

THE Chemical Age

VOL. LXXIII

15 OCTOBER 1955

No. 1892

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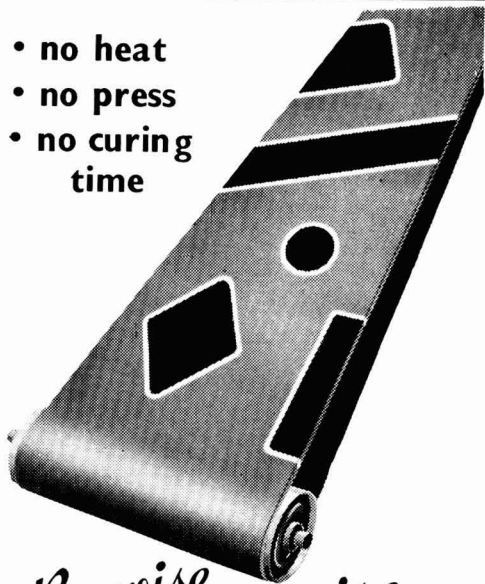
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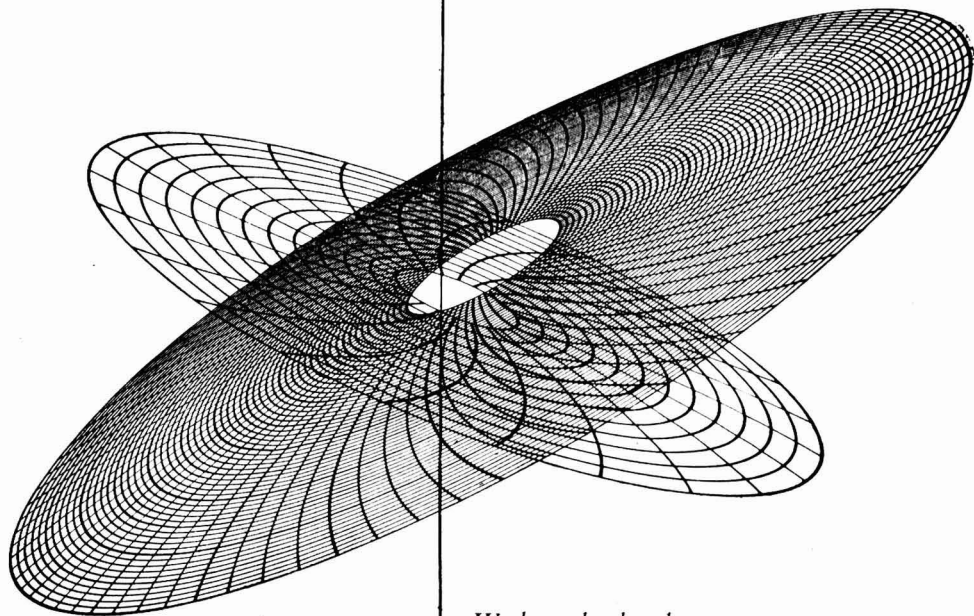
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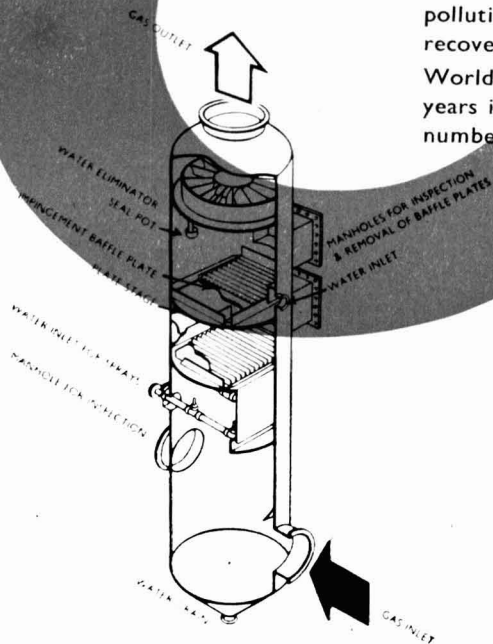
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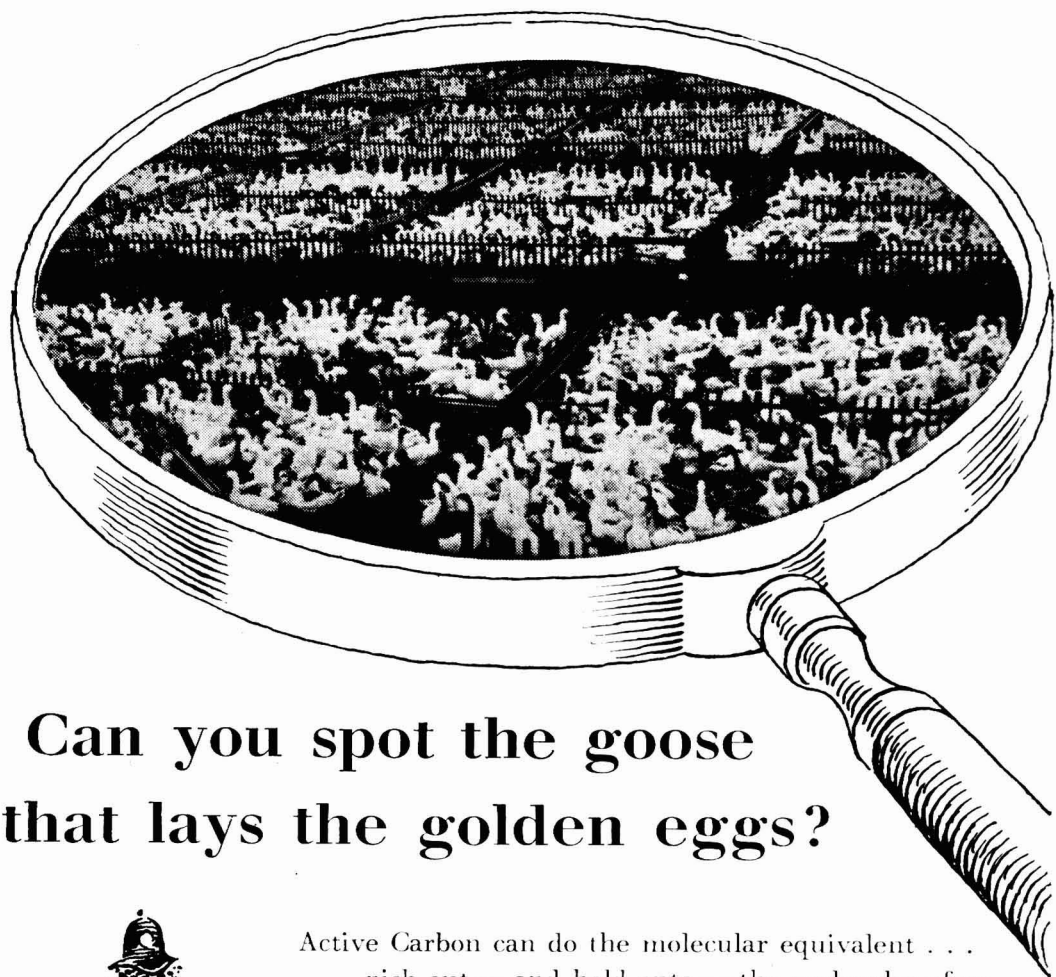
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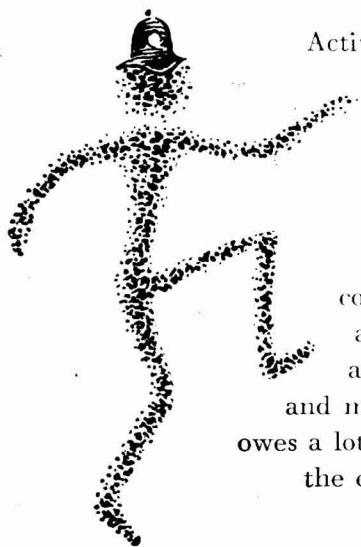
