training such a number of technologists that the demand for them was slightly less than the supply and the surplus found administrative positions. There was little hope of satisfying the demand for highly skilled technologists by recruiting from industry because the graduate who returned to the University often lost his seniority in his firm. The speaker favoured a steady expansion of the technological faculties of our universities, and said a steady supply of money for education was necessary. The education of a technologist could not be made both broad and deep in less than five years while three years training would provide only one of these qualities.

In the evening a dinner and dance was held at the Midland Hotel. Among the guests were The Lord Mayor of Manchester, Alderman D. Gosling, O.B.E., J.P., Sir Christopher and Lady Hinton, The Earl and Countess of Halsbury, and the president of the Institution of Chemical Engineers, Mr. S. Robson and Mrs. Robson.

Fertiliser Prices Raised

THE Minister of Materials has made an Order increasing with effect from 1 February, the maximum price of superphosphate in Northern Ireland with small consequential increases also in the prices of compound fertilisers.

Superphosphate (18 per cent grade) is increased by 5s. 6d. per ton—from £6 19s. 6d. to £7 5s. This is the net price after taking account of the contribution payable under the Fertilisers (Northern Ireland) Scheme, 1952 (S.I. 1952 No. 1274). The unit differential for other grades is increased from 7s. 8d. to 8s. per unit P_2O_5.

The standard price of the compound fertilisers for the principal specification is increased by 3s. 10d.—from £12 11s. to £12 14s. 10d. per ton, and the differential for soluble P_2O_5 used in computing the prices of other compounds is increased from 6s. 8d. to 7s.

The Chemist's Bookshelf

MALEIC ANHYDRIDE DERIVATIVES—Reactions of the Double Bond. By L. H. Flett and W. H. Gardner. John Wiley & Sons Inc., New York; Chapman & Hall, Ltd., London. 1952. Pp. x + 269. 52s.

Until a few years ago, maleic anhydride was a laboratory curiosity; now it is available in quantity from the catalytic oxidation of benzene and has proved to be both an important industrial chemical and a versatile laboratory reagent. This book deals with numerous reactions (some commercially important) of maleic anhydride, and of the closely related substances maleic and fumaric acids and their esters and amides. No less than 116 different types of reaction, mostly additions to the double bond, are discussed. The layout of the book is unusual, and makes for clarity although not for continuity. Each type of reaction is illustrated by a selected example; brief experimental details are recorded on a right-hand page, together with clear formulae indicating the initial and final products. On the facing page are general comments on the reaction and on the properties and uses of the products. Each page has headings, resulting in a book reminiscent of a card index.

The authors point out that they did not attempt to write a textbook, encyclopedia, or monograph. A more comprehensive monograph would have been a worthier objective, although the authors undoubtedly have succeeded in their limited objective of producing a book to interest and excite the imagination of the browser.

The printing has been beautifully done in the U.S.A., and there are few obvious errors. A compound is formulated on p. 51 with pentacovalent phosphorus; if this existed, it would be a hydrated form of phosphorus oxychloride. Too frequently there are vague statements similar to 'these compounds should be useful intermediates for various syntheses.' The decarboxylation of maleic acid in dilute solutions irradiated by ultra-violet light gives acrylic acid, but reference in the same section to the industrial uses of acrylic acid is hardly justified.

Organic chemists everywhere will find much of interest and profit in this book, and it should be available in all reference libraries.—W. WILSON.

DETERGENTS—WHAT THEY ARE AND WHAT THEY DO. By D. Price. Chemical Publishing Co. Inc., New York, 1952. Pp. 159. $4.00.

Here is an amusing little book explaining the phenomena of detergency to the layman in a simple but intelligent fashion. The material has been condensed from lectures delivered by the author to a variety of lay audiences, and though the style is frequently repetitive and even rather rambling, on the whole the attention is held throughout the book.

In the first chapter the essential features of the soap molecule are discussed, and this basic treatment is used to explain the properties of the synthetic detergents later on. While at no time are the individual formulae of a host of surface-active agents mentioned, the author has taken care to give examples of the main classes and to illustrate them by reference to the development of the modern detergents industry. The function of the other constituents of a packeted detergent are mentioned, the builders at some length, and the optical bleaching agents only in passing. The book is recommended to those wishing to have a general idea of the history, function, and uses of detergents, without studying surface tension or aliphatic organic chemistry. In particular, all baffled husbands, who, after explaining for the tenth time that the bearings of the domestic washing machine must not be degreased by the use of detergents, have been defeated by the bland inquiry 'What's the difference between this stuff and soap?' have now been provided with an answer 'Read Dr. Price.'—J.R.M.

HOME

Works Explosion

Two workmen were badly burned in an explosion which occurred at the works of the Lancashire Tar Distillers, Ltd., Ashton Marsh, Preston, on 13 January. A routine operation of blasting blocks of pitch with gunpowder was being carried out at some distance from the main works when the explosion occurred and the men's clothing caught fire. The cause of the accident is being investigated.

Biennial Dinner

The Society of Public Analysts and Other Analytical Chemists will hold its biennial dinner (79th anniversary) on Friday, 6 March, at the Hall of the Worshipful Society of Apothecaries of London, Blackfriars Lane, London, E.C.4. The reception will be at 7 p.m. and the president, Dr. J. R. Nicolls, C.B.E., F.R.I.C., will be in the chair. The society's medal will be presented to the first two Bernard Dyer Memorial lecturers, Sir E. John Russell and the honourable Mr. Justice Lloyd Jacob.

Overseas Guests

Pharmacists from eleven European countries, each member of the Commonwealth, Israel, and the United States have been invited to London in Coronation year as the guests of the Pharmaceutical Society. They will be among the delegates to the British Pharmaceutical Conference from 31 August to 4 September for whom close upon 500 rooms at five London hotels and students' hostels have already been reserved. There will be three days' discussion of some thirty papers giving the results of recent research work in pharmaceutical industrial establishments and schools of pharmacy.

New Section Opened

A new section of the Sondes Place Research Institute laboratories has just been opened for the assaying and analysis of ores and metals and the testing of minerals by froth flotation and other methods. It will be under the supervision of Mr. E. W. Dawson, A.M.I.M.M., who has had more than 25 years' experience in this field. It is hoped shortly to install pilot plant which will enable larger quantities of materials to be treated than is possible in the laboratory.

Chemicals & Overseas Trade in 1952

Despite all the difficulties of increased competition, plant replacement problems and the burden of taxation which beset the chemical industry in 1952, exports of chemicals, drugs, dyes and colours from the United Kingdom were well maintained. The total value at £138,053,562 was only £4,641,955 less than the record level achieved in the previous year, while being £30,395,458 better than the figure for 1950.

Polythene Bottles at −50° F.

Cascelloid, Ltd., of Leicester, makers of the polythene 'bottles that bounce' have received a cable from the British North Greenland Expedition who are using 1-gallon polythene bottles as follows: 'Cascelloid bottles have been used on Northice as containers for battery acid. They were parachuted from about 800 ft. unharmed and are still in excellent condition and apparently not affected adversely by temperatures down to minus 50° F.

