Chemical Age

B.A. ANNUAL MEETING AT CARDIFF

(page 385)

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10 September 1960

WEEKLY NEWSPAPER OF THE CHEMICAL INDUSTRY

INDEX TO ADVERTISERS

The first figures refer to advertisements in **Chemical Age Directory & Who's Who,** *the second to the current issue*

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INDEX TO ADVERTISERS

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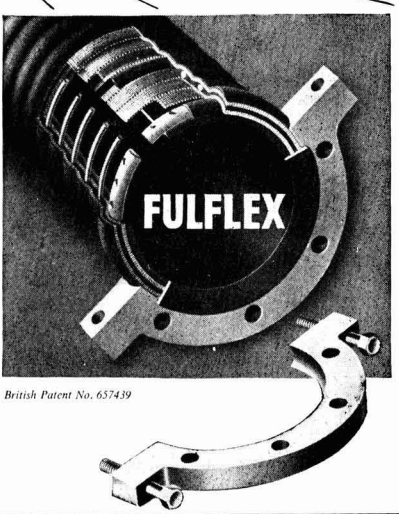

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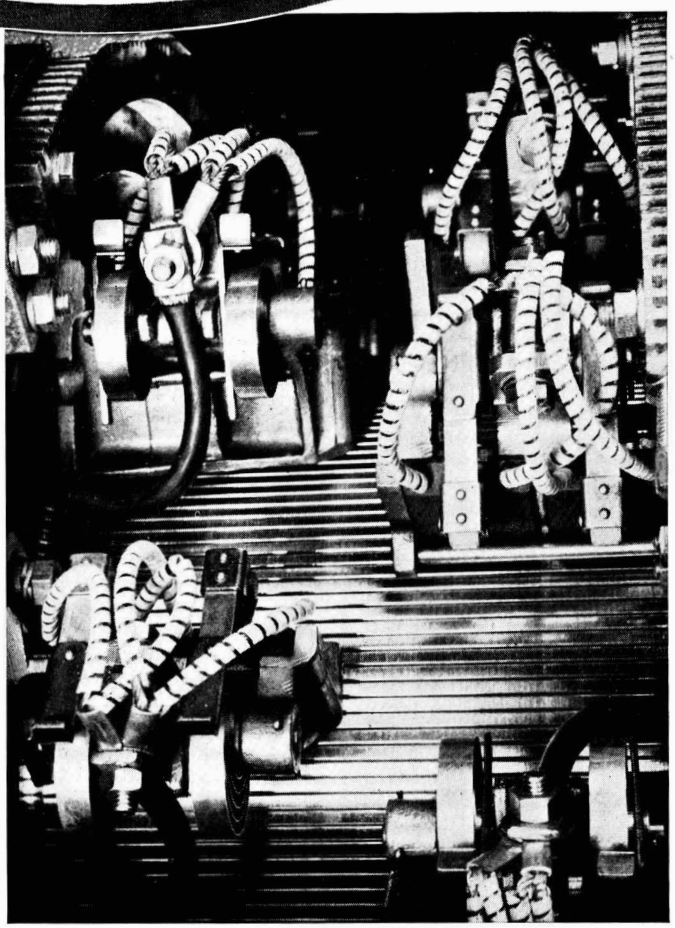

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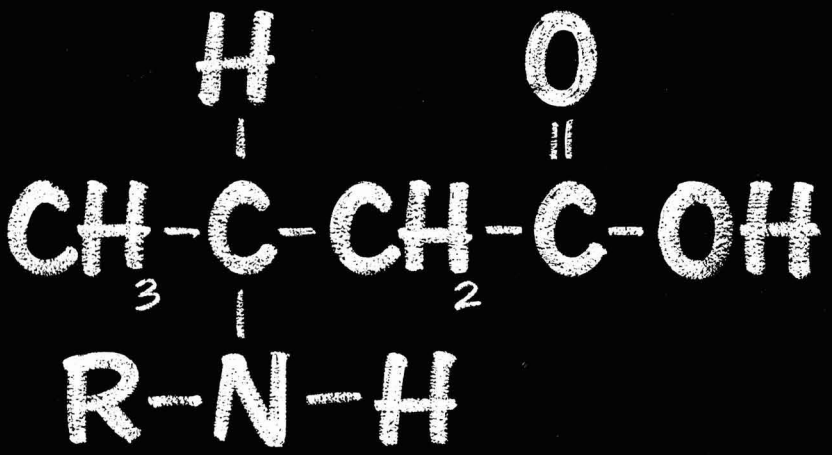

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IN THIS ISSUE

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CHEMICAL AGE

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A FUTURE FOR BROMINE

DEMAND for bromine appears to have increased in Britain as well as throughout the world, leading to general shortages, particularly on the Continent. In fact, there is evidence that production is now nearing capacities and even U.S. users are reportedly importing large quantities from Israel, while one U.S. producer, Michigan Chemical, seeing substantial growth ahead, are doubling the size of the 5 million lb./year plant that they own jointly with the Murphy Corporation.

Despite this situation, which gives promise of continued growth, our U.S. contemporary, *Chemical and Engineering News* (1960, **38**, No. 35, p. 28), believes that bromine is reaching the end of the growth period. Main reason for this belief is uncertainty concerning the future of the halogen, ethylene dibromide (EDB), as a lead scavenger in antiknock compounds, a use that accounts for about 80% of total bromine output, both in the U.S. and in this country.

The U.S. Bureau of Mines estimates 1959 sales of bromine and bromine compounds by major U.S. producers at 231 million lb., equivalent to 195 million lb. of elemental bromine. The 1959 figure is 11% higher than the 1958 sales and equal to the 1956 sales, a record year. A 3% to 4% increase on 1959 is expected this year.

Each pound of tetraethyl lead takes 0.29 lb. of EDB, while 1 lb. of TEL in aviation fuel takes twice as much. Last year in the U.S., antiknock fluids used about 167 million lb. of EDB (bromine content 140 million lb.). Main reason for the decline in TEL concentration is due to catalytic reforming, which takes fuel of low antiknock quality, catalytically treats it and produces high octane petrol and petrochemical feedstocks. U.S. reforming capacity accounts for about 20% of the total crude capacity.

Between 1956 and 1958, TEL consumption in the U.S. fell by 14%. Since then, TEL has held its own. It is expected that tetramethyl lead (TML) will take from 20% to 50% of the TEL market in America, but this would not greatly affect sales of EDB. In the long run, it is expected that developments in engine technology, including the development of the gas turbine engine, might well drastically affect the position.

The second major outlet for EDB is in the agricultural field, particularly for use on tobacco crops, where consumption of the halogen is increasing. Total U.S. consumption of EDB is expected to rise from 135 million lb. this year to 154 million lb. by 1965.

Production of methyl bromide is expected to expand continually in the coming years, particularly for use as a fumigant and seed dressing. Photography and the pharmaceutical industry are seen as expanding users of inorganic bromides.

Another developing and large scale use for bromine is believed to be in swimming pool sanitation, where the market is now largely held by chlorine. U.S. bromine producers point out that their halogen has many advantages over chlorine. Bromine is non-irritating to mucous membranes; the treated water is odourless and taste-free; bromine kills *bacillus coli* more effectively than chlorine, sodium hydrochlorite, chloride of lime or iodine. Bromine requires no pressure equipment and brominators cost as

little as $100, considerably less than chlorine feeders. Bromine also stays in solution longer and less is used with resultant savings.

At present U.S. producers are in the midst of a publicity campaign to bring bromine to swimming pool owners in tablet form and in combination with quaternary compounds that combat algae and slime formation (*Oil, Paint and Drug Reporter,* **177**, No. 15, p. 3).

Potential uses for bromine as an intermediate in chemical synthesis are numerous, although in this respect bromine, while more reactive than chlorine, has been neglected—probably on account of the price position. Bromination clearly calls for an integrated process if only because the by-product aqueous HBr must be upgraded. Many companies have found it much cheaper to use the services of a specialist firm that can provide the bromination process, rather than to do it themselves.

The only bromine producer in the U.K., the Associated Ethyl Co. Ltd., have an annual capacity of 50 million lb. Their plants are based on production from sea water. Associated Ethyl's main interest, of course, is in the production of the halogen ethylene dibromide for they are also the only U.K. producers of TEL.

Bromine is imported into the U.K. from the Dead Sea Works, Israel, whose capacity this year is expected to reach an estimated 8 million lb. of elemental bromine. U.K. imports from Sodom approach 2.25 million lb./year; U.K. consumption of bromine, other than for EDB, is estimated at 7.5 million lb./year.

There are some 100 users in the U.K., the largest being F. W. Berk and Co., who use bromine as an intermediate and who opened their large Sandwich plant three years ago; May and Baker, for the production of potassium bromide; I.C.I., whose Dyestuffs Division uses large quantities in the production of dyes; and Chemical Compounds. It is estimated that about eight of the users account for some 90% of the total consumption.

With rising production of TEL and all-round increases in the other uses of bromine in this country, there seems to be every expectancy that consumption will continue to expand in the next few years. Certainly there is no support for the U.S. view that bromine can no longer be regarded as a growth product.

WORLD FOOD PROBLEMS

NEEDS of the less developed countries so far as increased food production is concerned were put into perspective at the symposium on world food and population held in connection with the British Association annual meeting at Cardiff on Monday.

Dr. Norman Wright, deputy director-general of the U.N. Food and Agriculture Organisation, pinpointed the vast problem. If the world population reaches 6,000 million by the year 2000 as the United Nations has forecast, then the world cereal production will have to be raised more than 100% and production of animal products by between 200 and 300%. And at least half the population of the world is today either undernourished or malnourished.

The big increase in world population is a dilemma created by medical science in overcoming so many of the potentially fatal diseases. It is now up to agricultural scientists to find the remedies.

A big part of finding the solution lies with the world's chemical industry and at a meeting earlier in the B.A. programme, Dr. H. L. Richardson of I.C.I.'s Central Agricultural Control said that the production of food crops could be doubled without increasing the area sown in most underdeveloped countries by using fertilisers and other techniques immediately available.

Dealing more specifically with the chemical problems involved, Sir Alexander Fleck, F.R.S., a B.A. past-president, pointed out that just as people were starved of food, so most crops were starved of those essential elements—nitrogen, phosphorus and potassium. Although production of fertiliser nitrogen now runs at 10 million tons a year, the fixation of nitrogen ranks as one of the most under-exploited discoveries of all times, having regard to its potentialities for promoting human wellbeing. Present consumption in the Far East totals less than 2 million tons a year, but an extra 7 million tons in that area would achieve a vast improvement in general social conditions, as well as greatly increased food availability.

It has been estimated that fertiliser nitrogen likely to be needed to maintain food supplies for the population of 6,000 million expected by the end of this century would range from 30 million to 60 million tons a year. In fact Sir Alexander rightly pointed out the need for more fertiliser and more water is now much more urgent than that for labour-saving equipment; until there is sufficient alternative employment in factories, the saving of agricultural labour would create more problems than it solved.

The lesson for the West is not to thrust undiluted western techniques of mechanisation on primitive smallholdings, but to help in evolving new and simple tools appropriate to the conditions in which they will be used. The biggest contribution that the West can make is in the provision of scientists and technologists to tackle the problems of undernourishment.

U.S. POLYISOPRENE LICENSING

UNDER the terms of the consent decree issued by the U.S. Court for the District of Columbia, which terminates a legal action filed by the U.S. Government against the B. F. Goodrich Co., Goodrich-Gulf must grant non-exclusive licences to other manufacturers to make *cis*-1,4-polyisoprene using a titanium-based Ziegler catalyst at a royalty of 2.5% of sales. Goodrich-Gulf are 50% owned by B. F. Goodrich and 50% by Gulf Oil.

The joint company will be able to charge $100,000 in cash when they grant a licence and another $100,000 to $200,000, depending on the size of the plant, when construction begins. Both cash payments are creditable to future royalty payments.

The Government suit was based on a research contract between B. F. Goodrich and the Government. Under the contract, Goodrich were to study the preparation of rubberlike polymers of butadiene and its homologues and to grant the Government and participants in the synthetic rubber programme a royalty-free licence to use the resulting information.

One of the interesting questions now being posed is whether the Goodrich-Gulf patents pending on polyisoprene, if issued, will cover polyisoprene made with a lithium catalyst and if so whether manufacturers using a lithium catalyst would be subject to infringement suits. Firestone Rubber, whose polyisoprene process uses a lithium catalyst, expect to complete their polydiene plant about the end of this year.

Goodrich-Gulf have already announced that they are to start a programme for granting licences to producers in the U.S. and Canada and on Monday this week, Dr. R. V. Yohe, president of B. F. Goodrich (Canada) said that production under licence, now possible in Canada, would mean that that country could be entirely independent of natural rubber imports. Nearly two-thirds of Canadian rubber consumption is synthetic; polyisoprene could now replace the imported natural product.

It seems that the stage may be set in the U.S. for a series of lawsuits before the patent rights on polyisoprene and polybutadiene are finally settled.

Project News

I.S.R. PLANT PRODUCES LATEX OF OVER 62% SOLIDS

USING a special process, International Synthetic Rubber Co. Ltd. are now producing high solids S.B.R. (styrene-butadiene rubber) latex at Hythe, Southampton, in the first large-scale plant of its kind in the U.K. The plant, which came on stream about four months ago, is at present producing about 3,500 tons/year but this figure may be doubled by the end of this year.