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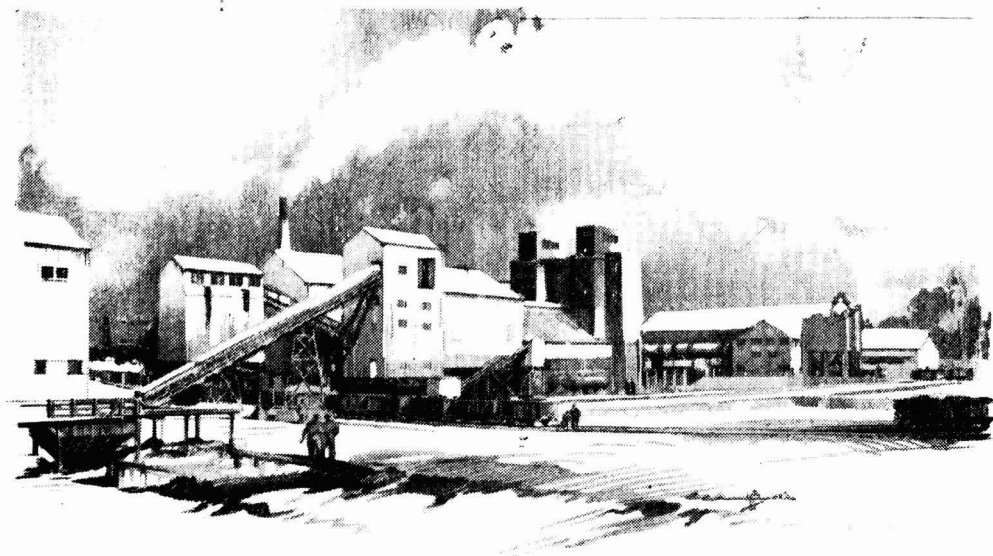
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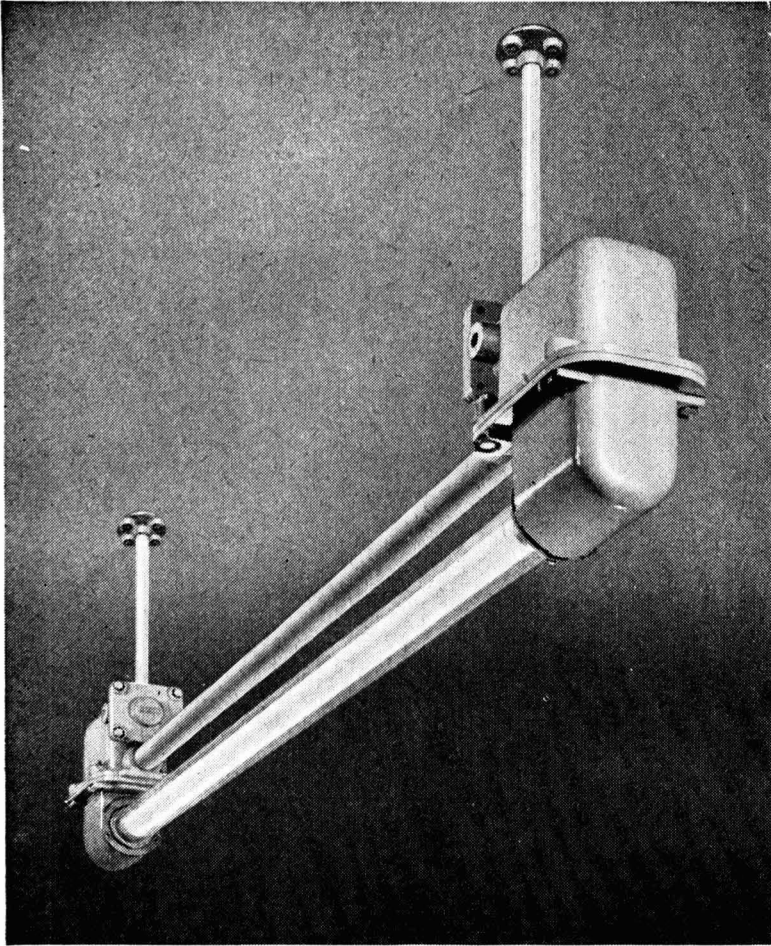
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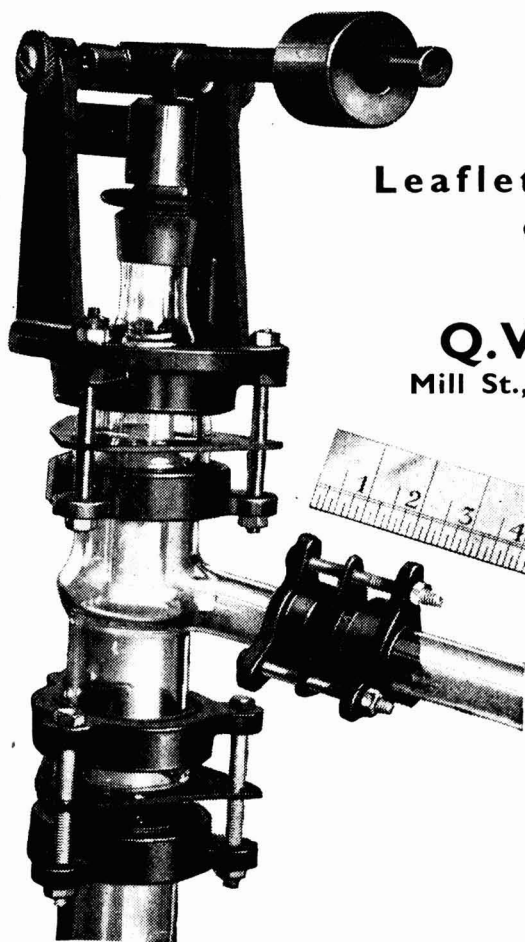
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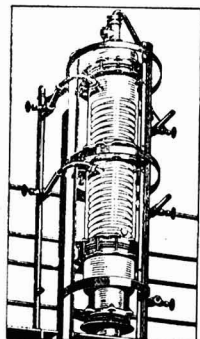
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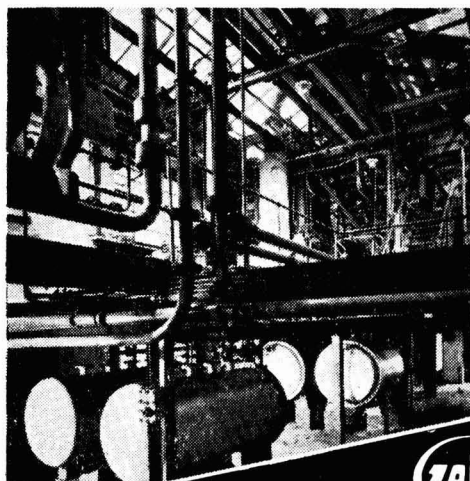
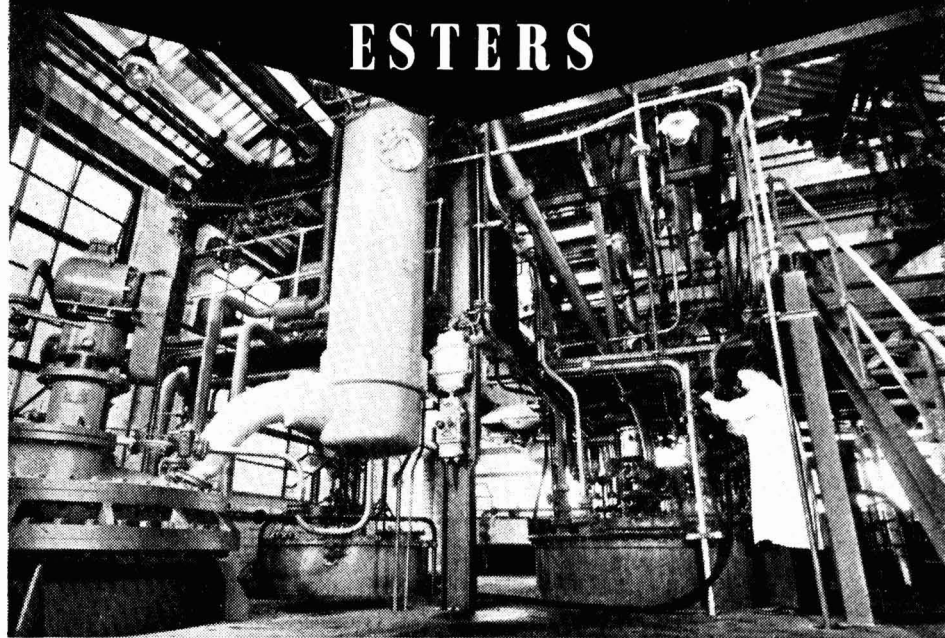
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The Chemical Age