Five Royal Colours

A commemorative display card illustrating the five Royal colours sponsored for the Coronation Year by H.R.H. Princess Margaret, has been issued by the British Colour Council. The colours are stated to have made a wide appeal to many industries and in many parts of the world. This card is now available from the British Colour Council at 13 Portman Square, London, W.1, price 12s. 6d. to members and £1 1s. to non-members.

Midlands Analytical Society

As previously announced the third annual general meeting of the Midlands Society for Analytical Chemistry will be held on Thursday, 5 February, at 7 p.m., in the Mason Theatre, The University, Edmund Street, Birmingham. Following the election of officers and other business, members will discuss a resolution that an eight-day international symposium on analytical chemistry be organised by the Society for the first week of September, 1954. Dr. G. F. Hodsman, head of the research department of Oertlings, Ltd., will give an address on 'The Historical Development of the Chemical Balance.'

• OVERSEAS •

Increasing Iron Output

An annual output of 10,000,000 tons of top quality iron ore is assured from the Steep Rock area of Northern Ontario, Premier Leslie Frost said recently. He added that a programme is well advanced to increase by five times the present output of upwards of 1,250,000 tons of iron ore per year. Because of the deep-seated nature of the Steep Rock deposits, a 10,000,000-ton annual output could be sustained for generations.

Injury Rate Record

Injury rates for American manufacturing hit a new low for the first nine months of 1952, according to preliminary reports received by the U.S. Department of Labour's Bureau of Labour Statistics. The average of 13.8 injuries per million man-hours worked was the lowest rate for the first nine months of any year on record. This figure was 13 per cent below that for the same period in 1951.

Domestic Fertiliser Spray

A new fertiliser called 'Folium' that can be sprayed or sprinkled on grass, flowers, shrubs, and trees with a garden hose coupled with a syphoning device has been announced by the Monsanto Chemical Company. 'Folium' is described as a 'quickly soluble fertiliser of 20-20-20 composition (nitrogen, phosphorus, potash).' It also has a chemical that is said to keep the fertiliser in a free-flowing condition. Tests have shown, the company said, that plant food given in water-soluble fertilisers is absorbed by the leaves within 30 minutes to two hours after application.

Indian Oil Search

Representatives of the Standard Oil Company have recently arrived in New Delhi to discuss with the Indian Government plans for prospecting for oil in the West Bengal basin. An aerial survey, made last year, indicated the possibility of an oil belt in the area. The company's representatives have already had a meeting with Mr. A. K. Chanda, Secretary of the Ministry of Production, and other Ministry officials.

Potash Production

The West German Miners' Union has announced that production of raw potash salts in West Germany during 1952 is estimated at 12,600,000 tons, compared with 10,500,000 tons in 1951. Exports of potassic fertilisers in the first nine months of 1952 amounted to DM. 80,000,000 against DM. 75,000,000 in the corresponding period of 1951.

Swedish Chelating Agent

The sales agents for Rexolinfabriken AB, Hälsingborg, Sweden (Allan Sjöstrand, Sigtuna) have announced that Rexolinfabriken AB have entered into full production of the Bersworth Chemical Company's 'Versene'—the tetra sodium salt of ethylene diamine tetra acetic acid—a most versatile chelating agent. Swedish production (which is under licence) will cover those countries who are unable to secure 'Versene' direct from Bersworth Chemical Company, Framingham, Mass., for reason of the dollar shortage.

Tariff Sought

Dow Chemical of Canada Limited on 12 January urged the Canadian Tariff Board to impose a 20 per cent tariff against imports of certain anti-freeze ingredients from the United States and other countries. The company is the biggest Canadian producer of ethylene glycol and it maintains a $24,000,000 plant at Sarnia which it has contended, is being threatened by imports of cheaper American glycol grades. Under the Canadian Tariff, ethylene glycol is allowed in duty-free. W. T. Wood, company attorney, contended in a brief before the board that much of the U.S. imports are not pure ethylene glycol, but a mixture or blend. As such, they should bear a 20 per cent tariff.

Oil Refinery in Turkey

An agreement has been concluded between the Ministry of Exploitation and representatives of a firm in Los Angeles for the construction of an oil refinery at Garzan in Turkey. The refinery, which will treat 6,250 barrels per day, is to be ready for operation in two years. The oil will be conveyed by a pipe line from the wells at Raman Dagh, 40 miles from Garzan.

PERSONAL

MR. A. ROBERT JENKINS, J.P., has been appointed managing director of Messrs. Robert Jenkins & Co., Ltd., Rotherham, in succession to the late Mr. Ernest Twigg. He will also be managing director of the firm's subsidiary company, the Rotherham Motor Co., Ltd.

Mr. Jenkins, who is president of the Rotherham Chamber of Commerce and of the Institute of Welding, has been works director and deputy managing director of Robert Jenkins & Co., and a director of the Rotherham Motor Co., Mr. Jenkins is the elder son of Mr. Edgar J. Jenkins who, until his retirement, was managing director of the firm.

MR. JOHN HOWARTH of Halifax, has been appointed to the charge of a new analytical laboratory recently built by Hoover (Washing Machines) Ltd., at Merthyr Tydfil, Wales. Born at Brighouse, Mr. Howarth began his career in Halifax, while continuing his studies at the Halifax Technical Institute. He later became a Fellow of the Chemical Society and an Inter B.Sc. He has been working for Hoover Limited for 12 years.

The American Institute of Mining and Metallurgical Engineers recently announced that the Robert W. Hunt award for 1953 would be given to DR. J. H. CHESTERS, D.SC., PH.D., for his paper entitled 'Flow Patterns in Open-Hearth Furnaces.' Dr. Chesters is assistant director of research for The United Steel Companies, Ltd., Sheffield.

The Hunt award was established in 1920, and is made for the best original paper or papers on iron and steel contributed to the Institute during the period under review.

Dr. Chesters was educated in Nottingham and at the University of Sheffield. He held the Robert Blair Fellowship in Berlin in 1931/32 and a Commonwealth Fund Fellowship at the University of Illinois between 1932/34 where he studied ceramic engineering. He was awarded the Sir Robert Hadfield Medal in 1946 and is the author of books on iron and steel and steel plant refractories, and of many papers and technical articles.

He was president of the British Ceramic Society (1951/52) and president of the Sheffield University Metallurgical Society (1951/53); he is also a member of council of the British Ceramic Research Association, chairman of the All-Basic Furnace Sub-Committee (BISRA-BCRA) and chairman of the Open-Hearth Instruments Sub-Committee of BISRA.

DR. GEORGE T. FELBECK has relinquished his responsibilities for Union Carbide's extensive work in atomic research and production in order to devote more of his time to the Corporation's coal-hydrogenation chemicals project, it was announced on 14 January by DR. J. G. DAVIDSON, president, Carbide & Carbon Chemicals Company, a division of Union Carbide and Carbon Corporation.