Synthetic rubber latex with a low solid content is produced as part of the process for the manufacture of solid S.B.R. at International Synthetic Rubber's big plant at Hythe—Britain's first plant for the full-scale production of general-purpose S.B.R.—which was commissioned towards the end of 1958. In the new process, this low-solids latex is concentrated to a latex of over 62% solids.

Applications

This material, although designed principally for the manufacture of foam rubber, is also finding considerable application in other fields, such as carpet backing, the impregnation and coating of board and other fibres, and in a wide range of dipped goods and adhesives.

In the last two years S.B.R. latices have begun to be available in bulk outside the U.S.A. where 60/40 S.B.R./natural rubber blends are common and 100% S.B.R. is not unusual in latex foam manufacture. The advent of stable and cheaper S.B.R. latex has enabled manufacturers to maintain steadier production costs than was possible when they were dependent upon the erratic price of natural latex and further experience in the use of S.B.R. latices will undoubtedly allow greater proportions to be used and consequently encourage a more competitive latex foam price structure.

The U.K. consumption of S.B.R. latex in 1959 was under 1,000 tons, but it is estimated that this will be running at a rate of more than 5,000 tons by the end of 1960 and, for the reasons mentioned above, there is every prospect that it will now take a much larger share of the 27,000 tons of latex being used annually in the United Kingdom.

In an announcement concerning the new plant, I.S.R. state:

"The production of high solids latex in the U.K. by the International Synthetic Rubber Co. Ltd. will give to manufacturers of latex foam and to other industries where this material is gaining ground the guarantee of high quality material produced at a stable price, as well as the assurance of delivery."

Leading manufacturers of latex foam products who have expressed satisfaction with the new development include Vitafoam Ltd., who confirm that production of synthetic latex at Hythe will help to stabilise the wide variations in natural latex prices which have plagued the industry hitherto. Vitafoam will be using a blend of I.S.R. and natural latex as a solution to this problem (see 'Distillates', p. 384).

Other projects, besides those concerned with synthetic latex production, are under way at Hythe. The plant which initially cost £6 million to build and equip, and which draws butadiene from the nearby Esso refinery at Fawley and styrene from British Hydrocarbon Chemicals' plant at Grangemouth, Scotland, started with a capacity of 70,000 tons/year of S.B.R. rubber. Current production is in the region of 85,000 tons/year, and as stated in CHEMICAL AGE, 30 January, p. 197, this is being expanded to 90,000 tons by the end of the year.

Marchon to Raise Fatty Alcohol Output by 50%

● AN extension to the fatty alcohol plant of Marchon Products Ltd., at Whitehaven, which will increase capacity by more than 50%, is announced by Mr. Frank Schon, chairman. The Marchon plant, which is the only hydrogenation unit in the U.K. making higher molecular alcohols, has been in production in the C8/C18 range of fatty alcohols for some years and the new extension, due to come into operation before the end of 1960, has been designed to meet a steadily increasing demand for fatty alcohols.

● THREE induced-draught cooling towers are to be supplied for the new Spencer works of Richard Thomas and Baldwins Ltd. by Head Wrightson Processes Ltd., a subsidiary of Head Wrightson and Co. Ltd. These towers, which have a total capacity of over 1.8 million gall./hr. of water, will be used for supplying cooling water to the hot and cold strip mills for the finishing section of the plant. The towers, which will be built to a special design developed by Head Wrightson and John Laing and Son Ltd., will incorporate, as a new feature, Polygrid high efficiency plastics packing.

● CONSTRUCTION work on the Orlon acrylic fibre plant being built by Du Pont de Nemours (Nederland) N.V. in Holland continues on schedule. Concrete foundations of all areas are essentially complete, and steel and brick work has begun. At present about 650 people are working on design and construction. At the peak of construction about 1,000 people will be employed. The plant is expected to be ready for operation in the latter part of 1961, and will have an initial production capacity of approximately 15 million lb. of Orlon a year. It will employ about 400 people when completed.

● TWO complete, automatic, base-exchange water treatment plants are to be supplied by William Boby and Co. Ltd. for two sugar beet factories to be built in Russia by Vickers and Bookers Ltd. Value of the water treatment plant contract is £7,000.

● PLANS have been approved for a redevelopment scheme at the Antimony Works, Stephenson Street, Wallsend, for Associated Lead Manufacturers Ltd.

I.C.I. Get Exclusive Montecatini Licence to Produce Polypropylene Fibres

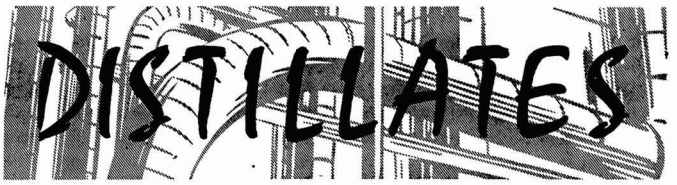
A PATENT licence agreement for the exclusive production in the United Kingdom of staple fibres, filament yarns and textile monofilaments from polypropylene has been signed in Zurich between Imperial Chemical Industries Ltd. and Montecatini of Milan, Italy. This is the outcome of negotiations which started last year (see CHEMICAL AGE, 19 September 1959, p. 341).

I.C.I. are already licensed by Montecatini to produce polypropylene for use as a plastics material and the I.C.I. plant to make 10,000 tons a year of this polymer will come into operation at Wilton later this year. Shell Chemical Co. also have a licence to make Montecatini polypropylene polymer and their plant at Carrington is expected to come on stream next year.

Montecatini's development of polypropylene fibres has been based on the researches of the Italian scientist, Prof. Giulio Natta, and of the company's own research workers. Montecatini are confident of the bright future for polypropylene fibres, although they do not regard them as competitors to Terylene, which Montecatini produce under licence from I.C.I. Produced in Italy by Polymer S.A., a Montecatini subsidiary, under the trade name Meraklon, polypropylene fibres are of high strength and durability, and very light in weight. Alone, or in combination with other textile fibres, they are expected to find uses in clothing, carpets, household textiles, rope-making, etc.

Pay Rises for Workers in Chemical Industry

An increase of 2¼d in the minimum hourly rate has been agreed between the Association of Chemical and Allied Employers and the union representing maintenance craftsmen employed by association members. This agreement follows a rise of 2¼d an hour for production workers in the industry.



★ In securing a patent licence agreement with Montecatini for the exclusive production in the U.K. of polypropylene fibres and filaments (see page 383), I.C.I. seem to have stolen a march on Shell, the other U.K. company who already have a licence from Montecatini to manufacture polypropylene as a plastics material. As it is, Shell's polypropylene plastics plant at Carrington is not likely to come into operation until some months after that being built by I.C.I. at Wilton, giving I.C.I. an important start in the development of the market for polypropylene in this country. The ability to offer the fibre forms as well will considerably strengthen I.C.I.'s hand.

More important, in view of the doubts that, because of the price, have been expressed in the market for polypropylene generally, I.C.I.'s new move can be seen as an act of faith—backed up, I have no doubt, by some very shrewd and well-informed reasoning. Certainly, if the company can manage to exploit new fields of application for polypropylene fibres in yarns, e.g. in clothing, carpets and household textiles as well as in industrial applications, considerable benefits should accrue as regards both the economics of production and the eventual market price.

It is worth noting that British Celanese, the Courtaulds subsidiary, have been producing a polypropylene fibre, using a Courtaulds process, at Coventry since early 1959. While no production figures are revealed for these fibres, which are sold under the Courlene trade name, it would seem that they still have a long way to go before they can be marketed on a scale to compete with Terylene, nylon and other established materials.

★ I was particularly interested in the paper that Dr. Ernst B. Chain, F.R.S., head of the Department of Biochemistry at the Italian State Institute of Public Health, presented at the British Association annual meeting on Monday. Readers will recall that Dr. Chain will be returning to this country shortly to take up the chair of biochemistry at the Imperial College which has been endowed with a £350,000 grant from the Isaac Woolfson Foundation for the building and equipment of laboratories for biochemistry and chemical microbiology.

Dr. Chain is famed for his pioneer work on penicillin and more recently in collaboration with Beecham Research Laboratories, the synthesis of penicillin. He spoke on recent advances in biochemistry which had made possible the production by the ton of drugs of vital importance to gynaecology and surgery. He described the successful attempts to produce the alkaloid class in cultures in the same way as penicillin. Among these is ergot, now widely used in childbirth to contract the womb.

Dr. Chain expected the next 10 years to produce remarkable results in mass tissue culture, producing such things as hormones. He added that if Britain soon had the large-scale facilities necessary for microbiological research, this country stood a good chance of regaining its lead in biochemistry.

★ Key to the production of gypsum chemically is the removal of free phosphoric acid during manufacture. This has been achieved by the Barrett Division of Allied Chemical, thus eliminating the corrosion of equipment which in previous attempts to make chemical gypsum has caused discoloration. Allied Chemical do not, however, reveal how acid is removed.

Ground has been broken for the company's new 'chemical gypsum' plant at Claymont, Delaware. When completed in September 1961, the new plant will have an initial capacity of 25 million lb./year, or enough to provide gypsum board for 32,000 homes. The new gypsum is said to be identical to that made from natural ore and allows better control of board hardness.

★ News of a venture by the London Section, Royal Institute of Chemistry, which promises to be of considerable service in bringing the achievements of chemists to a wide audience reaches me from Dr. Tom Dewing, of Burroughs Wellcome and Co., hon. recorder.

The section has arranged a series of popular lectures on subjects to which chemists have made important contributions. The lectures are intended mainly for audience of local residents, who will not necessarily need a scientific background to appreciate them.

Two of the lectures so far arranged are on subjects of wide popular interest —photography and detergents. The first, that on 'Modern colour photographic processes', will be given by Mr. R. B. Collins at the Goldsmith's College on 26 October at 7 p.m. The second, on 'Detergents', will be given by Dr. Kenneth Pankhurst at Hendon Technical College on 29 March at 7.30 p.m. Both speakers deserve the full support of chemists living in the vicinity.

★ Production of synthetic latex in the U.K., as has now been started by the International Synthetic Rubber Co. Ltd., at Hythe (see p. 383) is an inevitable development, since it appears that the expanding latex foam market will soon outrun natural supplies. Thus, the market in latex foam mattresses is growing from 5% of total bedding sales toward the 10% share taken by latex foam mattress makers in the U.S. The motor industry is also taking increasing quantities of latex foam while the furniture industry makes further big demands.

The prosperity of the industry may be judged by the progress of one of the largest producers of latex foam in Britain and Europe—Vitafoam Ltd., formed in 1949 and still expanding. With new facilities coming along the company expect to double their output within the next five years.

Vitafoam testify to the quality of the new synthetic latex from the I.S.R. plant at Hythe; they have discovered that a blend of this synthetic latex with natural produces improved foams more resistant to light and with better ageing characteristics. The combination also produces foam of a more even quality and results in fewer factory rejects. I learn that foam produced with 25% of the man-made latex has already met specifications of the Society of Motor Manufacturers and Traders.

★ Prophecy that a further vigorous expansion will take place in the British silicones industry for many years to come was made at the British Association annual meeting at Cardiff on Tuesday, by Dr. R. A. Gregory, managing director of Midland Silicones. In the short space of 10 years this industry (Midsil and I.C.I. Nobel Division) has grown from nothing to a multi-million pound venture employing 1,000 people. World production of silicones is put at about 20,000 tons a year, worth some £40-50 million.

Dr. Gregory has been in silicones since they were first made in this country. He qualified both as a physical chemist and as a chemical engineer at King's College, London, joining the research department of Albright and Wilson in 1937. He paid his first visit to the silicone plant of Dow Corning in Midland, Mich., in 1959. The following year Midland Silicones were set up as a joint enterprise by A. and W. and Dow Corning to manufacture these products in Britain. Production at Barry started in 1952 and this site has grown to be Europe's largest silicone manufacturing plant.

Throughout the world a large amount of research work is in progress on the production of new and improved types of silicones. Some of these have already completed their laboratory trials and are in small scale production. Many more are in various stages of development.

Alembic

British Association Annual Meeting

Cardiff Registrations Top 4,000, 25% Higher Than at York Meeting

REGISTRATIONS at the Cardiff annual meeting of the British Association for the Advancement of Science topped the 4,000 mark, 25% up on the meeting at York last year. This big increase was attributed to the keen interest in the papers and visits on the part of students.

Chemistry meetings—those held under the chairmanship of Dr. James Taylor, M.B.E., president of Section B—were, like those of other sections, well attended and on a number of occasions members who did not arrive early enough were disappointed at not being able to enter already crowded meeting rooms.

The presidential address by Sir George Thompson, F.R.S., 'The two aspects of science', and the address by Dr. Taylor on 'Chemistry is not enough', or 'The increasing scope of scientists' work in chemical industry' were referred to in the leading article last week.

Highlight of the meeting was the all-day symposium on 5 September on world food and population held in the Sophia Gardens Pavilion and attended by about 2,000 members. Papers in this session included: 'The current food supply situation and present trends', by Dr. N. C. Wright, C.B., deputy director-general, Food and Agriculture Organisation; 'Industrial and technological needs', by Sir Alexander Fleck, K.B.E., F.R.S., B.A. past-president; and 'Science and food production', by Dr. H. D. Kay, C.B.E., F.R.S., Professor Emeritus, Reading University.

So far as chemist members were concerned another highlight proved to be the evening discourse on 5 September on 'Microbiological methods in the development of drugs', given by Dr. E. B. Chain, F.R.S., Professor of Biochemistry, Instituto Superiore di Sanita, Rome. Also on 5 September, Dame Kathleen Lonsdale, D.B.E., F.R.S., Professor of Chemistry and Head of the Department of Crystallography, University College, London, received an Hon. D.Sc. (Wales) at a degree ceremony held in City Hall, Cardiff.