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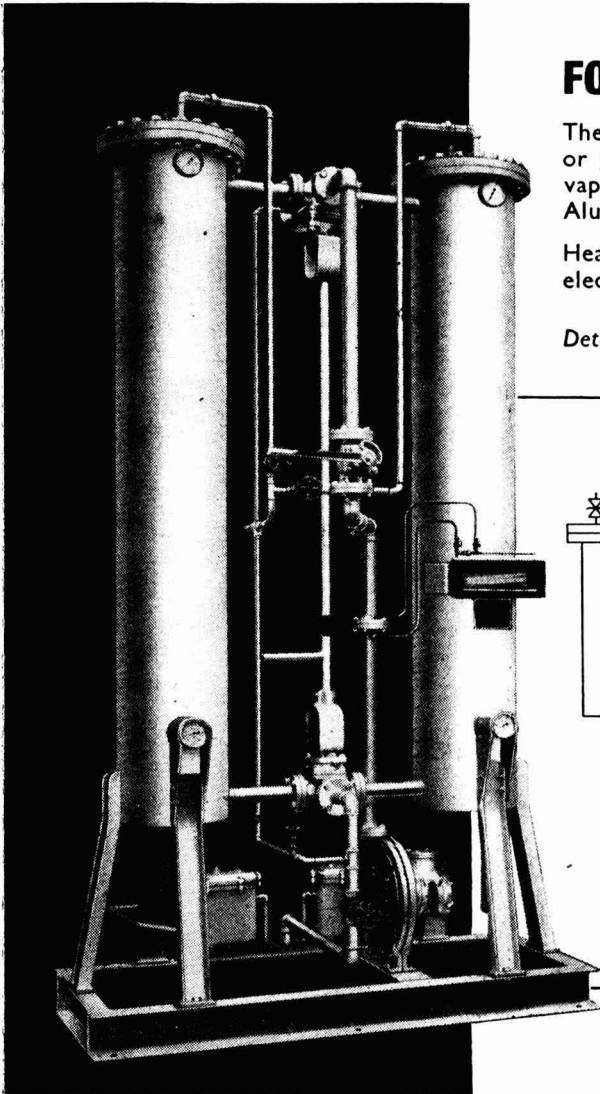
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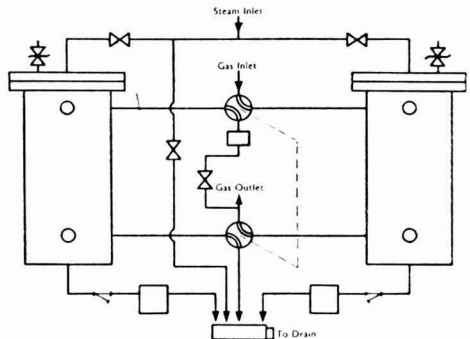
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Industrial Research

EARLIER this year a conference organised by the Federation of British Industries discussed one of the current scientific headaches—educating and training graduate staff for industrial research. An excellent account of the proceedings has now been published.* Some 80 industrial companies or organisations took part in the conference, in some cases represented by more than one executive. Scientists who are today middle-aged or older can hardly fail to contrast this situation with that of 25 to 30 years ago. Then, save for a few exceptional companies, industry's attitude to research was apathetic or casual and research was in most places, whether academic or industrial, the work of individuals. University centres may claim that they had developed the 'team approach' but this largely consisted of research 'schools' led by remarkably gifted individuals. Now the organised approach to research is paramount. And here lies danger for, while discoveries may be groomed for development by systematic research, it has yet to be disproved that great fundamental discoveries are made by individuals.

We are not pleading for an inverse of the present outlook, for some completely disorganised, random and dice-throwing approach to research. We merely draw attention to the danger of over-worship-

ping organisation in research and undervaluing the rôle of the individual. There are few important scientific discoveries which have not involved all the discomforts of a long pregnancy and final pains of birth. Organisation can provide clinics and midwives and maternity wards for mothers, but the creative contribution has been individual. Organised research has brought already a dangerous degree of anonymity into the human world of new ideas and discoveries. Two or three generations ago inventions or the groomed products of new scientific developments usually became known by the names of their creators; now there is a tendency to use instead the place-name of the research centre even though for the purposes of patent rights the name or names of individuals have had to be specified. At one time the research worker could reasonably dream of becoming rich and/or famous; today, in Britain at least, he has frequently neither prospects of wealth nor fame.