Dr. Felbeck is a member of Union Carbide's research committee and is a vice-president of the Chemicals Company. In addition to his work in the atomic energy field, he has been responsible for the development of Union Carbide's coal-hydrogenation process for producing chemicals from coal. He is the officer in charge of the Chemicals Company's physical processes department.

New Radioactive Mineral

THE discovery of a new kind of mineral very rich in the radioactive elements thorium and uranium was announced on 21 January at the Mineralogical Society by Mr. S. H. U. Bowie and Mr. J. E. T. Horne, of the Geological Survey and Museum, DSIR. Recognition of a new mineral species is a rare event.

The mineral contains 31 per cent thorium oxide and 4 per cent uranium oxide. It has been named cheralite, from Chera, the ancient name of the State of Travancore in South India where the new species was found. The deposit of the mineral is unfortunately much too small to be of any commercial importance.

A specimen of the new mineral is on display in the Geological Museum, South Kensington. It is of a dull green colour, in lumps an inch or two in size. Mineralogically it is related to monazite, the commonest ore of thorium.

Publications & Announcements

SOME of the simpler aspects of the inevitably complex subject of rheology are outlined in the December, 1952 (No. 14) issue of *The Bulletin* of the British Whiting Research Laboratories, Bedford. In the uses of whiting in paints, distempers, putties and mastics, and in linoleum and rubber mixes in the process of manufacture the suspensions of high solid concentration, pastes and semi-solids are of particular concern, and the rheological properties of these types of system are therefore of special interest. The *Bulletin* also contains a tribute to Mr. G. F. Holdcroft, chairman of the research council, to whose enthusiasm and efforts the existence of a whiting research organisation is largely due.

* * *

WISDOM and safety of the deliberate use of chemicals in food have been the subject of prolonged controversy. The view that the practice is not deleterious to health while being a valuable contribution to conservation of the food supplies of the world, is expressed by Professor A. C. Frazer, a leading authority on the subject, in the current issue of *Endeavour* (Vol. XII, No. 45), the quarterly scientific review published by Imperial Chemical Industries, Ltd. Other features include an article on 'The Microanalysis of the Inert Gases' by Dr. F. A. Paneth; 'Detergent Action,' by Dr. N. K. Adam, F.R.S., and Dr. D. G. Stevenson; and an article on 'The Zoological Society of London,' by Dr. L. Harrison Matthews, illustrated by excellent colour plates.

* * *

A VALUABLE tool in every chemical laboratory is the refractometer by means of which not only can measurement of the refractive index be quickly made but measurement of a second physical property, namely the dispersion, can also be made simultaneously. The instrument also affords the quickest means of finding the proportion of solvent to substance dissolved. A description of the Hilger Abbe refractometer, its applications and methods of use are given in a leaflet (CH22/9, January, 1953) issued by Hilger & Watts, Ltd., London. The design of the instrument has been completely reconsidered in detail, without, however, departing from the essential form which long use by chemists and others has proved to be particularly convenient for routine, continuous use. Engineering principles have been the basis of the changes in construction to secure long wearing qualities and full mechanical precision in those parts of the instrument which are particularly vulnerable and susceptible to wear.

* * *

WHILE chlorinated water is satisfactory for most purposes, it is necessary in some special instances to use water which is free both from chemicals and germs. For such needs, water sterilised by ultra-violet rays, while more expensive than chlorination, fulfils the requirements with several advantages. A new impetus to this method has been given by the introduction of two new models (4 and 5-manual operation and fully automatic) ultra violet-ray sterilisers developed by Hanovia, Ltd., of Slough, Bucks, and described in its latest illustrated catalogue. A self-starting high-pressure quartz mercury arc tube, consuming 1,100 watts, is placed within a quartz protective cylinder along the axis of a substantial cylindrical container, about 20 in. long by 4 in. diameter. The container is mounted horizontally, having inlet pipes diagonally opposed so that all water is exposed to the arc tube in passing through the container. The rays are so effective that at flows up to 1,500 gallons an hour, initial contaminations of Eschericha Coli up to 1,000,000 per cc. are destroyed.

* * *

A NEWLY developed alkyd moulding material having a valuable combination of electrical properties and heat resistance is announced by Bakelite, Ltd., London, in the winter 1952/53 issue of 'Bakelite Progress.' This group of resins has long been used in the manufacture of coatings, but until recently, has not been considered suitable for moulding purposes. The new material, X.17349, is designed for use in standard presses, such as are employed for phenolics, and so on. As yet production is in experimental quantities only, since it remains for manufacturers to discover applications for it. Illustrated articles include a description of the use of Bakelite laminated in Parsons turbo-alternators, and the wide potentialities of pulp-resin preforms based on Bakelite resins.

STANDARD rates for transport of any class of goods by rail for distances from 6 to 750 miles may be obtained at a glance from the new edition of the 'Scale of Railway Standard Charges' issued by the Railway and Shipping Publishing Co., Ltd., Birmingham (price 15s. postpaid). Revision was made necessary by the recent increases in railway freight charges. The rates shown are for classes 1-21 in owners' or company's wagons, and are the actual rates in force at present. In addition to the station to station rates, the Collected and Delivered and also the Collected or Delivered Charges for classes 11-20 are given.

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ACTIVITIES of the Vickers Group of Companies in all parts of the globe cover such a wide range that it is not surprising to find a great diversity of topics covered in its overseas house magazine 'Vickers Overseas News.' In the winter 1952/53 edition subjects range from 'The Caribbean Area" by Sir Harry Luke, and an article on the problems of photographing aircraft at high altitude by Anthony Squire who directed the aerial unit which shot the flying sequences of the film 'The Sound Barrier,' to a colour supplement on 'Temptation to Travel' by Anthony Armstrong and an article on 'Trends in American Typography.'

* * *

A NEW four page leaflet, number CM-53, describing the Apex Comminuting Mill, a new and revolutionary machine hitherto unavailable in this country, has been issued by Apex Construction, Ltd., chemical and pharmaceutical engineers, 15 Soho Square, London, W.1. Machines of this type are being extensively used in the United States, and are responsible not only for very high rates of production but have made possible the manufacture of new products not hitherto obtainable. Some of the advantages of the Comminuting Mill are said to be: (1) Very high output. (2) Great versatility, which is aided by non-corrosive construction, ease of cleaning and sterilisation, and mobility. (3) Extremely uniform products and dustless operation when operating on dry materials. (4) Dual action by the use of dual faced blades either of which can be quickly put into operation. (5) Various safety devices are incorporated and the machine fully conforms with the Factories Act. (6) Heat sensitive materials can be processed in temperature controlled models.

Possible applications in the chemical field include: (a) Size reduction of materials. (b) Dustless pulverising of chemicals. (c) Breaking up of agglomerates. (d) Mixing and sizing of materials in previously roughly mixed condition. (e) Dispersion of colours, lubricants, and other materials through dry, finely divided powders, or of solids and flocs in highly viscous bases, etc.