Section B events started on 31 August with a tea for young chemists in the Chemistry Department of the University. This was followed by Dr. Taylor's presidential address on 1 September. Local secretaries for the chemistry section were: Dr. A. R. Pinder, Department of Chemistry, University College, Cardiff, and Mr. R. F. Stephens, Newport, Mon.

Other chemistry section papers were given as follows:

1 September: 'Technical development of a new product—polythene', by Dr. E. Hunter, research director, I.C.I. Alkali Division; 'Commercial development of a new product—epoxide resins', by P. J. March, manager, Industrial Chemicals Division, Shell Chemical Co. Ltd.

2 September: Symposium on current work on polymer chemistry with an address by Professor C. E. H. Bawn, C.B.E., F.R.S., Grant Brunner Professor of Inorganic and Physical Chemistry, Liverpool University; 'Some new stereo-regular polymers', by P. R. Thomas, British Nylon Spinners Ltd.; 'The graft polymerisation of styrene on to pre-irradiated polyethylene', by Dr. T. T. Jones, Monsanto Chemicals Ltd.; 'Modern aspects of polymer structure and its relation to properties', by J. L. B. Benton, British Geon Ltd.; 'The mechanism of polymerisation reactions catalysed by ionic catalysts', by Professor A. G. Evans, Professor of Chemistry, University College, Cardiff.

6 September: 'The industrial application of silicones', by Dr. J. Bell, engineering and technical director, I.C.I. Nobel Division; 'The formation reactions of high-molecular polyorganosiloxanes', by Professor K. A. Andrianov, Moscow Energetics Institute; 'The commercial production of silicones', by Dr. R. A. Gregory, managing director, Midland Silicones Ltd.

Chemistry section's works visits included those to Midland Silicones Ltd., Barry; I.C.I. Billingham Division, Dowlais; Monsanto Chemicals Ltd., Newport; Plastics Group, Distillers Co. Ltd., Sully, research and development laboratories.

Papers in other sections included: 'Food preservation and sterilisation of medical products by irradiation', by F. J. Ley, Wantage Radiation Laboratory (Section A); 'Current research on control of fruit pests', by Dr. G. H. L. Dicker and R. C. Muir, East Malling Research Station (Section D); colloquium on organisation and financing of research in biochemistry and allied medical sciences (Section I); 'What fertilisers could do to increase world food production', by Dr. H. L. Richardson, I.C.I. Central Agricultural Control (Section M).

Shell Chemical Manager Describes Commercial Development of Epoxides

COMMERCIAL development of epoxide resins in the U.K. paint industry, the subject of a paper by Mr. P. J. March, manager of the Industrial Chemicals Division of the Shell Chemical Co. Ltd., was almost painfully slow. But over the last few years the annual rate of sales increase had been extremely rapid, resembling the growth rate of some of the faster-moving thermoplastics. Mr. March's paper followed that given by Dr. Hunter at the Section B meeting on 1 September.

These new products became available about 10 years ago in sufficient quantities to claim the interest of paint producers in the U.K. Based on pilot plant quantities, applicational techniques were evolved which showed that the epoxide resins led to paint films with exceptional toughness, flexibility and adhesion, combining a high degree of chemical resistance. The first step was to determine whether or not Shell Chemical should construct plant for commercial development.

The development price was about 10s a lb. compared with about 2s 6d a lb. for a good alkyd resin. In addition, some formulations required novel applicational techniques, while certain stoving compositions were only satisfactorily applied at temperatures in excess of those generally met with in industry.

Potential applications both in stoving and non-stoving finishes were considered in detail in order to form the basis for an appraisal of the market. At the development price of 10s it was evident that only small sales would develop, limited to those outlets where no other resin could perform adequately. At 8s it was felt that a more rapid sales build-up would be achieved, but that the major potential in can and drum coatings could not be exploited. However, at 6s there was good reason to believe that this and many other outlets, including that of the domestic equipment field, would be opened up.

Main objective set by the survey was the stepping up of sales and the support of commercial production at the rate of millions of pounds weight a year. The manufacturing side set themselves the task of making the resins at such a cost that a selling price of 6s/lb. would look profitable. The technical service and research laboratories were asked to improve applicational techniques, formulations, manufacturing processes and the products themselves.

The marketing side to achieve the objective, prepared a nine point plan: press publicity on commercial production; trade and technical Press advertising; displays at exhibitions; staff needs in head office; future staff needs in sales regions; staff training; timing and disposition of sales effort; method of allo-

cating limited supplies of resin; clarification of patent position.

The patent situation was liberalised for end-users in July 1955 by a cross-licensing arrangement between CIBA (A.R.L.) Ltd., and Shell Chemical, giving each company's customers freedom under their own and the other company's patents in the surface-coating field.

The commercial plant came into operation in September 1955, but by mid-1956 it was evident that sales were not building up as rapidly as had been anticipated. This called for a reappraisal leading to the setting of new objectives. A modified plan was drawn up and implemented by organising, co-ordinating and finally controlling.

Mr. March stressed that commercial development was not static. It required continual appraisal and plans might have to be modified from time to time. The cycle of events was: appraise, set objectives, plan, organise, co-ordinate, control and back to appraisal, etc.

Technical Development of I.C.I.'s H.-P. Polythene Process

DEVELOPMENT of the I.C.I. high-pressure process for polythene, now used in the production at home and abroad of about 100,000 tons of polythene a year, was described by Dr. E. Hunter, research director of I.C.I. Alkali Division, in his Section B (chemistry) paper at the British Association annual meeting at Cardiff on 1 September. The paper was entitled 'Technical Development of a new product—polythene'.

He said that the methods evolved in the development of polythene from 1936 when plans were made for semi-technical plant to the middle war years when full-scale production was established were now used in plants in many countries. Development work aimed at providing larger quantities of polythene for user trials; to fix on a process for economic full-scale production; and to assist in finding how users could best process the product.

The polythene process could be described as simply compressing ethylene of suitable composition to pressures between 1,000 and 2,000 atmospheres, bringing it to reaction temperature—in the neighbourhood of 200°C—and then separating the product. There were unusual circumstances; the raw material was a gas, exceptionally pure by industrial standards, the pressure was far higher than in other chemical processes, the reaction was explosively unstable, and the product did not behave in the users' fabricating machinery in just the same way as existing thermoplastics.

In the collaborations which overcame those difficulties, the chemist's part was at times a major one and at times a minor one, but seldom one of isolation. He had not merely to advise from his knowledge, extended by experiment where data were lacking, but also to be active in deciding what new data would be of most help in enabling sounder judgments on important problems, and in making others aware of the minimum chemical requirements of the process. In collaboration with engineers his fundamental knowledge of physics and chemistry aided surer design, for he could help to check that the principles of the proposed design methods were applicable to the novel circumstances of the polythene reaction.

Ethylene. The semi-technical plant adopted the industrial process in which ethyl alcohol is dehydrated on passing through heated tubes containing coke impregnated with phosphoric acid. Modifications were introduced to obtain ethylene with sufficiently low concentrations of aldehyde, ether, hydrogen and carbon monoxide—all undesirable impurities. Rather than attempt to remove oxygen from the product gas, it was found simpler to keep it down to a few parts per million by taking stringent precautions to prevent its ever entering any part of the system.

Petroleum seemed a more attractive source, even before the war, but it had then been concluded that it could only be more economic on a scale of very many thousands of tons a year, which at that time seemed an unlikely prospect for polythene.

High-pressure Equipment. Equipment for 2,000 atm. was wanted when the highest pressure process in Britain was synthetic ammonia at 250 atm. Standard 250 atm. machinery could be used in a primary stage of gas compression but specially made equipment was needed for higher pressures.

The only machine known to work at 2,000 atm. and above was obtained from Professor Michels of Amsterdam for general laboratory service. This used U-tubes with mercury seals. Many problems had to be solved to make this machine capable of working continuously for days on end, and eventually to progress to larger machines at first of 10 times the size and later 50 times as large.

Larger vessels than those of the laboratory were of course required. The leading part in this work was naturally that of the engineer, but close collaboration with the chemist was essential. The engineer preferred a high-pressure vessel to have as few and as small openings and as great a symmetry as possible because this allowed him to design more precisely. The chemist for his purposes was apt to ask for many holes for thermocouples, for admitting reagents and removing product. Both had to give way to some extent. Vessel sizes were increased in as big steps as it was safe to take, first from 1-litre to 10-l., as used in the semi-technical plant. The first commercial plant of 1939 had 50-l. vessels and those led in 1941 to 250-l. vessels. New types of closures and valves were developed. It is doubtful whether the previously accepted methods of design would have provided serviceable vessels; certainly they would have had very much thicker walls, and would have been of extreme weight and clumsiness.

Reaction. Early experiments had often ended in explosions, leaving only carbon, hydrogen and methane. The underlying cause was the very large heat of reaction—over 800 cal./gm.—and the acceleration of the reaction with rising temperature or pressure. Strict control of temperature and of oxygen content would be necessary to avoid explosions, but the process would nevertheless have to run at a high reaction velocity if its costs were ever to be comparable with those of low-pressure processes, for high-pressure reactors are much more expensive per litre than low. This would require very powerful and rapid means of absorbing the heat of the reaction and of changing its speed at will. The steady state which was wanted would necessarily be an unstable one, in which any uncorrected disturbance would continue to grow either towards an explosion or to a cessation of reaction. The requirements were stringent for explosions had developed in a second or two from a quiescent state, and although the reaction velocity is doubled by only a few degrees rise of temperature, the heat of reaction is so great that a 25% conversion without heat removal would raise the temperature 300°C.

The I.C.I. semi-technical plant was assembled from a 10-l. 3,000-atm. autoclave and the 2,500 atm. laboratory compressor which was capable of about 10 lb. of ethylene an hour. Neither had been designed for the specific process requirements.

Influence of Pressure on Reaction Velocity

The powerful and instantaneous influence of pressure on reaction velocity was used for control, by deliberately reducing pressure at the first signs of the temperature rising from the desired value in the region of 200°C and increasing it at signs of a fall, by making adjustments to the valve at the bottom of the autoclave through which the product and unreacted gas passed out. Experience with this equipment, during which the instrumentation was greatly refined, showed how the risk of explosions might be minimised, and the great heat of reaction brought under control, and demonstrated the feasibility of a truly continuous process, offering the economic advantages of a rapid, steady rate of production of a product whose properties could be controlled by control of reaction pressure and temperature, and of the few parts per million of oxygen added to the ethylene as catalyst.

When full-scale production had to be planned, conventional chemical engineering principles suggested that the only way to deal with much greater heat production when the largest scales of operation were reached would be to provide more and more wall surface for cooling, and that the simple way to do this would be to use a long tube in which the gas in its passage would first

be heated to reaction temperature and then cooled to remove the heat of reaction.

Although the laboratory compressor was tried with a tube, it was not large enough to test such proposals satisfactorily because it could not provide a highly turbulent flow in a tube wide enough not to block. There were also indications that the tube gave a much lower pass conversion, at a time when as much polythene as possible was wanted from whatever gas was available. A decision had to be made immediately and the design for the commercial plant adhered to the autoclave system. As soon as this plant started in September 1939 the behaviour of 50-l. autoclaves was closely studied and it was concluded that the autoclave system had much to recommend it for future design. The heat balance showed that heat absorption need not depend solely on wall cooling. Cold ethylene entered the reactor, but a substantial proportion left it unreacted, hot, at reaction temperature and so removed some heat of reaction. In fact a satisfactory conversion was obtainable without any cooling of the autoclave.

As a result of these physico-chemical studies it was appreciated that in designing for still greater outputs the autoclave system could offer the great advantage of avoiding increased difficulties of heat transfer. Given such a means of heat control, much greater steady state reaction velocities could be obtained from relatively small increases in pressure. Although larger production would need larger compressors, there need be no comparable increase in autoclave volume. This principle has been employed very successfully ever since.

The great increase in demand for polythene had come from post-war uses; packaging film and domestic moulded articles accounted for most tonnage, but there were developments in the use of polythene in cables. The very size of the industry and its continued high rate of growth gave rise to a variety of specialised occupations for chemists, but, stressed Dr. Hunter, it was still found that progress and improvement depended on collaboration in which chemists, physicists and engineers were prepared to be interested in each other's science and technology.

World Silicone Production Estimated at 20,000 Tons a Year

'THE commercial production of silicones' was the title of a paper given at the B.A. meeting by Dr. R. A. Gregory, managing director, Midland Silicones Ltd., on 6 September. He said that there were now some 12 major producers in the free world, and estimated total world production at around 20,000 tons a year, with a value of £40 to £50 million.

The first stage in manufacture involved the reaction of metallic silicon with methyl chloride. The metallic silicon—a hard silvery grey metal obtained by the electric furnace smelting of sand and coke—was ground to a fine powder and on heating the powder with methyl chloride to a temperature of 300°C, it reacted to form a mixture of colourless fuming liquids—the chlorosilanes. Other types of chlorosilanes were obtained by reacting silicone metal with compounds of benzene instead of with methyl chloride. The mixtures of chlorosilanes thus obtained then had to be subjected to a complex series of distillation processes in a plant somewhat resembling a very small scale oil refinery process, to separate them into their pure components, each of which must be obtained in a very pure state.