What has so far been said might seem to spike the guns of the FBI Report since the conference theme was dually linked with 'organisation'—supply of recruits for organised industrial research and

* 'Education and Training of Graduate Staff for Industrial Research,' 1955, 54 pp., 4s. net. from FBI, 21 Tothill St., London, S.W.1.

organising their training. At least two speakers, however, came to near or close grips with this dilemma of 'group and individual'. Professor J. A. Pope distinguished between fundamental and applied research, and thought that for the former 'the very best men must carry through the whole project from beginning to end' but that for the latter, projects could be broken down and team-conducted by various workers. Mr. C. Paine of I.C.I. was even more definite in distinguishing between the 'highly individual act' of germinating major new ideas, and research programmes that can be formally organised 'once new ideas have germinated'; he went as far as to say that 'only then can team effort be effective'. Frankly we prefer Mr. Paine's distinction to the professor's, for surely in these days industrial research is routine-operational only when it is not genuinely definable as research, when it consists of nothing more complex than a new application of established scientific concepts. An industrial research project that can put a company ahead in the world's markets—a new synthetic fibre, or an entirely new process for making some known substance—may demand as much complex study and as intense a flash of originality as any project of fundamental science. For the higher levels of industrial research, we do not think that Professor Pope's distinction is valid. Moreover, were it generally accepted, its correlated argument, that industrial research can be safely staffed by lesser-grade scientists in a sectionally-planned organisation, would ensure that Britain's industries never achieved a technical lead but always struggled to keep up with technical advances in other countries.

It could be replied that the primary basis of Professor Pope's suggestion was practical, that there are far too few first-class men to go round and that much of the industrial research still likely to be profitable here could be done by organising second- and third-class men. But this argument also ignores our world-economic position. If the majority of our best young scientists are employed in fundamental research, the old 'free-for-all' story of British scientific originality will continue with other countries' industries frequently reaping the quickest

harvests from British research. We never could afford this, but the time has passed when even the illusion is tenable.

Must industry and the universities and the government (to say nothing of American companies who now increasingly try to recruit European graduates) continue to compete for a non-expanding supply of first-class graduates in science? Can the scramble be better organised? There seems to be plenty of room for more co-operation between universities and industry. If, as was freely enough said, there are plenty of graduates who must be kindly and finally told that they are not quite good enough for careers in university science, is it not possible to pick more of them out at a midway stage and then to give an industrial bias to the rest of their university training. From the teaching side in the conference the point was frequently made that industry must expect to give a good deal of further training to graduates, that the first two years or so in industrial research must be regarded as a kind of post-graduate period. Why not, where abilities seem modest, let industrial preparation play some part in the pre-graduate stage as well? The purist conception of a university degree is much too narrow for the widened technical world of today. The manner of education has always counted more than its matter. Industrial research organisations may well have something to learn from the universities' handling of fundamental research. Environment, encouragement, and personal effort are the raw materials of discovery; the individual is not given any impression that he has become a cog in a system of interlocking wheels,

One final thought is comforting. It was not said at the conference but it has recently been voiced in America (C. D. Tuska, *J. Franklin Institute*, 1955, 260, 93). Inventiveness, as assessed by patent applications per year, has dropped by 40 per cent in the US since the mid-1920s; in Britain it has dropped by only 16 per cent. Today patent applications per 100,000 of population are higher here than in America. It is better that we should be critical than complacent, but it may well be that what we do, and all that we can hope to do with our manpower resources, is better than we think.

Notes & Comments

Passports for Capital?

AT the annual general meeting of the Chemical Workers' Union late last month, a resolution was passed 'noting with concern the large and expanding investments by American firms in the British chemical industry'. If counter-action by the Government was not precisely demanded, investigation was. The resolution was not one of those exceptionally red herrings that leap up from the floor at union gatherings. It was an official resolution presented on behalf of the Union's National Executive. It might be regarded as surprising that this subject has not been publicly ventilated before; now that it has been raised, it could lead to misinterpretation that an organisation of labour has taken the initiative. Those who take opposite sides whenever trades unions express opinions will hardly be able to consider this question of expanding US investment here without prejudice. Yet the same resolution might quite reasonably have been brought forward by an industrial body such as the Federation of British Industries. The view that capital has no passports or nationality died when the gold standard was abandoned, and even those who believe that the old *laissez-faire* principles of economics should play a stronger part in our internal economy must be less confident about extending this belief in a world of nationalisms and trade quotas and fettered currencies.

A Regrettable Development

THE new tendency for US capital to buy stock in Throgmorton instead of Wall Street is not some subtly sinister move towards industrial colonisation. The plain fact is that many British shares are under-valued whereas many US shares are at least fully-valued. Recently a shrewd investment commentator pointed out that dividends on British 'blue chip ordinaries' are in some cases covered 10 or 12 times by profit-earnings, but for US shares of the same class the cover is much less, perhaps

only from 2 to 3 times. If US capital seems to have shown some preference for buying British chemical shares, this simply reflects the fact that the shares of certain leading chemical companies are not only of blue chip status but also that they have exceptionally good growth prospects. British investors who took the same view a few years ago have been well rewarded. To say this is not to look upon increasing US ownership of British shares with satisfaction. It is a regrettable development, and the present credit squeeze with its curtailing influence upon British investment could help to expand it. The fact that Wall Street prices have fallen considerably in recent weeks has so far acted as a somewhat fortuitous check, for at the present time prices of British shares are well below the level of midsummer when very heavy American buying took place. It is not a form of nationalistic bias to want to see British industry predominantly owned by British capital—it is plain common sense. It is most unusual for us to agree with Mr. Bob Edwards and his Chemical Workers' Union, but this time we must agree that he has performed a valuable service in drawing attention to this matter.

Scientist Shortage

THE gravity of our continuing and intensifying shortage of young scientists has at last achieved top-level recognition. The Prime Minister in his Bournemouth speech last week made special reference to it and revealed a new and welcome Governmental determination to exert remedial influence. Whatever economies and restrictions may be necessary in the near future, Sir Anthony stated that he and the Chancellor were agreed that 'nothing will be cut away from the necessary work (in this nuclear sphere) or in the training of scientific man-power'. For scientific education, then, a priority has virtually been established, and the value of this priority is likely to be considerable as the future pattern of spending reductions in other national fields reveals itself. At the same

time, a London University sub-committee report is urging an increase of 60 to 100 per cent in the number of places for science graduates over the next five years. 'We are now in the throes of a second industrial revolution, the effect of which will be quite as far-reaching as that of the nineteenth century.' Critical mention is made of industry's 'talent-scouting' activities at universities; these efforts to sign up students six months or so before they actually graduate are cited as one of the reasons why increasingly few young scientists enter teaching. However, the basic shortage is of scientists, not only of science teachers, and the report says fairly and squarely that raising the total supply of scientists is the responsibility of universities.