* * *

SILICONE rubber, its unique properties and increasing applications in the chemical, electrical, engineering and packaging industries are described in an illustrated booklet published by the general rubber goods division of the Dunlop Rubber Co., Ltd. An example of the wide range of uses of silicone rubber in the chemical industry is its specification by Quickfit & Quartz for covers on the protectings rings which support the large glass boiling flasks used to evaporate nitric acid and similar types of compounds at a temperature of 100°-140°C. Although distribution of the booklet is restricted, copies while available, may be obtained on request from the General Rubber Goods Division of the company at Cambridge Street, Manchester.

* * *

FURNACE users are encountering continually rising fuel and maintenance costs while at the same time having to meet the need for increased output and improvement of high duty furnaces. To meet these more severe conditions of operation the Morgan Crucible Co., Ltd., is now manufacturing M.R. Plastic Mouldable, a super-duty refractory described in its leaflet, RD.34. M.R. Plastic Mouldable has a 60 per cent alumina content and is particularly recommended for service at high temperatures or where severe spalling or slagging is encountered. It has a maximum operating temperature of 1,650°C. and is suitable for the majority of industrial furnaces. The compound is of a stiff malleable consistency supplied ready for use in air-tight drums of 112 lb. (50 kg.), each containing approximately 7/10th of a cubic foot of material. M.R. Plastic Mouldable can be hammered into position with, or without, the use of formers. As it is impossible to 'overram' it can be used to install linings or make shapes using comparatively unskilled labour. More detailed instructions for its installation are given in the company's Instruction Card RD.32.

Next Week's Events

MONDAY 2 FEBRUARY

Royal Institute of Chemistry

Oxford: Physical Chemical Laboratory, the University, 8 p.m. London Section with the Alembic Club. Symposium on 'Research in Industry Compared with Research in Universities,' arranged by Dr. M. P. Appleby.

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 6.30 p.m. Joint meeting of the London Section and the Plastics and Polymer Group. Dr. D. Traill (I.C.I., Nobel Division): 'The New Wool-like Fibres.'

TUESDAY 3 FEBRUARY

The Chemical Society

Edinburgh: The University, Teviot Place, 7 p.m. Joint meeting with the RIC, the SCI and the University Chemical Society. Professor M. Stacey: 'Bacterial Polysaccharides.'

Manchester: The University, 6.30 p.m. Tilden Lecture. H. M. Powell: 'The Chemistry of Intermolecular Compounds.'

Institute of Metals

Oxford: Black Hall, St. Giles, 7 p.m. Symposium on 'Metal Pressing.' Film supplied by the Aluminium Development Association.

Society of Instrument Technology

Manchester: College of Technology, 7.30 p.m. Dr. J. E. Johnston: 'Some Industrial Applications of Radioisotopes.'

WEDNESDAY 4 FEBRUARY

Manchester Metallurgical Society

Manchester: Engineers' Club, Albert Square, 6.30 p.m. Dr. F. Ashworth, F. G. Haynes, and J. Johnson: 'Some New Laboratory Techniques.'

Institute of Welding

Manchester: College of Technology, 7.15 p.m. Dr. Tucker and E. Fuchs (I.C.I., Alkali Division): 'Developments and Trends in Pipe Welding.'

THURSDAY 5 FEBRUARY

The Chemical Society

Bristol: The University, 7 p.m. Joint meeting with the RIC and the SCI. Dr. F. L. Rose: 'The Practical Approach to Chemotherapy.'

London: Burlington House, Piccadilly, W.1, 2.30 p.m. and 7.30 p.m. Symposium on 'Acetylene Chemistry,' arranged by Professor E. R. H. Jones. Programme will include contributions by: Dr. E. A. Braude, Dr. M. C. Whiting and Dr. H. W. B. Reed, Dr. B. C. L. Weedon, Dr. R. A. Raphael, Professor E. R. H. Jones, Professor N. A. Sörensen, Dr. W. D. Celmer and Dr. I. A. Solomons and Dr. B. Lythgoe.

Sheffield: The University, 7.30 p.m. Professor F. S. Dainton: 'Nascent Hydrogen: A Re-interpretation.'

Society of Chemical Industry

Nottingham: Gas showrooms, Parliament Street, 7.15 p.m. Corrosion Group. Dr. J. C. Hudson and J. F. Stanners: 'The Effect of Climate and Atmospheric Pollution on Corrosion.'

London: Afternoon visit to Barclay Perkins & Co. Ltd., Southwark. Microbiology Group.

Institute of Metals

Birmingham: James Watt Memorial Institute, Great Charles Street, 6.30 p.m. Professor A. J. Murphy: 'Substitution.'

London: 4 Grosvenor Gardens, S.W.1, 7 p.m. Dr. N. P. Allen: 'Titanium.'

Leeds Metallurgical Society

Leeds: The University, 7.15 p.m. Dr. E. Scheuer: 'The Continuous Casting Processes.'

Midlands Society for Analytical Chemistry

Birmingham: The University, Edmund Street. Annual general meeting. G. F. Hodsman (research department, L. Oertling Ltd.): 'Historical Development of the Chemical Balance.'

FRIDAY 6 FEBRUARY

The Chemical Society

Swansea: University College, 5.30 p.m. Professor H. W. Melville: 'Some Recent Developments in the Investigation of Radical Reactions.'

Society of Chemical Industry

Manchester: The University, 6.30 p.m. Joint meeting of the Plastics and Polymer Group with the Manchester Section. Jubilee Memorial Lecture. J. R. Whinfield (I.C.I. 'Terylene' Council): 'Textile Fibres —Variations on Some Familiar Themes.'

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.)

HEMINGWAY & CO., LTD., London, E., colour, paint and varnish manufacturers. (M., 31/1/53.) 22 December, £100,000 debenture stock and a premium of 2 per cent in certain events secured by a Trust Deed dated 10 December, 1952; charged on 22 and 28 Marsh Gate Lane, Stratford, and a general charge. *Nil. 30 May, 1952.

Increases of Capital

The following increases of capital have been announced: EAGLESCLIFFE CHEMICAL MANUFACTURING, LTD., from £80 to £100; STERN PURE CHEMICALS, LTD., from £1,000 to £2,000.

New Registrations

Caleno Co. Ltd.

Private company. (515,254). Capital £100. Manufacturing analytical and consulting chemists. Solicitors: Montagu's and Cox & Cardale, 86-8, Queen Victoria Street, E.C.4.

S. B. Penick & Co. Ltd.

Private company. (515,360). Capital £100. Importers and exporters of drugs, chemicals, drysalters, minerals and produce of all kinds, etc. Directors: A. D. Penick and R. G. Archer. Reg. office: 5 Fenchurch Street, E.C.3.

Sandil Ltd.

Private company. (515,213). Capital £100. Manufacturers of chemicals, gases, drugs, medicines, etc. Director: C. E. Clegg. Reg. office: 115 Greenford Road, Greenford, Middx.

Company News

Ernest Benn Ltd.