Chlorosilanes were converted into silicones by reacting with water. The two liquids were stirred in a glass-lined vessel. The mixture separated into two layers, a silicone oil on the top and an acid layer underneath.

The crude silicone oil was washed free from acid and further treated in a variety of ways according to the type of finished product required. For some purposes a series of oils ranging in consistency from free running liquids to very heavy syrups were produced. By mixing the oils with metallic soaps or other fillers, a range of greases was obtained. Other silicones were produced as varnishes which after application followed by drying and baking, gave hard adherent films on many surfaces. Very stiff jellies or gums could also be produced which developed rubbery properties when mixed with finely powdered fillers, such as silica, and vulcanised.

Because of their relatively high cost these materials cannot compete with similar non-silicone materials under ordinary conditions of use but they have the very valuable property of maintaining their usefulness over a very wide range of temperatures under conditions where conventional materials would either be frozen hard and brittle, or burnt and reduced to a smouldering mass.

Hydrocarbon Oil Drawback on Intermediates

THE rates used to determine the quantities of hydrocarbon oil for which drawback is allowed as regards certain dyestuffs intermediates and industrial adhesive tapes are varied in the Hydrocarbon Oil Duties (Drawback) (No. 2) Order (S.I. 1531-1960).

The intermediates are: 3-hydroxy-2-naphthanilide (new rate, 1.4 gall. as against 1.42 gall. per 100 lb.); 3-hydroxy-2-naphtho-2'-naphthylamide (8.2 gall. as against 3.35 gall. per 100 lb.); and 3-hydroxy-2-naphtho-4'-chloro-2'-methylanilide (2 gall. as against 6.66 gall. per 100 lb.).

The order also withdraws the provision for drawback in respect of 3-hydroxy-2-naphtho-*m*-nitroanilide.

Further Cuts in I.C.I. Titanium Prices

FURTHER major reductions in the basic prices of their wrought titanium have been announced by Imperial Chemical Industrial Ltd., Metals Division. The cuts, affecting deliveries after 1 November next, range from 15% for rod, extrusions and commercially pure sheet to 10% for plate, wire and alloy sheet.

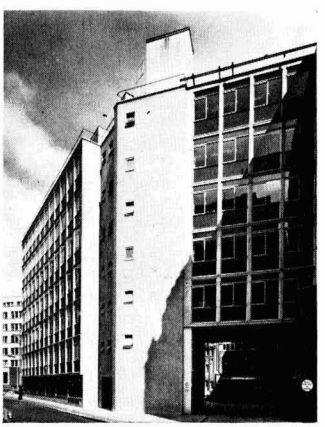
Typical comparative prices, with the previous prices shown in brackets, are: Hot rolled plate, 1 in. thick, 49s (54s); sheet (commercially pure) 8 ft. by 2 ft. by 20 gauge, 73s (85s); sheet (alloy) 6 ft. by 3 ft. by 20 gauge, 135s (150s); strip (cold rolled in coil) 9 in. by 28 gauge, 86s (95s); forged bar and billet, 8 in. dia., 48s (55s); rolled rod, 1 in. dia., 56s (66s); wire, 10 gauge, 121s (134s); extrusions, 90s (105s).

The company attribute this latest price reduction to increase in demand, and technical improvements resulting from research and development work. It is the fifth reduction since I.C.I. began selling wrought titanium six years ago, and it brings prices down to well under half their 1954 levels.

Open Days at National Chemical Laboratory

Work in progress at the D.S.I.R. National Chemical Laboratory can be viewed during the Open Days to be held on Wednesday, 19 October and Thursday, 20 October. Applications from those not already on the mailing list for invitations to the sessions (10 a.m. to 1.0 p.m. and 2.30 to 5.30 p.m.) should be sent to the director, National Chemical Laboratory, Teddington, Middlesex, not later than 24 September.

Union Carbide's New Head Office



Union Carbide House, the 9-storey building in Bruton Lane, showing the bridge from the top floor to 8 Grafton Street, where Union Carbide Ltd. now have their head office (see 'Chemical Age,' 3 September, p. 360)

Outstanding Success for New Beecham Penicillin

DEVELOPMENT by the Beecham Research Laboratories of a new penicillin which is effective against the hitherto resistant staphylococcus has now been confirmed and is hailed by the medical profession as an outstanding achievement. Hitherto known as BRL 1241, the new antibiotic is now revealed to be sodium 6-(2,6-dimethoxybenzamido)penicillinate monohydrate, which has been given the trade name Celbenin.

At present in pilot-plant production, Celbenin will be produced at the new Beecham factory at Worthing, Sussex, large-scale production being scheduled for early 1961. It will also be produced in the U.S. under licence.

Beecham's belief that they had succeeded in finding a penicillin that is resistant against staphylococcus was noted in CHEMICAL AGE, 30 July, p. 164, when it was noted that this development was a direct outcome of the penicillin breakthrough achieved last year, when the Beecham workers isolated the penicillin nucleus, 6-aminopenicillanic acid, which was produced by fermentation. However, at the time of our previous report, the results of clinical trials with the new penicillin had not been made available.

Results Published

Now, the results of these trials, published in the *British Medical Journal* of 3 September in a series of seven papers, show that Celbenin has so far exceeded all expectations. In one of these trials, carried out at St. Guy's Hospital, London, Celbenin treatment was applied to 13 patients severely infected with staphylococci resistant to other antibiotics. The usual dose was 1 gramme every four hours—the equivalent of 10 million units of penicillin G daily. In every case the infection was eliminated, which the *British Medical Journal,* in a leader, describes as "a remarkable fact in such a series." However, on a more cautious note, it is added that it would be rash at this stage to predict the future of Celbenin: much more extensive clinical experience is necessary before the potentialities and limitations of an antibiotic can be assessed. But Celbenin will certainly and immediately be in great demand for the treatment of otherwise resistant staphylococcal infections.

Reporting on microbiological studies on Celbenin carried out at Queen Mary's Hospital for Children and the Medical Council Research Laboratories, Carshalton, Dr. G. T. Stewart and his colleagues recall that the Beecham breakthrough in 1959 drew attention to the possibility of synthesising new forms of penicillin by the introduction of side chains. Derivatives prepared in this way may or may not possess antibacterial activity, but Celbenin proved to be particularly impressive. Trials were carried out using two synthetic penicillins—Celbenin and Broxil (phenoxy-propionamidopenicillin) and two natural penicillins. Important differences between the actions of the penicillins upon different organisms were revealed. In particular, Celbenin is much more resistant to the action of staphylococcal penicillinase, and other forms of penicillinase, than benzylpenicillin. It is as active against penicillinase-forming staphylococci as against penicillin-sensitive staphylococci.

In common with the other synthetic penicillin tested, which is also a derivative of 6-aminopenicillanic acid, Celbenin shows a narrower range of activity and less intrinsic activity than natural penicillins against various bacteria. It is concluded that the main place of these synthetic compounds at present, therefore, is in the treatment of staphylococcal infection.

As the latest and most effective of the 'tailor-made' penicillins made possible by the isolation of 6-aminopenicillanic acid, Celbenin will not, of course, be Beecham's last word on penicillins. Efforts will now be made to produce Celbenin in a form which can be administered orally, while work on the possibilities of producing more penicillins with equally or even more remarkable properties will be continued.

Computer Hire Service for Chemical Industry

A NEW type of computing service centre, based on a machine using both analogue and digital techniques, is now in operation at the computer department of Redifon Ltd., Crawley. The machine for hire at the centre is the RADIC (Redifon Analogue-Digital Computing System), claimed to be the first of its kind in the world to combine the advantages of both analogue and digital computing techniques in a single system.

Present work being undertaken at the centre includes: optimum blending of chemical products; calculations on heat transfer and related problems in chemical distillation columns; calculations on the design of pressure containers, and simulation of paper making processes.

Introduced in June 1960, the RADIC enables certain classes of calculation to be performed quicker and more cheaply than is possible with conventional computing methods. Cost of hiring the system is from £12-£50 an hour, depending on the size of the computation. Personnel are available to assist in preparing and translating the customer's work.

In the near future it is intended to transfer the computing service centre to the inner London area and at the same time extend the capacity of the present medium sized equipment.

Pyrene Enter Breathing Apparatus Field

THE firm of S. F. Roberts Ltd. has been acquired by the Pyrene Co., and will become one of the Pyrene Group. Manufacture of its range of safety products will be carried out at the Windmill Road Works, Brentford. The Pyrene Company, well known for nearly 50 years in the field of fire protection and safety equipment, also manufacture motor vehicle bumpers, operate metal finishing processes, and more recently, through their subsidiary, Pyrene-Panorama Ltd., manufacture a full range of industrial protection equipment, including goggles, eye shields, face shields and helmets, etc.

The name of the newly acquired company will be S. F. Roberts (1960) Ltd., whose products comprise breathing apparatus, fire protection apparatus, various forms of industrial protection equipment, and Sure Grip hose binding machines, as well as a range of Civil Defence equipment. This entry into the field of breathing apparatus extends the range of safety products manufactured and sold by the Pyrene Group.

Activities of S. F. Roberts (1960) Ltd., will be under the control of Mr. F. L. Dew, G.M., who has been a senior executive of Pyrene for many years. Certain members of the senior staff of S. F. Roberts, including Miss Kaiser and Mr. Ferguson will be supporting Mr. Dew in the development of this new venture. Mr. Francis A. J. Harrison, chairman and managing director of Pyrene, will also be chairman of S. F. Roberts (1960) Ltd.

I.C.I.-U.S. Agreement on Boron Compounds

AN agreement has been signed between Imperial Chemical Industries and the Callery Chemical Co. of Pittsburgh, Pennsylvania, providing for an exchange of assessment information in certain aspects of the field of boron compounds.

This exchange is with a view to the acquisition by either party of non-exclusive royalty-bearing licences under the other party's patents, as requested. Related technical information may also be made available for use on terms to be agreed.

Callery Chemical Co. are active in the field of boron chemistry applied to high-energy fuels and in the development of many commercial and industrial applications for boron compounds. The company is jointly owned by Mine Safety Appliances Co. and Gulf Oil Corporation.

Price's Develop Cetyl Alcohol Process to Cut Evaporation Losses on Small Reservoirs

A SIMPLE, inexpensive system for applying cetyl alcohol to small reservoirs and water holes to cut evaporation losses has been developed by Price's (Bromborough) Ltd. It automatically provides effective film for one month on water surfaces up to ¼ acre in extent.

Price's have for some time been co-operating with the C.S.I.R.O. on its work on water conservation in Australia and the new system for small water areas was among new developments in water conservation announced by Mr. W. W. Mansfield, of C.S.I.R.O., and Mr. B. R. Hook, sales director of Price's, at a reception held in London on 7 September. Price's supply the hexadecanol beads used in the new method of water conservation developed by the C.S.I.R.O.

The new Price's (Bromborough) unit, known as the constant feed submerged dispenser, is based on the principle that a solution of cetyl alcohol in kerosene, when allowed to float to the surface of the water, spreads a film which reduces evaporation losses. To be effective, however, the film must be maintained intact by continuous dosage with cetyl alcohol. Previous methods of achieving this have required constant supervision or expensive labour, while floating or land-based automatic continuous-dosage dispensers are subject to pilferage or damage by humans and animals and to fire risks.

Marketing Pack

The pack to be marketed is designed for use with the standard non-returnable kerosene can—for example, the 4 gallon debhi common to many parts of Africa. It consists of a constant feed device packed in a carton with a polythene bag containing a weighed quantity of cetyl alcohol sufficient to give a 3% solution (1 lb. for a 4 gallon can). The constant feed device consists of a bung carrying two tubes in one of which is positioned a hypodermic needle.

The operator simply rips off the cap on the kerosene can, shakes in the cetyl alcohol, stirring until it is all dissolved, and then presses the constant feed device firmly into the bung hole. The can is weighted with bricks or stones and the complete unit is sunk in the reservoir. Water enters through the inlet pipe in the bung, forcing the cetyl alcohol solution out through the hypodermic needle in the discharge pipe and the drops rise to the surface to generate the film.

Unlike shore-based or floating dispensers this new invention is designed to operate fully submerged. Thus it is kept at a substantially uniform temperature instead of being subject to the wide fluctuations of air temperature, and the viscosity of the solution—and hence the rate of discharge—remains constant.

Six units are now awaiting trial under field conditions in East Africa and arrangements are being made for similar tests to be carried out by C.S.I.R.O. in Australia. Once the final field work has been completed it is planned that the pack containing the cetyl alcohol charge and the constant feed device will be marketed through Price's agents overseas, at a cost estimated to be in the region of 10s. The unit will also be offered in the U.K.

The Chemist and Food Quality

'THE chemist and food quality' will be the title of a special meeting of the Society for Analytical Chemistry which will precede the Pure Food Centenary Conference. It will be held at the Royal Institution on 20 September at 11 a.m.

Papers will be given as follows: 'The food analyst today and yesterday,' by Dr. A. J. Amos; 'Some applications of research to the study and control of consistency in certain foods,' by E. H. Steiner; 'Estimation of the polyphenolic oxidation products in tea as an assessment of the quality—the spectrophotometric estimation of theaflavins and theorubigins in black tea liquors' by Dr. E. A. H. Roberts and R. F. Smith; 'The analysis of volatile strawberry flavours,' by D. S. Bidmead.