No British Exhibitors

THE first International Exhibition of Laboratory Equipment was held as a special feature to commemorate the 10th anniversary of the Foire Internationale de Gand, Belgium's great autumn trade fair, which was held in the Palais des Floralies at Ghent and which closed on 25 September.

Not a single British firm manufacturing laboratory equipment could be persuaded to exhibit there and apart from a handful of Dutch and Belgium exhibitors it proved to be an almost 100 per cent German show.

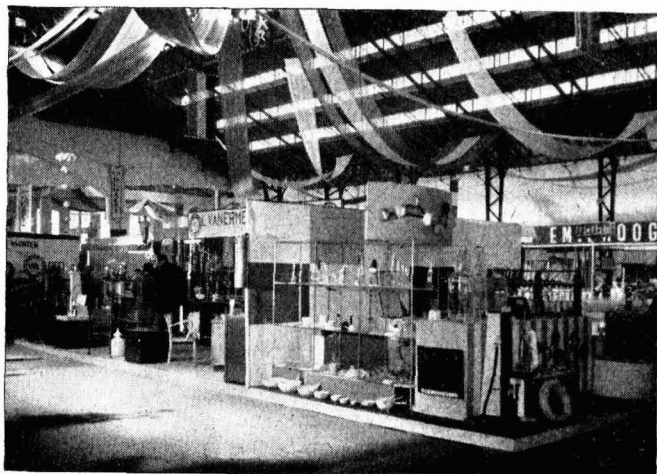
The exhibition was visited by 750,000 people and all the exhibitors are said to have expressed great satisfaction at having done excellent business.

Not So Heartening

THESE new expressions of outlook are certainly heartening, but a new factor of discouragement may well emerge from the proposed changes in call-up for national service. A gradual age-raising of call-up may improve the position of young men who go straight from school to employment, but it seems likely to dampen the ardours of those who decide to stay longer at school and also to add three or four years of university education to their non-earning youth. If we are so nationally short of scientists, there should be a general excusal of national service for young men who take science degrees; deferments should not be given simply for selected post-graduate kinds of scientific employment. So far this dilemma of social policy has been regarded as politically explosive, but some realistic boldness is urgently needed. We know of a young man who took his science degree this summer who is working in a woodwork factory while he waits for his call-up!

Alteration

A slight alteration has been made in the arrangements for the 50th meeting of the Manchester group of the Society of Leather Trades' Chemists. The meeting will now be held on Saturday 29 October at 2.30 p.m. at the Grosvenor Hotel, Deansgate, Manchester. Dr. T. Vickerstaff will read a paper entitled 'Colours and How We See Them'.



A general view of the 1st International Exhibition of Laboratory Equipment

Shop Rise in German Chemical Imports

Foreign Interest in Petrochemicals Production

AN INTERESTING feature of the chemical trade of the German Federal Republic this year has been the sharp rise in imports. While chemical exports in January-June rose by 18 per cent to DM.1.673,000,000, chemical imports advanced by 35 per cent to DM.570,000,000. As last year when the percentage increase of imports also exceeded that of chemical exports, the sharp expansion of purchases from foreign sources was necessitated in part by the inability of domestic producers to step up outputs as quickly as the rapidly rising home market demands required. Strenuous efforts are being made to add to the available plant capacity for basic materials but pending their completion imports are bound to rise.

This year, however, it has been noted that the import increase has been most marked in semi-finished manufactures and smallest in basic chemicals, with finished products occupying an intermediate position. Although this development has caused some misgivings in the German chemical industry, the Federal authorities are hesitant to interfere, and this for two reasons: firstly, most of these imports originate from other EPU countries and thus create additional outlets for German industrial exports; secondly, they tend to check any tendency to excessive price demands which might otherwise be inevitable in the present boom.

America Buying More

As for chemical exports, Asia, North America and Africa this year account for a higher percentage of the total while in Europe the Netherlands and Switzerland appear to be the only countries buying substantially larger quantities of chemicals from the Federal Republic. The British market, which is the biggest single outlet for German chemicals, absorbed less, and trade with South America was disappointing though it may have improved in the last few months for which the figures are not yet at hand. German chemical manufacturers are pressing for greater concessions in overseas countries selling primary commodities to Germany and would also like the Federal authorities to insist on a higher

degree of trade liberalisation in other European States.

Rheinische Olefinwerke GmbH has now officially opened its polythene plant at Wesseling. The final cost of the plant is nearly DM.70,000,000, more than twice the capital of DM.30,000,000, and its annual production will consist of 10,000 metric tons of polythene and up to 12,000 metric tons of ethyl benzene; provision has been made for possible later extensions. The raw material is obtained from the adjoining refinery of Union Rheinische Braunkohlen-Kraftstoff AG, and the ethyl benzene output is passed on to the BASF works at Ludwigshafen to be processed into polystyrene. The total labour force, including office staff, numbers 450.

BASF Using I.C.I. Patents

The process used at Wesseling has been developed by BASF on the basis of its licence from I.C.I. and its own wartime experience. Two large plants using the process have been built in America, and another one is to be built in a so far undisclosed foreign country under a contract concluded a few weeks ago. The Wesseling product will be sold under the trade name Lupolen H to distinguish it from the Lupolen now made at Ludwigshafen.

The two founders of Rheinische Olefinwerke GmbH who have contributed to the capital in equal parts, BASF and the German Shell subsidiary, appear to be well satisfied with their venture which constitutes the first big petroleum chemicals enterprise in Germany. Shell supplies the Union refinery with its crude oil and markets its finished products; apart from supplying the raw material, part of the capital and personnel, Shell has co-operated in technical matters concerning the polythene plant and hopes to 'continue successfully the fruitful and well-tried co-operation' with BASF, possibly in other fields, as the Shell spokesman said at the opening of the plant.

Meanwhile several companies in Germany are showing interest in the low-pressure production of polythene. Kohle-Oel-Chemie GmbH, which was formed early this year by Deutsche Erdöl AG, Farbwerke Höchst

AG, and Mannesmann AG intends to operate a 24,000 ton plant at Gelsenkirchen from early 1957; its output will be processed by Mannesmann AG, Germany's largest makers of pipes and tubes. A small low pressure polythene plant is already being operated by Farbwerke Höchst AG at Höchst, and a larger one is to be put into commission there towards the end of this year. Two large Ruhr mining companies have also shown interest in the Ziegler process for low pressure polythene; Gelsenkirchener Bergwerks AG stated last month that it was giving 'intensive' consideration to the planning of a large plant, and Hibernia Bergwerks AG has been running a pilot plant for some time. So has Ruhr-Chemie AG, according to the German press.

Finally, Chemische Werke Hüls AG is reported to be preparing for the early production of polythene by a process of its own. There is thus no lack of interest in the possibilities of the plastic, and even if not all projects are proceeded with, the total capacity may eventually exceed the needs of the German market. BASF, however, believes that its product will prove competitive because it does not require purifying and shows a high degree of durability. It is expected that the plant at Wesseling will allow larger outputs under continuous operation than originally thought; the output of 10,000 tons of Lupolen expected now compares with an earlier estimate of 7,000 tons.