Associates of the publishers of THE CHEMICAL AGE, Ernest Benn, Ltd., have been appointed selling agents for the old established book publishing business of Williams & Norgate Ltd., it is officially announced. Very shortly the whole business of Williams & Norgate will be transferred to Benns' Building, Bouverie House, 154 Fleet Street, E.C.4. The new board has been elected for Williams & Norgate and Messrs. Glanvill Benn, Keon Hughes, and A. R. C. Fleming, A.C.A., have been appointed directors.

During the war, in the absence of the working directors on service, Benns were obliged to 'go slow' with their book publishing activities. Since 1946, however, expansion has been correspondingly rapid. Technical books, Blue Guides, serious history such as Halevy's six volume 'History of the English People,' biography, politics, and a wide variety of fiction have appeared. Only last Spring Ernest Benn Ltd., acquired a substantial interest in Quality Press, which now carries on its publishing activities from Bouverie House.

Williams & Norgate, established 1843, were the original publishers of the world-renowned Home University Library. As Benns may be said to have established their name in the world of books with the equally remarkable Sixpenny Library, there is clearly a natural affinity between the two houses.

Next Week's Events *continued*

The Royal Institution

London: 21 Albemarle Street, W.1, 9 p.m. Dr. Henry Seligman (head of the isotope division, Atomic Energy Research Establishment, Harwell): 'Production and Uses of Radioisotopes.'

British Paper & Board Makers' Association

Manchester: Engineers' Club, Albert Square, 6 p.m. Informal dinner; 7 p.m. annual general meeting. Lecture: 'Recent Developments in Effluent Treatment.' The British Paper and Board Industry Research Association.

British Chemical Prices

LONDON.—Active trading conditions have been reported from most sections of the chemicals market during the past week, and the recent improvement in demand for the textile and kindred consuming industries has been sustained.

A fair amount of shipment business has been put through at competitive rates, and for most items, prompt delivery dates can be offered.

The price situation has changed very little apart from the fluctuations in the chemical compounds of the non-ferrous metals.

Business in the coal tar products is steady with buyers showing little interest in covering more than nearby requirements.

MANCHESTER.—A fair amount of activity has been reported during the past week on the Manchester market for heavy chemical products and current business, it seems to be generally agreed, represents a further gradual recovery compared with conditions in the closing months of last year. Caustic soda and most of the other alkalis are in steady request and there has been a fair inquiry for the leading potash and ammonia compounds. Prices keep steady for the most part though there are easy spots in one or two directions. Conditions in the tar products section are rather better and trade in fertilisers is of fair extent

General Chemicals

Acetic Acid.—Per ton : 80% technical, 1 ton, £96 ; 80% pure, 10 tons, £102 ; commercial glacial 10 tons, £98 ; delivered buyers' premises in returnable barrels ; in glass carboys, £7 ; demijohns, £11 extra.

Acetic Anhydride.—Ton lots d/d, £149 per ton.

Acetone.—Small lots : 5 gal. drums, £143 per ton ; 10 gal. drums, £125 per ton. In 40/50 gal. drums less than 1 ton, £105 per ton ; 1 to 9 tons, £104 per ton ; 10 to 49 tons, to £103 per ton ; 50 tons and over, £102 per ton.

Alcohol, Industrial Absolute.—300,000 gal. lots d/d, 3s. 7½d. per proof gallon ; 100,000 and less than 200,000 gal. lots, d/d, 3s. 8½d. per proof gal.

Alcohol, Diacetone.—Small lots : 5 gal. drums, £162 per ton ; 10 gal. drums, £172 per ton. In 40/45 gal. drums ; less than 1 ton, £142 per ton ; 1 to 9 tons, £141 per ton ; 10 to 50 tons, £140 per ton ; 50 to 100 tons, £139 per ton ; 100 tons and over, £138 per ton.

Allyl Alcohol.—Less than 40 gals., 3s. 10½d. per lb. ; 40 gal., 3s. 6½d. per lb. ; 2 to 5 40 gal. drums, 3s. 4½d. per lb. ; 1 ton and over, 3s. 2½d. per lb.

Alum.—Ground, £24 per ton, f.o.r. MANCHESTER : Ground, £25.

Aluminium Sulphate.—Ex works, £12 per ton d/d. MANCHESTER : £14 to £15.

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

Ammonium Bicarbonate.—2 cwt. non-returnable drums ; 1 ton lots £47 per ton.

Ammonium Chloride. — Grey galvanising, £31 5s. per ton, in casks, ex wharf. Fine white 98%, £23 12s. 6d. to £26 5s. per ton. See also Salammoniac.

Ammonium Nitrate.—D/d, £18 to £20 per ton.

Ammonium Persulphate. — MANCHESTER : £6 2s. 6d. per cwt. d/d.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £93 and £91 10s. per ton.

Antimony Sulphide.—Golden, d/d in 5 cwt. lots as to grade, etc., 2s. 3¼d. to 3s. 1½d. per lb. Crimson, 3s. 4¼d. to 4s. 5¼d. per lb.

Arsenic.—Per ton, £59 5s. nominal, ex store.

Barium Carbonate.—Precip., d/d ; 2-ton lots, £35 5s. per ton, bag packing.

Barium Chloride.—£42 15s. per ton in 2-ton lots.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £38 per ton d/d ; 2-ton lots, £38 5s. per ton d/d.

Bleaching Powder.—£21 per ton in casks (1 ton lots).

Borax.—Per ton for ton lots, in free 140-lb. bags, carriage paid: Anhydrous, £59 10s.; in 1-cwt. bags; commercial, granular, £39 10s.; crystal, £42; powder, £43; extra fine powder, £44; B.P., granular, £48 10s.; crystal, £51; powder, £52; extra fine powder £53.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granular, £68; crystal, £76; powder, £73 10s.; extra fine powder, £75 10s.; B.P., granular, £81; crystal, £88; powder, £85 10s.; extra fine powder, £87 10s.

Butyl Acetate BSS.—£181 per ton, in 20-ton lots.

Butyl Alcohol BSS.—£180 per ton in 10-ton lots.

***sec.* - Butyl Alcohol.**—5 gal. drums £174; 40/45 gal drums: less than 1 ton £144 per ton; 1 to 10 tons £143 per ton; 100 tons and over £140 per ton.

***tert.* - Butyl Alcohol.**—5 gal. drums £195 10s. per ton; 40/45 gal. drums: less than 1 ton £175 10s. per ton; 1 to 5 tons £174 10s. per ton; 5 to 10 tons, £173 10s.; 10 tons and over £172 10s.

Calcium Chloride.—70/72% solid £9 12s. 6d. per ton, in 4-ton lots.

Chlorine, Liquid.—£28 10s. per ton d/d in 16/17-cwt. drums (3-drum lots).

Chromic Acid.—2s. 0½d. to 2s. 0¾d. per lb., less 2½%, d/d U.K.

Citric Acid.—1 cwt. lots, 201s. cwt.; 5 cwt. lots, 196s. cwt.

Cobalt Oxide.— Black, delivered, 13s. per lb.

Copper Carbonate.—MANCHESTER: 2s. 7d. per lb.

Copper Sulphate.—£97 10s. per ton f.o.b., less 2%, in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., about £11 2s. d/d.