Two U.K. Firms Co-operate on Concessions for Lacq Sulphur

IT has recently been announced that K.W. Chemicals Ltd., of London, who have been granted exclusive concessions in the United Kingdom as stockists and grinders of sulphur produced by Société Nationale des Pétroles d'Aquitaine in their operations at Lacq in France, have concluded partnership agreements for these concessions with Wm. Blythe and Co. Ltd., of Accrington.

S.N.P.A.'s production of sulphur at Lacq, in what is claimed to be the world's largest sulphur plant, is associated with the exploitation of the celebrated Lacq natural gas deposits and places France as one of the world's largest producers of sulphur, coming next, with Mexico, to the United States. At present 175 million cu. ft. of gas are treated each day. In 1961, when the gas fields will be working to the full, at a rate of 700 million cu. ft. of gas a day, production of sulphur will be at the rate of about 1.4 million tons/year.

The Lacq deposits at the foot of the Pyrenees, covering an area about 15 km. by 7 km., have been evaluated at 280,000 million c.m., of which about 200,000 m. are workable. Exploitation began in April 1957, with an extraction of 1 million m^3/day in the first stage of the exploitation programme, leading to extraction of 3 million m^3/day in August 1958 and 5 million m^3/day in March 1959 in the second stage. The third stage was estimated to bring production to 10 million m^3/day in the second half of 1959 and the fourth and fifth stages should raise the figure to 20 million by the end of 1960. Attainment of this figure necessitates bringing the number of wells to about 35; the greater part of these have now been sunk and equipped and completion of the remainder should be achieved this year.

The extraction of sulphur forms one of the three principal operations in the treatment of the gas at Lacq, being carried out after desulphurisation and refining of the crude gas. The acidic gases from the desulphurisation process are treated by a technique which involves the partial oxidation of H_2S in air. The gases pass successively through a furnace, a cooling condenser, then two catalytic converters each followed by a condenser. Sulphur collected in the furnace, the converters and the condensers is maintained at a temperature of about 140-150°C to obtain maximum fluidity, the sulphur being pumped away in the liquid state for subsequent solidification and storage.

Fisons' Director Visits Immingham Works

Sir Ian Jacob, director of Fisons Ltd. (left), recently made his first official visit to the group's superphosphate works at Immingham largest of its kind in the U.K. Centre is F. Doyle, regional engineer, and right, A. L. G. Carter, Immingham works engineer, Fisons Fertilizers Ltd.

Removing Chromium from Waste Waters

OWING to the prevailing standards in the U.S., the adoption by the World Health Organisation of the U.S.P.H.S. standard for chromium level in potable water, and the general distrust of chromium in Britain, most industries make determined efforts to remove chromium from their waste water. The Westinghouse Electrical Co. in the U.S., for example, reduces chromate bearing wastes from 1,000 to 0.05 p.p.m. chromate and 1.0 p.p.m. trivalent chromium.

Several techniques are currently employed:

(1) *Reduction and Precipitation.* This, the most widely used method, consists of the reduction of the hexavalent metal by sulphur dioxide, sodium sulphite or ferrous sulphate, and subsequent precipitation of the chromium as hydroxide. Normally quicklime is used, though the addition of barium carbonate as witherite has been employed. The use of witherite introduces another metal into the waste which, though precipitated as insoluble barium sulphate, may introduce traces into potable water, a clearly undesirable practice.

(2) *Ion Exchange.* Recent work on the application of ion exchange resins has proved practical for the removal of chromium in chrome plating rinse wastes. Chromium cations are taken up on passage through high-capacity cation exchange resins, while the chromate anions are adsorbed by anion exchange resins. Though a slow and expensive method, chromium can be re-used when the cations are regenerated.

(3) *Absorption by Activated Carbon.* When washed in alkali activated carbon will take up to 5% of its own weight of chromic acid. However, this method is not really practical as it is expensive and requires considerable adjustment of the pH of the rinsing solutions.

Whatever method is employed, it is inevitably expensive, either in running or capital cost, though in the final analysis, safety is worth buying at any cost.

The foregoing observations are made in *Water Research News,* No. 9, published by the Water Research Association, Redhill, Surrey, in an article which goes on to discuss various aspects of the chemistry of chromium and the nature of the change from hexavalent to trivalent chromium, while the toxic activity of chromium is also reviewed and a comparison is made with the toxicity of chlorine.

The balance between trivalent and hexavalent chromium, in raw and treated river water, is considerably affected by both the organic and inorganic content of the water. Organic matter is almost always present in river water and is readily oxidised by chromate, which is consequently reduced to the trivalent form. Recently, two Swedish workers have thrown doubt on this by an experiment claimed to show that the reduction of hexavalent chromium by organic matter in sewage, is relatively insignificant. The observed lack of reduction may well be due to the local pH conditions, known to exert a considerable effect on oxidation-reduction reactions.

As most potable water is at some stage treated with chlorine, the effect of chlorine, itself a powerful oxidant, must be considered. The chlorine system has a slightly higher oxidising potential than the chromium system:

$$Cl_2 \rightleftharpoons 2Cl^- \quad +1.36V$$

$$Cr_2O_7^{2-} \rightleftharpoons Cr^{3+} \quad +1.33V$$

therefore chromic ions will tend to be oxidised to chromate by the chlorination process.

The chloramines, which are formed during the course of water chlorination, are in a more reduced state than chlorine and consequently have lower oxidation potentials. In the presence of chloramines, it is probable that the proportion of hexavalent to trivalent chromium decreases.

Thus, the state of the chromium ions in river water depends upon the amount of organic matter, the pH, the presence of chlorine and the chloramines, and the inter-relation between all these factors.

Before any definite conclusions can be drawn, the effect of trivalent chromium ions on cellular metabolism and on living tissue must, first, be investigated. It has been suggested that metal-containing enzyme systems, such as the cytochrome system, may be interfered with by chromium, when the enzymes are synthesised in the living cell. This may give rise to deficiency effects, which could be detected experimentally.

One writer has pointed out that the heavy metals are protein-precipitators: chromium might therefore cause the inactivation of cellular enzymes. If chromium is a toxic agent, this might be the cause, though it is strange then, that there is no confirmatory experimental reports. If proved non-toxic, then attention should be turned to the effect of hexavalent chromium.

Properly controlled experiments must be arranged as the organic matter in water and in living tissue is readily oxidized by chromates, the concentration of which immediately falls. For such investigations, the conditions must be so controlled that the concentration of hexavalent chromium remains appreciably unaltered.

It would be revealing to compare the effects of agents such as chlorine, ozone and hydrogen peroxide, used in the disinfection of water, with chromate on the basis of equivalent oxygen producing powers. The actual physiological mode of action of the water disinfecting agents has, as yet, not been fully explained, although it is considered to be oxidative.

All these possibilities should be investigated, even though most of the present evidence points to the action of hexavalent chromium as an oxidative destruction rather than as a specific toxic effect.

The article concludes that, in view of the present uncertainty concerning the toxicity of chromium, it is clearly advisable to accept the current World Health Organisation limit of 0.05 p.p.m. hexavalent chromium in potable water.

Fatty Alcohol Supplies Not Affected by Fire

FOLLOWING a fire at the fatty alcohol distillation unit of Marchon Products Ltd., Whitehaven, which broke out early on Monday morning, the plant will be out of action for three weeks. However, stocks are such that Marchon foresee no difficulty in maintaining normal supplies to the trade until production is resumed.

The fire damaged distillation equipment, but there were no injuries. See 'Project News', p. 383, for details of extension project.

Albright and Wilson Launch Phosphate Rock Carrier

A NEW 10,000 ton (deadweight) single-screw motor ship, *Arthur Albright,* for the carriage of phosphate rock in bulk, was launched by Albright and Wilson Ltd. on 5 September, at the Firth of Forth yard of the Burntisland Shipbuilding Co. Ltd. Mrs. S. Barratt, wife of the Albright and Wilson chairman, performed the naming ceremony.

Phosphate rock for their U.K. phosphorus manufacturing operations has for many years been imported by Albright and Wilson, largely from Florida and North Africa.

Shorter Week for Soap and Fats Workers

AGREEMENT has been reached at the Joint Industrial Council for the Soap, Candle and Edible Fat Trades on a reduction in the working week without loss of pay. For 21 Class 1 firms the weekly hours will be reduced from 42 to 40 spread over a five-day week, and for 48 Class 2 firms, from 44 to 42 spread over a five or a five-and-a-half-day week. The new agreement comes into operation on 3 October 1960.

To ensure the full productive utilisation of the shorter working week, both sides of the Joint Industrial Council have agreed to certain principles covering such items as the use of a four-crew working system for continuous processes.

A.C.C. Employees Withdraw Strike Notice

Fifty men employed by Associated Chemical Companies, Ltd., Yarm-on-Tees, have withdrawn their threat to take strike action over a wage claim. The men, who had stated that their wage claim pending since June 1959, was being ignored by the management, decided to continue at work while the matter was negotiated between their union and the employers.

Overseas News

U.S. GROUP TO BUILD PETROCHEMICAL COMPLEX IN ARGENTINA

A GROUP of five U.S. companies plan to construct a $74.5 million petrochemical complex in the Argentine. The companies are: Continental Oil, Cities Service, U.S. Rubber, Witco Chemical and Fish International.

Fish International state that the group is ready to begin erection as soon as Argentine government approval is received. The plants would employ about 700 workers, would take about 36 months for completion, although the initial units should be on stream within 18 months.

The plants will produce about 45,000 tons a year of synthetic rubber; 11,500 tons of carbon black; 7,000 tons of styrene in addition to quantities used in the rubber production; benzene and other intermediates.

Site is at San Lorenzo, a deep water port on to the Rio Parana. Earlier this year the group formed the Argentine corporation, Pasa, to own and operate the plants.

Pyrethrum Industry Still Growing in Kenya

Kenya's Labour Minister, Mr. R. Ngala, visiting the Pyrethrum Board of Kenya's extract plant at Nakuru, was told by the Board's executive officer, Mr. N. H. Hardy, that Kenya's production of pyrethrum flowers is double that of all other pyrethrum-producing countries in the world combined. Some 60% of the extract is sold to the U.S.

Three years ago Kenya sold 3.500 tons of pyrethrum; last year, 6,500 tons. This year, production and sales are expected to reach 9,000 tons, bringing an estimated £3½ million to Kenya. (See also CHEMICAL AGE, 30 July, p. 160.)

It is further estimated that the colony's production of flowers will increase to 15,000 tons in two years, making pyrethrum a £6 million/year industry.

Olin-Mathieson Build New Caustic-Chlorine Plant

A $13 million plant is being built at Charleston, Tenn., by Olin Mathieson with a capacity of 180 tons/day of chlorine and 195 tons/day of caustic. The unit will use the Mathieson electrolytic cell.

Houston Chemical Plan to Enter TEL, TML Field

Houston Chemical are to build plants valued at $10 million at Beaumont, Tex, for tetraethyl lead and tetramethyl lead. Both will be on stream by September 1961. The company hopes to get about 10% of the total U.S. market when the plants are in production; at present E. I. du Pont de Nemours and the Ethyl Corporation share the U.S. TEL market and both have TML plants under construction. Demand for both products is expected to reach 530 million lb. in the U.S. in 1960, rising to 565 million lb. by 1965.

Union Carbide Cut Acrolein Price by 15 Cents

Price of acrolein has been reduced by Union Carbide Chemicals by 15 cents/lb. to 31 cents on a tank-car basis. This substantial reduction is said to be the result of significant process improvements and will it is thought stimulate new applications for acrolein.

Two New Polymers from Dow Chemical

Two new polymers with molecular complexing properties have been announced by Dow Chemical, Midland, Mich. Poly-*N*-vinyl-5-methyl-2-oxazolidinone, known as Devlex 130, is said to have properties similar to those of natural proteins and to have high molecular complexing abilities. The other polymer, which also offers complexing properties, is Devlex A515, a copolymer of *N*-vinyl-5-methyl-2-oxazolidinone and vinyl acetate. It forms hard, clear films with low hygroscopicity.

Brazilian Undertaking Increases Coke and By-products Capacity

Brazil's leading heavy industrial undertaking, Companhia Siderurgica Nacional, of Volta Redonda, has brought into operation 20 new coke furnaces at its main plant. While raising coke production by 60%, from 1,500 to 2,400 tonnes daily, the company's expansion scheme will send up production of such coal chemicals as naphtha, tar and light oils.

Texaco's New Cumene Plant on Stream

The new cumene plant at Westville, N.J., of Texaco Inc., has been started up with a capacity of some 70 million lb./year. Output will be sold largely as a raw material for phenol.

Uddeholm Plan Chlorine Expansion in Sweden

The Swedish wood-processing, chemical and metallurgical concern Uddeholm A.B. are planning to expand chlorine capacity at their electrochemical plant further from 30,000 to 35,000 tonnes a year. This expansion is to cost some 4.5 million Swedish crowns.

At the company's Skoghall wood-processing works, expansion work is almost completed which will bring cellulose capacity up to some 200,000 tonnes/year. The company also plan to spend 13 million crowns on the replacement of an existing sulphate bleach plant by a new unit with a greater capacity.

U.S. Semi-works Unit for Synthetic Rubbers

American Rubber and Chemical are to build a semi-works plant at Louisville, Ky., for the production of synthetic elastomers and rubbers that are said to be "chemically related to polybutadiene and polyisoprene". The unit will make use of the Crawford and Russell process for stereospecific rubbers (CHEMICAL AGE, 27 August, p. 325). The company, jointly owned by Stauffer Chemical and American Synthetic Rubber, are also building a 30,000 tons/year plant at Louisville for the production of polybutadiene and polyisoprene under a Phillips Petroleum licence. The semi-works unit is due for completion in the spring of 1961 and the full-scale plant should be on stream by the autumn of 1961.