A 12,000 ton plant for the production of phthalic acid from naphthalene is being built by Bochumer Bergbau AG at Bochum under an agreement with BASF. The latter company and Gelsenkirchener Bergwerks AG, which owns Bochumer Bergbau AG, are responsible for financing the plant in equal proportions.

Foreign Competition Challenge

INCREASED foreign competition, particularly from Germany and Russia, as well as the continuation of the US competitive economy will demand much of the chemical engineering profession. So stated Mr. Bruce K. Brown, President of Pan-American Southern Corporation, in a paper presented on 28 September, to the National Convention of the American Institute of Chemical Engineers at Lake Placid, NY.

Taking a long look at the future of society

and economics, Mr. Brown stated that chemical engineering students will have to be concerned more with principles and less with practice. Practice training to a great extent will be taken over by industry.

Mr. Brown foresaw the possibility of dividing the field of chemical engineering into a specialists and generalists area with suitable curricula for each. To help future chemical engineers to make a decision between these possibilities, the help of psychologists with improved techniques of aptitude testing would be enlisted.

Specialists would concern themselves primarily with basic principles and mathematics including the new techniques of linear programming.

The generalists training, while enabling him to understand the language of the specialist, must include administration, economics, and other subjects related to management.

This should bring some order out of the chaos that now existed and increase the efficiency of the training by both college and industry.

Card-Index System

DR. M. A. PHILLIPS and Associates, consulting chemists and chemical engineers, have accumulated a comprehensive card-index system relating to the manufacture and uses of a large number of fine chemicals, insecticides, pesticides, and pharmaceutical chemicals, including recent patent references.

Anyone who would like to have the information contained in this index relating to any specific compound or compounds, can be supplied, the only proviso being that inquiries be accompanied by a stamped addressed envelope. The index includes cross references to proprietary names and equivalents, official names, etc. (British, American and German proprietaries). Inquiries should be addressed: The Secretary, Dr. M. A. Phillips and Associates, 14 Western Road, Romford, Essex.

Scottish Agents

W. Crockatt & Sons Ltd., of 64 Darnley Street, Glasgow, S.1, have been appointed exclusive agents for Scotland for the Sinex vibrating screens, automatic weighing machines and vertical vibratory bowl-type feeders for component parts.

The Applications of Fluid Mechanics

Hydromechanics Research Association on View

MORE than 700 people representing subscribing organisations, industry, universities, and the press attended the open days (5 and 6 October) of the British Hydro-Mechanics Research Association at Harlow, Essex. They saw working scale models of current and long-term research, and work of more immediate practical utility.

A non-profit making organisation, the BHRA is controlled and financed by some 50 industrial members with the help of a proportionate Government grant, and its yearly income exceeds £50,000. Its speciality is the practical applications of fluid mechanics. Member firms faced with a problem and having a new idea pass it to BHRA who carry out research. Such an idea was that of a member firm, who, faced with the problem of droplets of contaminating fluid in a normal pipe flow which would not settle out because of turbulence, sent an idea to BHRA.

The idea was for separating water from kerosene. BHRA investigated it, and then sent their clients another idea which the firm is now operating. The original idea was perfected at Harlow and is now used to separate water from carbon tetrachloride. It was found that by passing the flow through an expanded section full of tubes the flow could be made laminar and the contaminant allowed to settle out by gravity.

Air-Entraining Vortices

A subject of research which has given results of considerable economic value is the design of pump suction sumps for minimising the entry of swirl and of air-entraining vortices into pump inlets. After studying the formation and prevention of air-entraining vortices, BHRA's experiments have shown that they arise from asymmetrical approach of the water towards the suction inlet. It has now been found possible to guard against this reduced pump efficiency and wastage of power through the initial design of the sump which can often be made more cheaply than is customary.

Work at Harlow on the flow in pipelines of slurries containing very fine particles has shown that the flow of suspensions of fine particles such as fly ash or chalk is not in-

fluenced significantly by gravity, but as the velocity is diminished a stage is reached where the pressure loss ceases to correspond with that for plain water. Comparisons of tests on the pipe flow of a fly ash slurry and its properties in a rotating cylinder viscosimeter showed that the pressure losses of such materials flowing in pipes can be closely related to the viscosity-shear rate properties of the slurry.

High Viscosity Slurries

The high viscosity of such slurries sometimes extends the viscous flow region up to quite high velocities. Because of the variation of viscosity with shearing rate the Poiseuille equation of viscous flow is not applicable, and one which takes account of the variation of viscosity across the pipe diameter must be used.

A considerable amount of research at Harlow is being done on pump impellers. Recent air flow tests of a freely discharging centrifugal pump impeller have been carried out and experiments made on a rotating impeller discharging freely into the atmosphere and throttled on the suction side. The relative velocity has been measured with hot wire anemometers at several positions across a vane passage inside the impeller. At some distance within the impeller the relative flow angle is about constant, and the highest velocity is found to occur near the suction face of a vane, although several previous impellers tested have not shown this similarity with the theoretical flow pattern.

The velocity emerging from the impeller has been measured by a stationary instrument close to the periphery of the rotating impeller. A cyclic pattern in this velocity is associated with the passage of the impeller vanes past the instrument, but, in addition, the random turbulence is also very severe at all the conditions tested. Near the best efficiency point the head measured on this impeller with pilot tubes was about 6.5 per cent higher than the delivery head of the impeller when in a volute casing, but at higher deliveries the difference was much greater.

For observing flow in centrifugal pump impellers the BHRA used a transparent cen-

trifugal pump impeller which could be rotated inside a large cylindrical tank with transparent windows at top and bottom. Small solid spheres of a mixture of wax and lead stearate of unit specific gravity were introduced into the flow paths of these tracers within the impeller passages and then recorded photographically. From these records absolute and relative velocities were determined.

Expansion Plans Outlined

ONE hundred and six long-service employees of Kelvin & Hughes Ltd., are to be presented with gold watches by the company. At the Kelvin Hughes annual dinner on 3 October the company presented watches to 71 employees. On 24 November a further 35 long-service men and women will receive watches.

A total of 3,451 years of service is represented by these 106 employees, many of whom have been with the company for more than 35 years.

Kelvin & Hughes Ltd., has three factories, at Barkingside, Essex, Basingstoke, Hants, and at Hillington, Glasgow. The 61 long-service employees from Barkingside represented a total of 1,928 years of service (average 31.61 years), the 28 from Hillington 934 years (average 33.36 years) and the four from Basingstoke 128 (average 32.0 years).

During the company dinner in London, Mr. W. T. Slater, assistant managing director, gave an assessment of the future position of the company. After dealing with the tremendous increase in competition, particularly from Germany, he outlined measures being taken to meet this challenge.

'This year the development departments of the organisation are to get a lion's share of the company's income', he said, and 'we propose to spend more than ever. We look for new boiler house instruments, increased application research on flaw detection, and new models of the Ampro projector'.