Ethyl Acetate.—20 tons and upwards, d/d, £151 per ton.

Formaldehyde.—£35 10s. per ton in casks, according to quantity, d/d.

Formic Acid.—85%, £82 5s. in 4-ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1.260 S.G. £14 19s. per cwt. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hydrochloric Acid.—Spot, 12s. to 16s. per carboy d/d, according to purity, strength and locality.

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

Hydrogen Peroxide.—27.5% wt. £124 10s. per ton. 35% wt. £153 per ton d/d. Carboys extra and returnable.

Iodine.—Resublimed B.P., 21s. 3d per cwt. in 28 lb. lots.

Iodoform.—25s. 4d. per cwt. in 28 lb. lots.

Lactic Acid.—Pale tech., 44 per cent by weight £122 per ton; dark tech., 44 per cent by weight £67 per ton ex works one ton lots; dark chemical quality 44 per cent by weight £102 per ton, ex works; Usual container terms.

Lead Acetate.—White: £137 10s. per ton.

Lead Nitrate.—£105 per ton.

Lead, Red.—Basis prices per ton. Genuine dry red lead, £130 10s.; orange lead, £142 10s.. Ground in oil: red, £156 10s.; orange, £168 10s.

Lead, White.—Basis prices: Dry English, in 5-cwt. casks, £146 5s. per ton. Ground in oil: English, under 2 tons, £166 10s.

Lime Acetate.—Brown, ton lots, d/d, £30 to £34 per ton; grey, 80-82%, ton lots, d/d, £34 to £39 per ton.

Litharge.—130s. 6d. per cwt. in 5-ton lots.

Magnesite.—Calcined, in bags, ex works, £22 to £24.

Magnesium Carbonate.—Light, commercial, d/d, £87 15s.; cwt. lots £97 10s. per ton d/d.

Magnesium Chloride.—Solid (ex wharf), £15 per ton.

Magnesium Oxide.—Light, commercial, d/d, £240; cwt. lots £250 per ton d/d.

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

Mercuric Chloride.—19s. 3d. per lb. in 28 lb. lots; smaller quantities dearer.

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

Methanol.—Pure synthetic, d/d, £28 to £38 per ton.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 6s. 4½d. per gal.; pyridinised 64° O.P. 100 gal., 6s. 6d. per gal.

Methyl Ethyl Ketone.—5 gal. drums, £183 per ton ; in 40-45 gal. drums, less than 1 ton, £153 per ton ; 50 to 100 tons, £150 per ton ; 100 tons and over, £149 per ton.

Methyl *iso*Butyl Ketone.—5 gal. drums, £203 per ton in 40-45 gal. drums, less than 1 ton, £173 per ton ; 1 to 10 tons, £172 per ton ; 10 to 50 tons, £171 per ton ; 50 to 100 tons, £170 per ton ; 100 tons and over, £169 per ton.

Nickel Sulphate.—D/d. buyers U.K. £140 10s. per ton.

Nitric Acid.—£35 to £40 per ton, ex works.

Oxalic Acid.—Home manufacture, £170 per ton ; foreign manufacture £137 10s. per ton.

Phosphoric Acid.—Technical (S.G. 1.700) ton lots, carriage paid, £87 per ton ; B.P. (S.G. 1.750), ton lots, carriage paid, 1s. 3½d. per lb.

Potash, Caustic.—Solid, £98 10s. per ton for 1-ton lots ; Liquid, £37 15s.

Potassium Bichromate.—Crystals and granular, 10§d. per lb. ; ground, 11§d. per lb., standard quantities.

Potassium Carbonate.—Calcined, 98/100%, £116 per ton for 1-ton lots, ex store.

Potassium Chloride.—Industrial, 96%, 6-ton lots, £20 to £22 per ton.

Potassium Iodide.—B.P., 18s. 7d. per lb. in 28 lb. lots ; 18s. 1d. in cwt. lots.

Potassium Nitrate.—Small granular crystals, 81s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 9½d. per lb. for 1-cwt. lots ; for 3 cwt. and upwards, 1s. 8½d. per lb. ; technical, £9 2s. per cwt. ; for 5 cwt. lots.

***iso*Propyl Alcohol.**—Small lots : 5 gal. drums, £156 per ton ; 10 gal. drums, £146 per ton ; in 40-45 gal. drums : less than 1 ton, £126 per ton ; 1 to 9 tons, £125 per ton ; 10 to 50 tons, £124 per ton ; 50 to 100 tons, £123 per ton ; 100 tons and over, £122 per ton.

Salammoniac.—Dog-tooth crystals, £72 10s. per ton ; medium, £67 10s. per ton ; fine white crystals, £21 10s. to £22 10s. per ton, in casks.

Salicylic Acid. — MANCHESTER : Technical 2s. 7d. per lb. d/d.

Soda Ash.—58% ex depôt or d/d, London station, £8 17s. 3d. to £10 14s. 6d. per ton.

Soda, Caustic.—Solid 76/77% ; spot, £23 5s. per ton d/d. (4 ton lots).

Sodium Acetate.—£85 to £91 per ton d/d.

Sodium Bicarbonate.—Refined, spot, £12 5s. per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 9¾d. per lb. ; anhydrous, 11¼d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite.—Powder, 60/62%, £40 per ton d/d in 2-ton lots for home trade.

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

Sodium Chlorate.—£87 to £95 per ton.

Sodium Cyanide.—100% basis, 8d. to 9d. per lb.

Sodium Fluoride.—D/d, £4 10s. per cwt.

Sodium Hyposulphite.—Pea crystals £28 a ton ; commercial, 1-ton lots, £26 per ton carriage paid.

Sodium Iodide.—B.P., 20s. 1d. per lb. in 28 lb. lots.

Sodium Metaphosphate (Calgon).—Flaked, loose in metal drums, £123 ton.

Sodium Metasilicate.—£22 15s. per ton, d/d U.K. in ton lots.

Sodium Nitrate.—Chilean Industrial, 97-98%, 6-ton lots, d/d station, £29 15s. per ton.

Sodium Nitrite.—£31 for 1 ton lots.

Sodium Percarbonate.—12½% available oxygen, £8 2s. 10½d. per cwt. in 1-cwt. drums.

Sodium Phosphate.—Per ton d/d for ton lots : Di-sodium, crystalline, £37 10s., anhydrous, £78 10s. ; tri-sodium, crystalline, £39 10s., anhydrous, £75 10s.

Sodium Prussiate.—10d. to 10½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber's Salt).—£8 per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. £6 per ton d/d station in bulk. MANCHESTER : £7 per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot. £30 17s. 6d. per ton, d/d, in drums ; broken, £31 12s. 6d. per ton, d/d, in drums.

Sodium Sulphite.—Anhydrous, £59 per ton , pea crystals, £37 12s. 6d. per ton d/d station in kegs ; commercial, £23 7s. 6d. per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £22 16s. 6d. to £25 6s. according to fineness.

Tartaric Acid.—Per cwt. : 10 cwt. or more, £11.