Imperial Oil to have Largest Canadian Benzene Plant

Imperial Oil Ltd. are to build Canada's largest benzene plant at Sarnia, Ont, at an estimated cost of £5 million. To be completed by autumn 1961, it will have a capacity of 30 million gall./year. Part of the production will be used by Imperial Oil in their other petrochemical operations; the balance is scheduled for consumers in Canadian and export markets.

Italy Doubles Imports of Synthetic Rubber

Italian exports of synthetic rubber in the period January to May totalled 12,213 tonnes (12,379 tonnes). Synthetic rubbers imported during the same period totalled 14,844 tonnes (7,363 tonnes).

During the first half of 1960, Italy exported 15,363 tonnes of raw sulphur to a total value of Lire 267 million.

First French Carbon Black Unit on Stream in November

The first French carbon black plant built at Beck d'Ambes will come into operation in November using Lacq natural gas. The plant is operated by Compagnie Française du Carbon Black (Cofrablack) the company formed by Phillips Petroleum and Continental Carbon.

India Accepts U.S. Fertiliser Study Offer

The Indian Government has accepted the Ford Foundation offer to send a chemical expert to India to examine technical reports on fertiliser plants. Object of the visit would be to create interest among U.S. investors in collaborating with Indian companies in setting up fertiliser plants in the private sector. The Government has already earmarked an additional 200,000 tons of fertiliser capacity for the private sector.

Low-cost U.S. Fertiliser Plant Uses Saint-Gobain Processes

THE first plant in the U.S. to produce high analysis fertilisers using the Saint-Gobain processes for phosphoric acid and ammonium phosphate—developed by Compagnie de Saint-Gobain of Paris—is now being operated by Coastal Chemical Corporation as part of their $12 million integrated fertiliser facilities at Pascagoula, Miss, the company being a subsidiary of Mississippi Chemical Corporation. Located on a 1,350-acre site with a 1,500 ft. deep water channel frontage, the plant is designed for economical operation, a particular feature being the comparatively low investment required. An important investment saving is in the use of a single reactor for making phosphoric acid. The fertiliser plant has a capacity of 350 tons/day of 14-14-14 (nitrogen-phosphorus-potassium) fertiliser, capacity varying according to the grade manufactured.

As described in *Industrial and Engineering Chemistry*, 1960, **52**, No. 8, 638, the reactions involved are those of making sulphuric acid from sulphur, ammonia from natural gas and nitrogen, phosphoric acid from phosphate rock by acidulation, and neutralisation of phosphoric and sulphuric acid with ammonia. Potassium comes to the finished fertiliser by a physical process. Complexities of the process lie in the side reactions, stemming mainly from the materials with which the phosphorus is associated. Proper control of these conditions is therefore a dominant factor in economical operation.

Manufacture of phosphoric acid starts with the continuous conveying of ground phosphate rock, stored in a 350-ton hopper, to the reaction vessel, via a gravimetric belt feeder. A recycle stream of filtered phosphoric acid of medium strength, 20-25% P_2O_5, wets the rock and washes it down into the vessel. At the same time, some 10 tons/hr. of 93-98% sulphuric acid is fed continuously into the vessel, where it mixes with a recycle stream of phosphoric acid-gypsum slurry from the filters. Acid flow is regulated by an automatic control valve while a ratio controller links up the control valve with the gravimetric belt feeder to keep acid and rock feeds in the proper ratio. About 2.6 tons of sulphuric acid will make 1 ton of P_2O_5.

The reaction vessel is constructed of steel and lined with acid-proof brick. Efficient agitation is produced by both the method of adding the recycle slurry-acid mixture and by four turbine agitators. The return slurry descends through a funnel-like structure fitted with a vertical propeller. Cooling air enters the vessel through spargers connected to a circular manifold around the top of the vessel. An exhaust fan draws air over the slurry and out through a fume scrubber by means of which hydrofluoric acid is removed. A submerged pump takes out the slurry which is either filtered or recycled with fresh sulphuric acid mixed in it.

For filtering of the slurry, there are a 192 sq. ft. travelling pan vacuum filter and also a horizontal filter, which has a capacity of about 1.1 lb. of P_2O_5/sq. ft./hr. compared with the 3.9 lb./sq. ft./hr. of the travelling pan filter. Product acid goes through a thickener and then to storage. Settled gypsum goes back to the reaction tank.

For the manufacture of ammonium phosphate fertilisers, phosphoric acid is fed to the three-stage neutralising plant, as is also sulphuric acid, liquid anhydrous ammonia being added continuously to permit about 80% of the neutralisation to occur. Slurry from the first neutralising vessel continuously overflows into the second vessel, where the balance of the necessary ammonia is added. The third vessel acts mainly as a slurry surge tank.

Slurry from the third neutraliser is absorbed in a bed of dry recycle fertiliser material moving through a rotating shell granulator, in which the material becomes coated with a film of slurry to produce a smooth, hard granular product. A rotary dryer dries the granules to less than 1% moisture.

The phosphoric acid and granulated fertiliser plants were engineered and constructed by the Fluor Corporation of Los Angeles, California.

New Combined Weedkiller and Grass Retarder Demonstrated

HIGHLY satisfactory results were achieved in combating tall grass and weeds on roadside verges by spraying with grass growth regulator and a selective weedkiller, the active growth inhibiting agent being maleic hydrazide. According to Whiffen and Sons Ltd., its manufacturers, to achieve maximum efficiency it is first converted into a soluble derivative and then formulated to allow adequate spreading and absorption when sprayed on to grass. Spraying tests carried out on roadside plots over the past six years have proved so satisfactory that it has not been found necessary to cut the verges for the whole of this period.

In a series of visits by highway officials and representatives of other organisations to trial plots at Bibury, Glos, the results have been studied of spraying verges with Regulox growth inhibitor, containing maleic hydrazide, and Vergemaster selective weedkiller. Correct use of these treatments has produced excellent control of growth. A new combined regulator—a single spray which retards growth of grass and removes weeds such as hedge parsley, dock and thistle at the same time—was also demonstrated. Organisers of the visits were Baywood Chemicals Ltd., distributors of the chemical treatments, in association with Whiffen and Sons Ltd., manufacturers of maleic hydrazide.

World-wide Agreement on U.S. Electrochemical Corrosion Control System

AN exclusive world-wide licensing agreement has been concluded by Minneapolis-Honeywell Regulator Co., Philadelphia, with Continental Oil Co., Houston, to manufacture and market a new electrochemical system for controlling corrosion. The system, developed by Conoco scientists and to be marketed under the trade name of Anotrol, will be offered initially for the control of corrosion in the storage and processing of sulphuric and certain other corrosive acids, as well as corrosive caustics. It is expected to find immediate application in storage tanks, tank cars, trucks, barges and process vessels exposed to such corrosives.

A 'passive film' is developed and maintained on the internal surfaces of metal vessels by passing a direct current from a specially designed electrode, acting as a cathode, through the corrosive liquid to the vessel, which itself serves as the anode. A controller supplies current to the system in order to maintain a predetermined voltage between the anode and a reference electrode.

This film makes mild steel or alloy steel surfaces of such vessels resistant to such chemicals as sulphuric, phosphoric and nitric acids; sodium and potassium hydroxide; and aluminium sulphate and ammonium nitrate.

The system is said to represent a new and successful approach to solving costly corrosion problems. Elimination of electrolytic corrosion by the new system is said to improve product quality by ridding acids and end products of metal contaminants.

The Anotrol system is the result of many years of work in Conoco's research laboratories at Ponca City, Okla. Conoco first tested it in a sulphonation unit at their Baltimore, Md., petrochemical plant for more than a year and found that it substantially eliminated vessel and related piping corrosion during that period.

Honeywell state that manufacture and marketing of the system, which makes use of electronic circuitry, has been assigned to their Rubicon Division in Philadelphia, Pa.

PEOPLE in the news

● **Mr. A. Henderson, F.C.A.,** managing director of Associated Chemical Companies Ltd., Urlay Nook, Eaglescliffe, Stockton-on-Tees, has been appointed deputy chairman. **Mr. W. F. Dunnett** has been appointed to the board.

● **Mr. J. B. Hamilton-Meikle** has resigned from the board of Henry Balfour and Co. Ltd. to devote more time to his own business.

● **Dr. W. M. Hampton** is retiring from the managing directorship of Chance Brothers, Smethwick, but will remain on the board. He will also continue as chairman of the British Glass Industry Research Association.

● **Mr. R. Turner** has been appointed managing director of Powell Duffryn Technical Services Ltd., in succession to **Mr. D. G. Hemmant,** who has resigned.

● **Mr. G. B. Goodyear** has left the advertising department of the Goodyear Tyre and Rubber Co. (Gt. Britain) Ltd., Wolverhampton, for an appointment in the P.R. Department of Shell Chemical Company as a press relations executive.

● **Mr. C. E. H. Verity,** managing director of Foster Wheeler Ltd., Foster Wheeler House, 3 Ixworth Place, London S.W.3, has recently been elected a director of the parent company, Foster Wheeler Corporation, New York.

C. E. H. Verity (left) and J. D. Kendall

● **Dr. John D. Kendall** has been appointed director of the European research laboratories of the Minnesota Mining and Manufacturing Co. Ltd., London. He was for many years responsible for the direction of organic chemical research at Ilford Ltd. In his newly created post with 3M Co. the first assignment for the new laboratory organisation will be the development of new graphic products. A permanent location for the new laboratory has not as yet been selected and it may be either in England or on the Continent. Dr. Kendall will work under **Dr. Carl E. Barnes,** 3M Co.'s vice-president for research who is located at the firm's headquarters in St. Paul, U.S.

● **Commander E. G. Sutton, M.I.Mech.E., R.N.(Rtd.),** has been appointed works director of Sir W. H. Bailey and Co. Ltd., Albion Works, Patricroft, Manchester. Manager and director of a John Thompson company concerned with the launching equipment for the Naval Seaslug missile, and the charge face equipment for Berkeley Nuclear Power Station, he will in his new position be responsible for the production of the whole range of pressure regulators, sluice valves, pumps and turnstiles manufactured by Sir W. H. Bailey and Co.

● **Mr. B. R. Fraser** has been elected a director of Mobil Oil Co., and will be in charge of manufacturing. He succeeds **Mr. J. Blake Middleton** who has resigned from the board and is retiring from the Mobil group early next year, after 40 years' service.

● **Mr. R. L. J. Hayden, Mr. C. J. Geiss, Mr. J. F. G. Arman, Mr. A. S. Bridgwater** and **Mr. J. McLean** have been appointed to the board of Foster Wheeler Ltd.

● **Mr. P. R. McGehee** has resigned from the board of Aluminium Corporation.

● **Dr. W. J. Kroll,** of Cornvallis, Oregon, U.S., will give the Castner Memorial lecture at 6 p.m. on 7 October on 'The fusion electrolysis of titanium' at the Royal College of Science and Technology, Glasgow. All interested persons will be welcome.

● **Dr. Walter G. Whitman,** chairman of the Department of Chemical Engineering at the Massachusetts Institute of Technology, has been appointed science adviser to Mr. Christian A. Herter, U.S. Secretary of State.

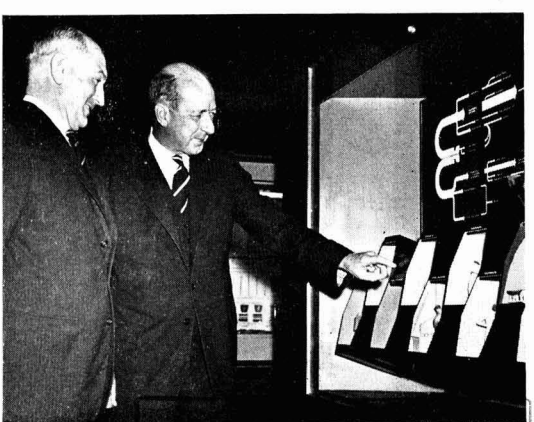
● **Mr. C. J. Grayston, M.I.Chem.E.,** has been appointed group research director of the recently opened research and development centre of the Balfour Group of Companies at Leven, Fife. He will have overall control of all sections of the enterprise. One of his particular duties will be to supervise the Group's student and graduate apprenticeship schemes. Mr. Grayston has spent a lifetime in the Scott organisation and is a director of George Scott and Son (London) Ltd., and Ernest Scott and Co.

C. J. Grayston

Anthracene Exempted from Import Duty

Certain chemicals are temporarily exempted from import duty under the Import Duties (Temporary Exemptions) (No. 8) Order (S.I. 1532-1960). Among the chemicals which are exempted until 1 October are: *m*-chlorotoluene and dioctyl maleate, mixed esters. Anthracene is exempted until 1 January 1961.

PHOSPHORUS MODEL FOR SCIENCE MUSEUM



Sir Owen Wansbrough-Jones, right A. & W. technical director, presents the Albright and Wilson Group's model on phosphorus to Dr. D. H. Follett, director of the Science Museum (see 'Chemical Age,' 3 September, p. 348)

Commercial News

- Berk Half-year Group Profits Up 26%
- Sadler Say Coal-Tar Profits Satisfactory
- Evans Medical Take Over Sheffield Firm
- Murex to Raise Tantalum Output Again

F. W. Berk

Half-year statement from F. W. Berk and Co. Ltd. puts group profits, after all charges except tax and capital issue expenses, at £367,653 for the six months ended 30 June—an increase of 26% over the figure of £291,998 for the same period of 1959. Turnover over the six months' period was £4,509,000, compared with £8,344,100 for the previous 12 months. Ordinary shareholders are to received an unchanged interim dividend of 3¾%.