Mr. Slater said the company will invest large sums on new factory buildings, and was now spending money on buildings and research at a rate which exceeded the whole annual turnover of the two earlier companies (Henry Hughes & Son Ltd., and Kelvin, Bottomley & Baird Ltd.), in the years before the war.

Antioxidant For Rubber

A NEW non-staining antioxidant for rubber has been produced by I.C.I. dyestuffs Division. Its antioxidant powers are claimed to be equal to those of phenyl- β -naphthylamine (one of the most powerful of the established staining antioxidants). At the same time it is said to afford protection against the ageing brought about by contamination of the rubber with copper and manganese.

Exposure tests carried out in Great Britain and Northern Ireland have shown that this material, Nonox WSP, delays the onset of crazing and retards its development over long periods of exposure, it is claimed. Although Nonox WSP gives some measure of protection against flexcracking in both black and non-black loaded stocks, it does not, however, equal the established anti-flexcracking antioxidants in this respect.

In a brochure devoted to the new product, data are given on the effect of Nanox WSP on the ageing resistance of a variety of rubber compounds, as well as information on the chemical and physical characteristics of the new material.

Raw Cotton Conference

BOOKINGS for the Textile Institute one-day conference on 'Raw Cotton—Its Properties and Distribution', which is being held in the Walker Art Gallery in Liverpool on Wednesday, 23 November, are already considerable, say the Institute.

Summaries of the four papers, 'Genetics' by Professor S. C. Harland, F.T.I. (Hon.), of Manchester University, 'Cotton Quality and Its Assessment' by E. Lord, of the British Cotton Industry Research Association, 'Spinners Requirements' by Allan Draper, F.T.I., of William Birtwistle Allied Mills Ltd., Preston, and 'Supply and Marketing' by W. B. Hutchinson, of Major Cleaver & Co., Liverpool, will be distributed in advance to those attending the conference, and lively and sustained discussions are expected.

The president of the Textile Institute, Mr. W. T. Winterbottom, C.B.E., will open the conference at 9.45 a.m.

Booking forms and further information about the conference can be obtained from the general secretary at the Textile Institute.

Some Aspects of Automatic Control

Papers Presented at Joint Conference

AS reported in last week's issue of THE CHEMICAL AGE (p. 779) a joint conference on 'Automatic Control in the Process Industries' was held on 4 October at Church House, Westminster, London S.W.1. In our account we summarised briefly a number of papers, four of which we are now presenting in greater detail.

The four papers are, 'Automatic Control of Batch Processes' by W. A. Goldstein, of Bakelite Ltd., 'The Temperature Control of Large Storage Tanks' by W. A. J. Preece, of Shell Refining and Marketing Co. Ltd., 'Automatic Control in the Pulp & Paper Industry' by N. C. Underwood, of Bowaters Development & Research Ltd., and 'The Economics of Process Control' by S. W. J. Wallis, of the British Petroleum Co. Ltd.

There are many processes which are still carried out in batches, said Mr. Goldstein, and automatic control has a considerable part to play in them. Although the problems involved are somewhat different from those in continuous operations, the same advantages, uniformity of product, economy of operation and safety of operation, are obtained.

Batch Processes

Many batch processes which require the use of automatic control involve some form of heat transfer and are carried out in vessels in which the contents are heated or cooled by jackets or internal coils. Compared with many continuous processes, the volume of reactants is large in relation to the area of the transfer surface providing control, and efficient agitation must be applied. In addition, such physical properties as viscosity and density may be continuously varying in the course of the reaction, as will be the conditions in which the detecting elements and controlling surfaces are required to function.

Finally the wide variation in control capacity required calls for very careful consideration of the size of correcting element necessary.

Level and flow control do not generally play a very significant part in the control of batch reactions, the usual controlled variables being pressure and temperature, in

some cases allied to pH, viscosity, etc. Many reactions have at least one volatile component and it may be possible to use the vapour pressure of the reactants as a sensitive measure of temperature. In many reactions, however, direct measurement of temperature is necessary, and here considerable care is needed both in instrument selection and installation.

Accurate and stable control under varying rates of heat transfer can be obtained by the use of the cascade control system in which the temperature of the medium in the jacket or coil is controlled by deviations from desired value of the primary controlled variable.

Programme Controllers

Mr. Goldstein went on to discuss programme controllers. For economical operation it is essential that process equipment should be utilised for the reaction for the maximum period of its operating time, and, in addition, the reaction rate should be the maximum possible. To obtain these conditions some form of programme controller is necessary. There are many varieties of these but they can be divided into four main sections:—

(a) A series of cams mounted on a common spindle, each cam controlling a particular operation.

(b) Single cam instruments which basically control one variable.

(c) Pre-set types consisting of a number of electric or pneumatic timers in conjunction with a suitable sequence mechanism.

(d) Simple unit timers which may be cascaded in order that a given process may be carried out in the correct sequence and with the correct timing. The type of controller will depend on the degree of complexity of the process.

A simple hypothetical case was discussed by Mr. Goldstein to give some idea of the application of batch control. The stages involved were the charging of two or more raw materials to the process equipment, a period of heating under temperature control, of cooling under pressure control, and the discharge of finished product.

The first automatic instruments to be ap-

plied to the process would in all probability be pressure and temperature controllers which the operator would put into service as necessary.

Except in small plants, said Mr. Goldstein, the siting of hand valves so that one man can both operate them and observe the results is difficult. The next stage in instrumentation would therefore be centralisation of control, which could be accomplished by the use of a simple hand operated six position switch in conjunction with air operated raw material feed and finished product discharge valves and the existing pressure and temperature controllers.

Three Responsibilities

At this stage the human operator is still left three responsibilities, namely: that the correct quantities of raw material are fed to the process, that the correct processing periods are used, and that the finished product is fed out without delay. When this stage is reached, said Mr. Goldstein, it is worth considering whether further automatic operation is justified. Each problem must be considered on its merits but it may be poor economics to risk producing a product of inferior or inconsistent properties, or to attain less than the best plant utilisation through lack of automatic control.

Discussing future developments Mr. Goldstein said that the main weakness of many existing control systems was that the control was applied on secondary variables such as temperature and pressure. Although the composition or quality of the materials being processed is available from separate analyses, corrective action is only applied indirectly. Work at present is proceeding on the development of industrial type equipment, both for the automatic analysis of materials and the continuous measurement of such quantities as viscosity and turbidity.

Surprisingly little is known at the moment of the kinetics of the reactions involved in many batch processes. When this information is available it will enable the chemical engineer to give more precise information on plant behaviour under given conditions. This will reduce the present severe limitation in the employment of computers as it will be possible to provide an adequate programme to supply the necessary corrections for any given set of circumstances.

The basic problem in the temperature control of large storage tanks is that the

tank temperature has no single value, said Mr. Preece. Similar problems are encountered in many pressure control systems and in the temperature control of a distillation column and many other control systems.

In most cases a single point is chosen for the measuring element either because it is the most important in the system or because it represents the best approach to an average. In either case an undesirable time lag is likely to be introduced.