Titanium Oxide.—Standard grade comm., with rutile structure £143 per ton ; standard grade comm., £130 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d ; white seal, £117 10s. ; green seal, £116 10s. ; red seal, £115.

Rubber Chemicals

Antimony Sulphide.—Golden, 2s. 3¼d. to 3s. 1½d. per lb. Crimson, 3s. 4¼d. to 4s. 5¼d. per lb.

Carbon Bisulphide.—£65 5s. per ton, according to quality.

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

Carbon Tetrachloride.—£74 10s. per ton.

India-rubber Substitutes.—White, 1s. 6¾d. to 1s. 10¼d. per lb. ; dark, 1s. 4½d. to 1s. 8½d. per lb.

Lithopone.—30%, £60 per ton.

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

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

Sulphur Chloride.—British, 63s. per cwt.

Vegetable Lamp Black.—£64 8s. per ton in 2-ton lots.

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

Nitrogen Fertilisers

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, £16 18s.

Compound Fertilisers.—Per ton in 6 ton lots, d/d farmer's nearest station, I.C.I. Special No. 1 £27 9s.

'Nitro-Chalk.'—£12 9s. 6d. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean agricultural for 6-ton lots d/d nearest station, £28 15s. per ton.

Coal-Tar Products

Benzole.—Per gal, ex works : 90's, 3s. 8¼d. ; pure, 3s. 11½d. ; nitration grade, 4s. 2½d.

Carbolic Acid.—Crystals, 1s. 6d. to 1s. 8d. per lb. Crude, 60's, 8s. MANCHESTER : Crystals, 1s. 6d. to 1s. 8d. per lb., d/d crude, 8s. naked, at works.

Creosote.—Home trade, 10d. to 1s. 2d. per gal., according to quality, f.o.r. maker's works. MANCHESTER : 1s. to 1s. 8d. per gal.

Cresylic Acid.—Pale 99%, 5s. 8d. per gal. ; 99.5/100%, 5s. 10d. American, duty free, for export, 5s. to 5s. 8d. naked at works.

Naphtha.—Solvent, 90/160°, 4s. 10½d. per gal. for 1000-gal. lots ; heavy, 90/190°, 4s. 3½d. per gal. for 1000-gal. lots, d/d. Drums extra : higher prices for smaller lots.

Naphthalene.—Crude, ton lots, in sellers' bags, £18 16s. 3d. to £34 per ton according to m.p. ; hot-pressed, £50 to £60 per ton, in bulk ex works ; purified crystals, £68 10s. to £79 3s. 4d. per ton.

Pitch.—Medium, soft, home trade, 130s. per ton f.o.r. suppliers' works ; export trade, 200s. per ton f.o.b. suppliers' port. MANCHESTER : £8 f.o.r.

Pyridine.—90/160°, 42s. 6d. per gal. MANCHESTER : 42s. 6d. to 45s. per gal.

Toluol.—Pure, 4s. 7½d. per gal. MANCHESTER : Pure, 4s. 7½d. per gal. naked.

Xylol.—For 1000-gal. lots, 5s. 6d. per gal., according to grade, d/d.

Intermediate and Dyes (Prices Nominal)

***m*-Cresol 98/100%.**—3s. 9d. per lb. d/d.

***o*-Cresol 30/31° C.**—1s. 4d. per lb. d/d.

***p*-Cresol 34/35° C.**—3s. 9d. per lb. d/d.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—88/89°C., 1s. 11d. per lb.

Dinitrotoluene.—S.P. 15° C., 1s. 11½d. per lb. ; S.P. 26° C., 1s. 3d. per lb. S.P. 33°C., 1s. 1½d. per lb. ; S.P. 66/68 C., 2s. per lb.

***p*-Nitraniline.**—4s. 5½d. per lb.

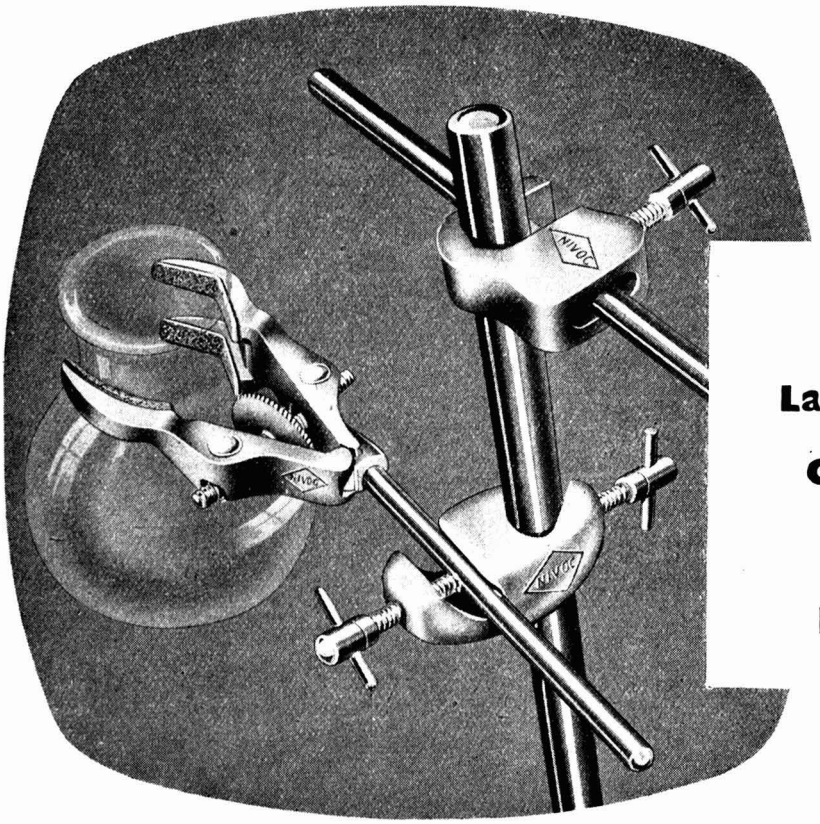
Nitrobenzene.—Spot, 9¼d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—2s. per lb.

***o*-Toluidine.**—1s. 7d. per lb., in 8/10-cwt. drums, drums extra.

***p*-Toluidine.**—5s. 6d. per lb., in casks.

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



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W101

Chemical & Allied Stocks & Shares

STOCK markets have been more active and share values, particularly in the industrial sections, moved in favour of holders. Continued hopes that the Budget will bring some reduction in taxation helped sentiment and was largely responsible for the further rise shown in British Funds. The City is assuming that Government expenditure and subsidies are likely to be reduced in order to make lower taxation possible. It is realised that in any case no big reduction in taxation is likely, but there is a widespread belief that even small concessions would have a big psychological effect on industry. It is also being suggested that Mr. Butler may bring forward a plan for lowering taxation on profits earned in export markets.

In recent weeks there has been an unusual crop of news and rumours of company mergers and take-over offers. Many of these are based on the knowledge that current share prices are much below the break-up value of the shares based on the present day value of assets, which incidentally is much in excess of the figures at which they are carried in most company accounts. Moreover, as a move to offset possible take-over offers, the directors of some companies have started a more generous dividend policy with a view to raising the market price of the shares.