No dividend has yet been received from the company's investment earlier this year in Spencer Chapman and Messel, but this company's progress is reported to be in line with forecasts at the time of the investment.

British Glues

British Glues and Chemicals has acquired for cash all the issued share capital of the British Gelatine Works and C. Simeons and Co., of Luton.

British Tar Products

Increased business in hydrogenated tar products, and increased variety of derivatives, were reported in the annual review of the chairman of British Tar Products Ltd., Mr. F. Woolley-Hart, O.B.E. Plant extensions were continually being made to cope with increased demand. The acute shortage of naphthalene prevents the company from operating their refining plant at its full capacity, but the support of some traditional suppliers of raw material had made it possible to satisfy in some measure the requirements of the home trade.

Net profit was £54,971 after charges, compared with £39,284 for the previous year. The board recommended a final dividend of 10% less tax, making a total distribution of 15% less tax for the year, compared with 13¾% last year.

Evans Medical

Evans Medical Ltd., Liverpool, have acquired for cash the whole of the share capital of J. Gilbert Jackson Ltd., wholesale chemists, Sheffield. For the time being the company will continue to trade under their own name. Mr. W. R. B. Sheldon has been appointed managing director.

J. Gilbert Jackson Ltd., were incorporated on 31 March 1913, to acquire a retail business founded in 1896. They started trading as wholesale chemists in 1935.

Dow Chemical

The proposed merger between Dow Chemical and Allied Laboratories has been approved by directors of both companies. Under the scheme Allied Laboratories' shareholders would receive two-thirds of a share of Dow Chemical common stock for one share of Allied stock. Allied Laboratories would become a Dow Chemical division. The merger would give Dow Chemical ethical drug facilities through the Pitman-Moore Division of Allied Laboratories, together with a veterinary and animal health production unit.

Murex Ltd.

At Rainham, expenditure was spread over a wide range of activities including further development of the new tantalum niobium plant which had been fully occupied, stated Sir Arthur Smout, chairman of Murex Ltd. in his annual report. Demand for tantalum had grown more rapidly than envisaged and additional expenditure would be needed to increase output further and to incorporate improved techniques that had resulted from recent development work. Capital expenditure at Rainham and at Waltham Cross over the next two years was substantial and likely to exceed the annual average of £500,000 spent in the last few years.

Sadler and Co.

Group trading profit for 1959 of Sadler and Co. was £36,544 (£17,673) after charging £44,000 arising from over-assessment of stocks in 1958. After tax nil (£3,754), loss was £16,525 (loss £76,193). Credit tax adjustments £13,500 (nil), from reserves in subsidiaries nil (£100,000). Carry forward was £152,443 (£156,691). No dividend is being paid (same).

Maj. G. H. C. Sprot, chairman, said that profit margins particularly in the coke market will remain tight for foreseeable future but profits from coal tar by-products likely to continue at satisfactory level. Should trade continue with no unforeseen setbacks in 1960, a dividend may be recommended at a later date.

Minnesota Mining

Plans have been announced for a proposed merger between Minnesota Mining and Manufacturing and Warner-Lambert Pharmaceuticals, two U.S. companies. Subject to approval by directors and shareholders of the two companies, it is planned to effect the merger by an exchange of one share of Warner-Lambert common stock for 1.1 shares of Minnesota Mining common stock. Warner-Lambert would retain their full identity and operating autonomy. The products of the two companies do not compete.

Yorkshire Imperial Metals Ltd.

The directors of the Delta Metal Co. Ltd. and Yorkshire Imperial Metals Ltd. announce that arrangements have been made whereby the alloy tube manufacturing business hitherto carried on by Booth and Mapplebeck Ltd. (a member of the Delta Group) will be acquired by Yorkshire Imperial Metals and that Delta will take an interest in the latter company.

The production of copper tube by the Delta Group, through its subsidiary Earle, Bourne and Co. Ltd. is unaffected by this arrangement.

INCREASE OF CAPITAL

JOHN KELLYS (LONDON) LTD., manufacturers of and dealers in drugs, chemicals, oils, etc., 5 Mansfield Street, London W.1. Increased by £30,000 beyond the registered capital of £30,000.

NEW COMPANIES

MERCOL PRODUCTS LTD. Cap. £1,000. Manufacturers of and dealers in chemicals and chemical products, and other apparatus or materials for the treatment of water and for the removal of scale, etc. Secretary: E. H. Rowley. Reg. office: 5 Hounsfield Road, Sheffield 3.

ADDISON CHEMICAL LTD. Cap. £100. Consulting, analytical, designing and industrial chemists, etc. Director: F. E. Planer. Reg. office: 36 Southampton Street, London W.C.2.

KAYLIS CHEMICAL LTD. Cap. £5,000. Manufacturers of and dealers in thermoplastic moulding compounds, plastics, etc. Solicitors: Slaughter and May, 18 Austin Friars, London E.C.2.

B.o.T. Consider Drawback of Silicone Fluids Anti-Dumping Duty

An anti-dumping duty of 4s/lb. was imposed on 7 January 1958 on polymethylsiloxane fluids (commonly known as silicone fluids) originating in France, these being products of the Société des Usines Chimiques Rhône-Poulenc, by the Anti-Dumping (No. 1) Order, 1958, which remained in force until 2 June 1959 when it was revoked by the Anti-Dumping (No. 1) Order, 1958 (Revocation) Order, 1959.

The Board of Trade now give notice that they have under consideration an application for allowance of drawback of the anti-dumping duty charged under the above mentioned Order, when the imported goods are re-exported in the same state as they were in at the time of importation.

Representations which interested parties may wish to make in the matter should be addressed in writing to the Tariff and Import Policy Division of the Board of Trade, Horse Guards Avenue, London S.W.1, not later than 22 September.

TRADE NOTES

Aluminium Stearate

Three Abrac grades of aluminium stearate are discussed in technical information bulletin No. 151c from A. Boake, Roberts and Co. Ltd., Carpenters Road, Stratford, London, E.15. After an introductory account of the structures of aluminium stearates, the properties of the three Abrac grades are described, with tabulated data. The main portion of the bulletin is devoted to the applications, e.g. in the manufacture of inks, lubricating greases, oils, plastigels, paints, paper-coating and water-proofing compositions, etc. References to the literature are included.

Amberlite Ion Exchange Papers

By arrangement with the Rohm and Haas Co. of Philadelphia the B.D.H. Laboratory Chemicals Division, Poole, Dorset, have undertaken the marketing of the IERL (ion exchange resin loaded) papers recently introduced by Rohm and Haas under their trade name Amberlite.

These ion exchange papers will be marketed by B.D.H. exclusively in all countries other than the United States and Japan, where the arrangement does not apply; and Canada and Mexico, where the papers may also be marketed through other channels.

B.D.H. literature on these new resin papers is being prepared and will shortly be available. In the meantime prices are being quoted on request.

Reagent for Copper

Monograph No. 40 from Hopkin and Williams Ltd., Chadwell Heath, Essex, describes 2 : 9 dimethyl 1-1 : 10-phenanthroline, otherwise known as Neocuproine, as a reagent for copper. A recommended procedure for the determination of copper is given and some applications of the compound in the determination of copper in various media are briefly discussed.

Change of Address

As from 19 September the London headquarters of Richard Baker and Co. Ltd. and W. Harrison and Co. Ltd. will be at 12 Broadway, London S.W.1 (telephone: Abbey 3221).

Dracone Licence

Dracone Operations, London, manufacturers of Dracone flexible containers, have appointed Talbot Shipping and Trading Co., Montreal, as their representatives in Canada.

Water-wash Additive

The build-up of lime deposits mixed with paint on water-wash booth flow sheets is a frequent occurrence, particularly in hard-water areas. An important problem which arises is that the deposits dull the reflective surface of the flow sheets, thereby lessening the degree of light in the booth. While the deposits can be cleaned off with phosphoric acid and abrasives, this action results in a further dulling of the surface.

To overcome this problem, Aerostyle Ltd., Sunbeam Road, London N.W.10, have developed hard water grade additive. The use of this compound in the water is claimed to prevent any build-up of deposits. It is introduced in the proportion of approximately 6 to 8 lb. per 100 gall. of water, according to hardness and acidity.

British Refrasil

The name of one of the principal subsidiary companies of Darlington Chemicals Ltd., the British Refrasil Co. Ltd., Stillington, Co. Durham, has been changed to Darchem Engineering Ltd. Ownership and board of the company remain unaltered and all existing activities will continue.

The division of the company supplying Refrasil insulation blankets will be known as the British Refrasil Division. The other main interests of Darchem Engineering Ltd. are ; stainless steel foil internal insulation for reactors and allied equipment, Rostenit stainless steel tank linings, general light-gauge stainless steel fabrication and specialised welding processes.

New Geon P.v.c. Compound

British Geon Ltd. has now started production of a new unplasticised p.v.c. compound, Geon RA.130. This is claimed to have good impact strength properties, which have been achieved without the addition of a modifying material. It is designed for use in all profile extrusions and for most pipe applications.

RA.130 is tougher than other medium-impact unplasticised p.v.c. compounds manufactured by British Geon. Pipe of o.d. 1.06 in. and i.d. 0.85 in. extruded from the new compound has a 65% pass on a modified K.I.W.A. test, and an impact strength greater than 5 ft.lb./in. notch. Sheet made of Geon RA.130 has a tensile strength greater than 7,000 p.s.i.

Details are given in Information Sheet No. G109, available from Information Department, British Geon Ltd., Devonshire House, Piccadilly, London W.1.

Change of Name

Simonside Productions Ltd., manufacturers of rubber, textiles, leather, building, engineering and chemical materials, etc., of Bede Trading Estate, Jarrow-on-Tyne, have changed their name to Simonside Ltd.

Refinery Fittings Agreement

Under a licensing arrangement between the Sivyer Steel Casting Co. of Milwaukee, Wisconsin, U.S.A., and A.P.V.-Paramount Ltd. of Crawley, Sussex, the latter, a subsidiary of the A.P.V. Co. Ltd., are to manufacture and sell Sivyer refinery fittings in Europe and the Commonwealth. These fittings, which are manufactured in carbon, low, medium and high alloy steels, include return bends, corner and terminal fittings, multiple hole headers, etc., such as extensively employed in process heaters and various refinery installations.

Porous Ceramic Tiles

Porous ceramic tiles for fluidisation and powder handling have become an important part of the range of Doulton Industrial Porcelains Ltd., one of the industrial divisions of the Royal Doulton Potteries. Equipment for bin discharge, conveyance and treatment of powders by fluidisation is described in a new leaflet available from the company at Doulton Potteries, Wilnecote, Tamworth, Staffs.

Polyurethane Growth

The di- and tri-isocyanates of Farbenfabriken Bayer AG, distributed in this country by J. M. Steel and Co. Ltd., are registered under the trade mark 'Desmodur' and not 'Desomodur' as stated in our leading article on 'Polyurethane growth' of 27 August.

Market Reports

COAL TAR PRODUCTS IN GOOD DEMAND

LONDON Active trading conditions have been reported from most sections of the chemicals market during the past week, with buyers taking more interest in covering forward requirements. The volume of export enquiry continues to be well maintained. Prices for the most part are unchanged and firm.

There has been a little more activity in the fertiliser market, while in the coal tar products market most items are firm on a good demand.

In prices current (CHEMICAL AGE, 27 August), cresylic acid pale, 99/100, was quoted erroneously at 12s; the price should be 7s.

MANCHESTER Price movements in chemicals on the Manchester market have been of relatively little consequence and the general undertone remains steady. With holiday interruptions to business now less in evidence there has been a fair number of enquiries circulating and reasonable additions to order-books, including export business. In the meantime existing commitments in the alkalis and other heavy chemicals are being drawn against steadily by industrial users in the home section, and a fair movement on shipping account is reported. In the market for fertilisers there is a steady call for deliveries of basic slag and more business has been placed in the compounds and some of the nitrogenous materials.

SCOTLAND From most sections of industry in the Scottish market the report is of a very much quieter week's trading. Buying has been concerned mostly with the usual range of standard basic chemicals with quantities nominal. However, a slight improvement was noted towards the end of the week.

There is little change to report in agricultural chemicals, except perhaps in regard to weed killers in which some interest is still being shown. Prices have remained fairly steady.

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents)', which is available from the Patent Office (Sales Branch), 25 Southampton Buildings, Chancery Lane, London W.C.2, price 3s 6d including postage; annual subscription £8 2s.