Imperial Chemical at 46s. have been prominent in the better trend in stock markets, but have not held best levels touched recently. The market continues to expect the I.C.I. dividend to be kept at 13 per cent, and there is renewed talk that the company may make a fresh application for permission to distribute a share bonus.

Chemical shares generally have only participated to a limited extent in the better trend in stock markets. This is because of general recognition that earnings in many sections of the industry are now running well below the high levels recorded a year ago. Competition both at home and abroad is becoming much keener. Monsanto 5s. units were 23s. 9d. after touching 24s. 3d., Reichhold Chemical 5s. shares eased from 8s. 6d. to 8s. 1½d., but Eaglescliffe Chemical 5s. shares were steady at 16s. 9d., Fisons at 32s., though Laporte Chemical 5s. shares have come back to 10s. 7½d., at the time of writing, awaiting details of the company's new issue plan, which is expected to be a big placing of debentures.

Borax Consolidated at 37s. 7½d., have been active on market talk of higher dividend possibilities. William Blythe 3s. shares changed hands around 9s. 6d., Brotherton 10s. shares at over 22s. and Greeff-Chemicals Holdings 5s. shares around 17s., Albright & Wilson 5s. shares have risen further to 16s. 9d. in anticipation of the financial results. On the other hand, following the reduction in the interim dividend, British Glues and Chemicals 4s. ordinary shares fell to 8s. 3d., and the participating preference shares to 28s. 9d.xd., British Xylonite were 27s., British Industrial Plastics 2s. shares 4s. 6d., while following the announcement regarding payment of the preference dividend, Erinoid 5s. shares have improved and changed hands up to 5s. 3d., United Molasses were better at 30s., the 4s. units of the Distillers Co., 16s. 10½d., Turner & Newall strong at 104s., Unilever 47s., while Boots Drug 5s. shares were 20s. 6d., and Sangers 5s. shares 15s. 3d.xd. Among oils, the premium on Anglo-Iranian new debentures narrowed to 46s. 3d., but the shares have improved to £5 15/16, while Shell were 77s. 6d., and Trinidad Leaseholds 5s. shares 27s. 9d.

Factory Extensions

Further additions now being made to the Marchon Products chemical plant at Whitehaven involve an extension of some 36,000 square feet. The plant is already one of the biggest factories in the county and the three new schemes now under way will still further expand production. The new building will tie up with the firm's subsidiary company, Solway Chemicals Ltd., who are to process sulphuric acid for anhydrite which is to be mined within a few hundred yards. The driving of a drift for the mining of anhydrite has already begun, and it is estimated that when the processing plant is in full operation Marchon products will be independent of outside sources for its supply of sulphuric acid.

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.

ASSISTANT ENGINEER required by Chemical Engineering Firm in London. Qualifications required are: Age up to 30; B.Sc. or equivalent; good knowledge of physics and heat transfer essential; good mathematics; understanding of chemistry desirable; practical Works' experience essential; understanding of general office procedure and technical sales an advantage. The position offers excellent opportunities to a man having these qualifications coupled with a keen business outlook. Write stating age, qualifications, salary required to Box No. **C.A. 3195, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

SENIOR SCIENTIFIC OFFICERS; SCIENTIFIC OFFICERS; PATENT EXAMINER AND PATENT OFFICER CLASSES. The Civil Service Commissioners invite applications for permanent and pensionable appointments to be filled by competitive interview during 1953. Interviews will continue throughout the year, but a closing date for the receipt of applications earlier than December, 1953, may eventually be announced. The Scientific posts are in various Government Departments and cover a wide range of Scientific research and development in most of the major fields o fundamental and applied science; in Biology the number of vacancies is small. The Patent posts are in the Patent Office (Board of Trade), Admiralty and Ministry of Supply.

Candidates must have obtained a university degree with first or second class honours in an appropriate scientific subject (including engineering) or in Mathematics, or an equivalent qualification; or for Scientific posts, possess high professional attainments. Candidates for Senior Scientific Officer posts must in addition have had at least three years' post-graduate or other approved experience. Candidates for Scientific Officer and Patent posts taking their degrees in 1953 may be admitted to compete before the result of their degree examination is known.

Age Limits: Senior Scientific Officers, between 26 and 31; for Scientific Officers and Patent Classes, between 21 and 28 during 1953 (up to 31 for permanent members of the Experimental Officer class competing as Scientific Officers). London Salary Scales: Senior Scientific Officers, (men) £812-£1,022; (women) £681-£917; Scientific Officers, (men) £440-£707; (women) £440-576; Patent Examiner and Patent Officer Classes, (men) £440-£655; (women) £440-£576. Somewhat lower rates in the provinces.

Further particulars from the **CIVIL SERVICE COMMISSION, SCIENTIFIC BRANCH, TRINIDAD HOUSE, OLD BURLINGTON STREET, LONDON, W.1,** quoting No. S53/53 for Senior Scientific Officers and S.52/53, S.128/53 for the other posts.
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5—Johnson **FILTER PRESSES,** 24 in. square, side feed and enclosed delivery, fitted 29 plates and 30 frames.

1—Johnson **FILTER PRESS,** 36 n. square, plate and frame type, double inlet and enclosed delivery ports.

Johnson Oil **FILTER PRESS,** Premier type; plates 2 ft. 8 in. by 2 ft. 8 in., of which there are 45, with angle lever closing gear.

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1—24 in. **HYDRO EXTRACTOR,** self balancing, swan-neck type, self emptying bottom.

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Bennett Copper-built **EVAPORATOR,** 4 ft. diam. by 4 ft. 6 in. high, steam-jacketed bottom, mounted on legs, with swan-neck vapour pipe and separate vertical belt-driven vacuum pump.

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4 **SIFTER MIXERS** by Young, M.S. mixing trough 64 in. by 21 in. by 22 in. deep. Blending chamber feeds material to positive action brush sifter. Fast and loose pulley drive.

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Gardner **SIFTER MIXER,** trough 60 in. by 19 in. by 20 in. brush sifter. Spiral type agitator, motorised 440/3/50. Bottom slide discharge.

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THE Proprietors of Patent No. 613,106, for **"IMPROVEMENTS IN OR RELATING TO POLYHYDRIC PHENOL-ALDEHYDE RESIN ADHESIVES,"** desires to secure commercial exploitation by Licence or otherwise in the United Kingdom. Replies to **HASELTINE LAKE & CO., 28, SOUTHAMPTON BUILDINGS, CHANCERY LANE, LONDON, W.C.2.**

THE Proprietors of British Patent No. 632533 for **"IMPROVEMENTS IN OR RELATING TO CORROSION INHIBITION,"** desire to enter into negotiations with a firm or firms for the sale of the patent or for the grant of licences thereunder. Further particulars may be obtained from **MARKS & CLARK, 57 and 58, LINCOLN'S INN FIELDS, LONDON, W.C.2.**

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