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection 5 October

Isobutylene purification. Esso Research & Engineering Co. **850 415**

Process for the manufacture of nitrogen-containing hetrocyclic compounds. Imperial Chemical Industries Ltd. **850 418**

Organo-silicon coating or bonding composition and process of forming and using same. Lord Manufacturing Co. **850 419**

Purification of detergents. Unilever Ltd. **850 355**

Water-insoluble monoazo dyestuffs of the benzene-azo-indole series. Farbenfabriken Bayer AG. **850 422**

Polyester resin impregnated glass fibres. Siekmann, K. **850 785**

Stabilised hydrocarbon polymeric materials. Western Electric Co. Inc. **850 499**

6-methyl steroid compounds. British Drug Houses Ltd. **850 423**

Purification of gas mixtures. Imperial Chemical Industries Ltd. **850 760, 850 761**

Polyester resin compositions. Beck, Koller & Co. (England) Ltd. **850 762**

Phenylacetic esters having two basic substituents and production thereof. Laboratoires Dausse. **850 333**

Phenoxazine derivatives and preparation thereof. Pfizer & Co. Inc., C. **850 334**

Arylaliphatic aldehydes and their preparation. Rhone-Poulenc. **850 360**

Storage of chlorine. Columbia-Southern Chemical Corporation. **850 244**

Polymerisation of ethylene. Distillers Co. Ltd. **850 763**

Preparation of phenyl-alkylchlorosilanes. General Electric Co. **850 335**

Grafting on polymers. Soc. Des Usines Chimiques Rhone-Poulenc. **850 446**

Manufacture of polyene aldehydes and aldehydes. Hoffman-La Roche & Co., AG, F. **850 501**

Processes for the manufacture of steroid derivatives and new steroid derivatives. Schering AG. **850 447**

Manufacture of alkali metal hydroxides. Columbia-Southern Chemical Corporation. **850 337**

Process for the purification of silver nitrate solutions. Du Pont de Nemours & Co., E. I. **850 246**

Photopolymerizable compositions and articles made from them. Du Pont de Nemours & Co., E. I. **850 453**

Processing halogenated butyl rubber. Esso Research & Engineering Co. **850 429**

Electrolysis of alkali chloride solutions. Dow Chemical Co. **850 345**

Cross-linking polypropylene or copolymers of ethylene and propylenes. Hercules Power Co. **850 455**

Phenthiazine derivatives. Rhone-Poulenc. **850 431**

Method for the preparation of a soluble phosphorus chloronitride rubber polymer. Benckiser GmbH, Chemische Fabrik, J. A. **850 251**

Production of quinonoid compounds. Du Pont de Nemours & Co., E. I. **850 433**

Gum plastics. United States Rubber Co. **850 458**

Polyallylation and polymethallylation of phenols. General Mills Inc. **850 252**

Acrylonitrile polymer compositions having enhanced dyeability. Dow Chemical Co. **850 435**

Process for re-obtaining monomeric ε-caprolactam from poly-ε-caprolactam. Farbenfabriken Bayer AG. **850 437**

Method of producing sodium tetraborate tetrahydrate. United States Borax & Chemical Corporation. **850 438**

Metalliferous monoazo dyestuffs containing halogenotriazinylamino groups. Imperial Chemical Industries Ltd. [Divided out of 846 949.] **850 559**

Fluidised layer process for the production of anhydrous aluminium chloride. Badische Anilin- & Soda-Fabrik AG. **850 440**

Coating compositions for forming protective coatings. Du Pont de Nemours & Co., E. I. **850 722**

N-substituted amides of aromatic polycarboxylic acids and their production. Du Pont de Nemours & Co., E. I. **850 459**

Process for the preparation of pentataerythritol. Union Chimique Belge S.A. **850 460**

Halogenated cyclic ethers useful as insecticides and process for preparing same. Velsicol Chemical Corporation. **850 506**

Method for the preparation of modified polyamides. Benckiser GmbH, Chemische Fabrik, J. A. **850 724**

Production of hydrogen peroxide. Food Machinery & Chemical Corporation. **850 567**

Blends of polyisobutylene and polypropylene. Esso Research & Engineering Co. **850 568**

Production of acrylic acid esters. Union Carbide Corporation. **850 509**

Stabilising vinylidene fluoride copolymers. Du Pont de Nemours & Co., E. I. **850 579**

Open to public inspection 12 October

Separation of plutonium. Beaton, R. H. **851 171**

Polymerisation catalysts and catalytic polymerisation reactions. Petrochemicals Ltd. **851 111**

Catalyst solvent dispersions suitable for use in the polymerisation of olefines, and the polymerisation of olefines therewith. Petrochemicals Ltd. **851 116**

Manufacture of expanded polymerisation products. T.I. (Group Services) Ltd. **850 965**

Polymerisation of olefins. Petrochemicals Ltd. **851 112, 851,113**

Process for the manufacture of polyolefines of high molecular weight. Farbwerke Hoechst Aktiengesellschaft Vorm. Meister Lucius & Brüning. **851 073**

Process for preparing polymers of olefins. Montecatini. **851 175**

Polymerisation of olefines. Petrochemicals Ltd. **851 119**

High melting ethylene polymers. Montecatini. **851 051**

Reduction of silicon compounds. General Electric Co. **851 013**

Recovery of polymers from reaction mixtures. Goodrich-Gulf Chemicals Inc. **851 015**

Method of composition for bonding silicone rubber to other materials. Wacker-Chemie G.m.b.H. **851 016**

Preparation of steroid compounds. Glaxo Laboratories Ltd., and Henbest, H. B. **851 180**

Process for the continuous polymerisation of ethylene. Ruhrchemie AG. **850 865**

Hydrodealkylation of alkylated phenols. Pittsburgh Coke & Chemical Co. **851 212**

Stabilised polymers. Monsanto Chemical Co. **850 925**

Modified aminotriazine-formaldehyde resin compositions. British Industrial Plastics Ltd. **851 295**

Solvent extraction of olefines from hydrocarbon mixtures. Polymer Corporation Ltd. **851 057**

Process for polymerisation and the products produced thereby. American Cyanamid Co. **851 059**

Production of secondary amines. Imperial Chemical Industries Ltd. **850 870**

Process for the manufacture of phosphorylated hydroxy-acids and derivatives thereof. Ciba Ltd. **851 297**

Bisquaternary phenanthridinium salts. Crookes Laboratories Ltd. **850 930**

Preparation of polyesters. Goodyear Tire & Rubber Co. **851 061**

Unsaturated sulphonamides of chlorosulphonated olefin polymers. Du Pont de Nemours & Co., E. I. **851 062**

Upgrading of petroleum fractions. California Research Corporation. **850 933**

Removing impurities from catalysts. Esso Research & Engineering Co. **850 936**

Method of producing methylolacrylamide. American Cyanamid Co. [Addition to 810 170] **851 227**

Production of benzene. British Petroleum Co. Ltd., Moy, J. A. E., and White, P. T. **850 973**

Interpolyesters. Imperial Chemical Industries Ltd. **851 369**

Hemicyanine dyestuffs. Ilford Ltd. **850 976**

Maleic anhydride copolymers. Monsanto Chemical Co. **851 237**

Rigid thermoplastic moulding compositions. Imperial Chemical Industries Ltd. **850 947**

Steroid compounds and process of preparing same. Pfizer & Co. Inc., C. **850 951**

Production of gasoline. British Petroleum Co. Ltd., and Chinnery, K. M. **850 952**

Preparation of trichlor- and tetrachlorethylene. Soc. D'Electro-Chimie D'Electrometallurgie et Des Acieres Electriques D'Ugine. **850 953**

Production of cross-linked polyurethane materials. Continental Gummi-werke AG. **850 956**

Herbicidal compositions. Imperial Chemical Industries Ltd. **851 084**

Method of preparing fluoride-free uranium dioxide. Mallinckrodt Chemical Works. **850 957**

Ammonia synthesis. Imperial Chemical Industries Ltd. **850 843**

Method of producing boron hydrides or boron hydrides containing substituent organic radicals. Kali-Chemie AG. **851 169**

Ion-exchange processes. Permutit Co. Ltd. **850 872**

Purification of mono-sodium novobiocin. Merck & Co. Inc. **850 873**

Morpholine compounds and their production. Geigy AG, J. R. **851 311**

Polymerisation of monoepoxides. Union Carbide Corporation. **851 271**

Recovery of monocarboxylic acids. Imperial Chemical Industries Ltd. **850 960**

Acid monoazo dystuffs of the diphenyl-azo-naphthalene series. Sandoz Ltd. **850 844**

Process for the production of alkali metal and alkaline earth metal borohydrides. Studiengesellschaft Kohle. **850 980**

Continuous process for the preparation of superpolyamides. California Research Corporation. **850 848**

Thiophosphoric acid esters. Farbenfabriken Bayer AG. **850 984**

Highly polymeric polymethylene terephthalates. Imperial Chemical Industries Ltd. **851 244**

Sulphonylurethan salts and methods for their preparation. Chinoin Gyogyszer es Vegyeszeti-Termekek Gyara R. T. **851 010**

5-chloro-toluene-2: 4-disulphonamide and alkali metal salts thereof. British Drug Houses Ltd. **851 287**

Polyamide compositions. Imperial Chemical Industries Ltd. **850 986**

Stearylamine dispersions. Imperial Chemical Industries Ltd. **851 137**

Process of producing alkali metal salts of lower alkylene- and hydroxyalkylene-diamino or polyamino polyacetic acids. American Cyanamid Co. **850 879**

Polymeric materials comprising low pressure polyolefines. Petrochemicals Ltd. **851 138**

Process for the sulphonation of alkylaromatic compounds. Universal Oil Products Co. **850 881**

Production of oriented film of linear polymers. Du Pont de Nemours & Co., E. I. **850 993**

Production of polymers and copolymers of acrylonitrile. Deutsche Akademie der Wissenschaften Zu Berlin. **850 994**

Method of purifying trimethylchlorosilane. General Electric Co. **850 882**

Method of producing high quality silicon for electric semiconductor devices. Standard Telephones & Cables Ltd. **851 290**

Polyfluoroethylene films and methods of making them. American Machine & Foundry Co. **850 885**

Process for the preparation of para-fluorophenol from para-bromofluorobenzene. Olin Mathieson Chemical Corporation. **850 888**

Preparation of 1, 4-diphenyl butane. National Distillers & Chemical Corporation. [Addition to 771 329.] **850 890**

Lubricants comprising esters of polycarboxylic aromatic acids. Esso Research & Engineering Co. **851 205**

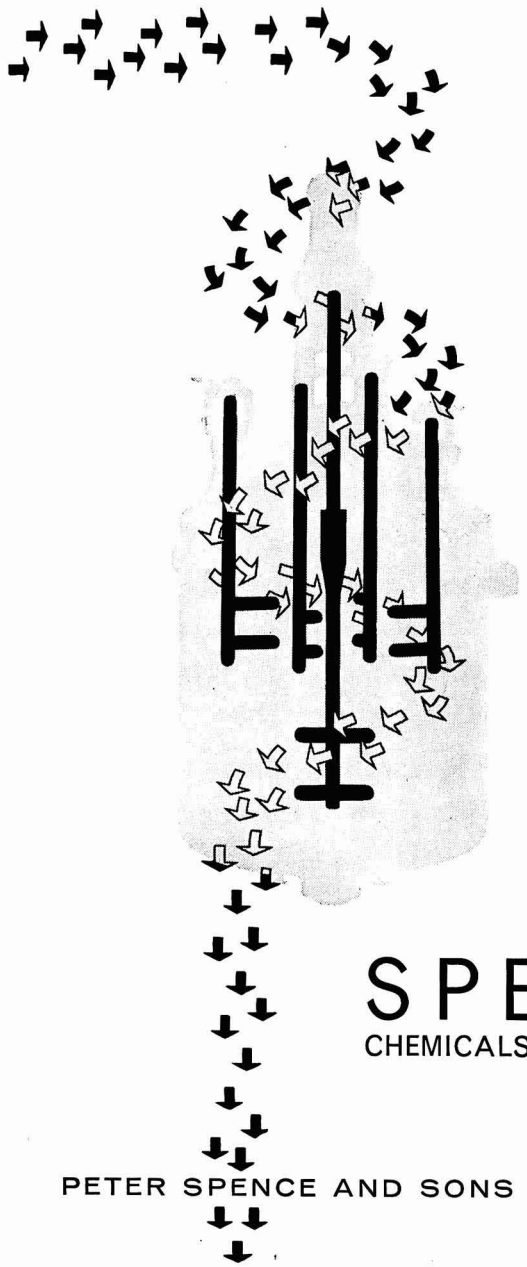
Coal gasification apparatus. Texaco Development Corporation. **851 206**

Process for preparing halogenated and halisulphonated polymers. Phillips Petroleum Co. **851 127**

Copolymerisable unsaturated polyester resins. Chemische Werke Albert. **851 207**

Copolymers. Union Carbide Corporation. **851 002**

Metal alkoxides and acetylacetonates



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Further particulars and information as to the method of application may be obtained from the Secretary, Association of Universities of the British Commonwealth, 36 Gordon Square, London, W.C.1. Applications close in New Zealand and London on **30th September, 1960.**

PATENTS & TRADE MARKS

The Proprietors of British Patent No. 732,652 for "AN IMPROVED METHOD OF EXTRACTING NAPHTHALENE FROM TAR DISTILLATION FRACTIONS", desire to enter into negotiations with a firm or firms for the sale of the patent or for the grant of licences thereunder. Further particulars may be obtained from Marks & Clerk, 57 & 58 Lincoln's Inn Fields, London, W.C.2.

The Proprietors of Patent No. 691908 for "POLYMERIZATION PROCESS", desire 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.

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SITUATIONS VACANT: continued

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Applicants should be University Graduates or A.I.M.

INTERVIEWS will be held at the Grand Hotel, Charing Cross, Glasgow C3, on Friday, 16th September from 6 p.m., and on Saturday, 17th September between 9 a.m. and twelve noon. Similar arrangements will be made at the Grand Hotel, Birmingham 3, on 30th September and 1st October, and at London during October. Alternatively interviews can be arranged at Aldermaston. Reasonable travel expenses will be paid.

If you would like to know more call at the hotel or write for an appointment to

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SITUATIONS VACANT: continued

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