A large proportion of the products in the petroleum industry are too viscous to be pumped if stored at atmospheric temperatures and for that reason storage temperatures between 50 and 170°C are employed. The majority of tanks in the petroleum industry use steam heating. The steam pipes extend over the whole of the tank area and are fixed one to two feet above the floor of the tank.

There are two main considerations in selecting the best location for the temperature measuring element. The location must enable a reliable indication of the temperature to be obtained when the tank is operated partly empty. Furthermore, it is important that no portion of the tank should fall below the minimum temperature for pumping, and therefore the element should be at the position of lowest temperature.

Satisfactory results have been obtained when the temperature element is from two to five feet above the steam pipes and six inches to two feet from the tank wall.

Uniform Temperature

Extensive tests were carried out on an 8,000 ton tank at Shell Haven which showed that this arrangement of the temperature element gave the best results. When the tank was being heated it was found that the temperature in the tank was substantially uniform for all positions more than two feet above the heating pipes. On cooling, the temperature half way up the tank was virtually the same as the temperature at the top.

When slow steam heating is employed the slow rate of temperature changes makes the on-off type of controller very suitable. When, as is sometimes the case, the heating coils are large enough to produce rapid heating some form of proportional controller will be more advantageous.

Where large quantities of liquid at a considerably higher temperature are frequently added to the tank, as in the handling of

bitumen, it is found that an on-off controller is the most suitable.

Mr. Preece went on to discuss some of the theoretical aspects of the heat characteristics of storage tanks. The rate of heat loss depends on the rate at which hot material from the main body of the liquid finds its way to the tank wall.

Because of its lower temperature the liquid adjacent to the tank wall will have a higher specific gravity than that in the bulk of the tank. It will therefore slowly sink and be replaced at the top by liquid moving out from the centre of the tank. It can be shown that the variation in cooling rate with temperature will be, in consequence of this, greater than would be anticipated by Newton's law of cooling. This has a very considerable effect on the behaviour of the control system if the control temperature is changed, an effect that is not easily overcome by changes in instrumentation but can be corrected by thermal insulation of the tank.

In the case of some bitumen tanks at Shell Haven refinery the lower minimum temperature when operating on automatic control has so extended the period during which steam is not required that very often a fresh charge of bitumen is in the tank before steam is required and the valve does not open at all.

Basic Processes

The basic processes of paper making have changed but little since their inception, said Mr. Underwood, and those engaged in the industry have occupied, with the printers, a special position in industrial society. The processes of the industry can be divided conveniently into three main sections, the production of pulp from wood by chemical means, the production of pulp by purely mechanical means, and the manufacture of this pulp into a continuous paper sheet.

In the chemical process the wood is cut into chips and placed in a digester containing about 50 tons of wood. A solution of calcium bisulphite is pumped in, the digester is sealed and steam is blown in. Cooking takes about eight hours. The cooking reagents are prepared in an adjacent plant.

The chief difficulty in controlling the digester is that of obtaining a representative temperature measurement for such a large volume, and a scheme has been used to control steam flow to a pre-set programme regardless of the temperature of the digester.

In the cheaper grades of paper a large proportion of the pulp is produced mechanically by feeding logs against a large grindstone. The power fed to the motor is measured by an ampere balance type of wattmeter or by an electronic method, while the controller output is used to operate the chain conveyor feed motor.

The control of stone speed and stock temperature is necessary for plant protection and temperature control. Unfortunately neither of these controls has a unique influence on those physical properties of the stock which it is desirable to maintain at a fixed level. Chief among these is freeness or the ability of the pulp to shed water. This property has as yet defied the application of automatic control. It is measured in the laboratory by a rate of filtration method in a standardised apparatus.

Automatic Handling

Throughout the grinder room the handling of the wood and the mechanics of the process are almost entirely automatic, but the control of quality is almost entirely manual.

One of the essentials to good paper manufacture is to maintain a constant consistency in the pulp flow. Most consistency controllers operate by diluting the stock until a pre-set viscosity is obtained. Heavy criticism is made against this system on the grounds that the viscosity-consistency relation is determined by the type of pulp and by its treatment. Other methods of control have been tried but have not found wide application.

The control of pH is generally accomplished manually, although pH controllers which will operate for reasonable periods are in use.

It is desirable to produce a sheet of uniform thickness having the same properties in all directions. In the main these properties are determined by the operation of the wire part of the machine, which is often set with the aid of a simple balance showing the weight per unit area of the finished paper, and from the appearance of the stock on the wire.

One of the most useful instruments for the investigation of sheet uniformity is the beta ray gauge. A weak ray source such as thallium is placed on one side of a paper sheet while an ionisation chamber is placed on the other side. Work with this instrument reveals that the weight per unit area

varies by up to ± 10 per cent over distances of a few inches.

The automatic control of machine speed is one of the oldest applications in the industry, said Mr. Underwood. The dynamic performance of a paper-making machine is highly complex. The speed varies slightly from section to section to allow for stretching and contraction of the sheet as it passes through different sections of the machine.

The paper is dried by passing it over large steam-heated cylinders using a cotton felt to maintain contact against the face of the cylinder. It is now thought that drying takes place as the paper moves from one cylinder to the next, with a consequent drop in temperature. Some form of constant temperature or constant pressure controller is usually fitted to the steam supply to the drying cylinders. At the present time the industry is reluctant to accept some of the more recent innovations. This is perhaps due to the lack of success of earlier models.

Integral Part

In conclusion Mr. Underwood said that instrumentation was now being considered as an integral part of new papermaking processes. The difficulty now was to deal effectively with the mass of data which was produced by instrumentation of a modern factory. We were looking forward, he said to the development and exploitation of data-handling systems to sort the abnormal from the normal, and to derive functions to give an overall picture of plant performance from individual installation on the manufacturing machines.

'Automatic control instruments reduce processing costs, improve product quality and yield, and provide better and safer working conditions for operatives,' said Mr. Wallis, introducing the subject of *The Economics of Process Control*.

Before analysing the costs of instrumentation it was necessary, he said, to appraise some of the factors involved. He proposed to examine the economic aspects of a processing unit for which no operating data were available. The instruments required for safe and correct operation of the plant would fall into one of four categories:—

1. Instruments and controls essential for plant operability.
2. Instruments and controls which reduce operating manpower.
3. Instruments which provide operating information.

4. Instruments which are desirable but not essential to plant stability.

The cheapest instrument to perform the required duty was not necessarily the best to buy. The apparent saving by the purchase of an assortment of cheaper instruments could easily be lost by expenditure on spare parts.

As an example of the order of cost of instrumentation Mr. Wallis cited the case of a medium-sized catalytic cracking unit (10,000 bbl per day).

Material cost of—			
Instruments and accessories	..	..	£43,300
Piping and wiring materials	..	..	£6,000
Air compressors and driers	..	..	£1,750
Labour cost of installation	..	..	£4,870
Total	..	..	£55,920

It was common practice to centralise all instruments in a control room. There was little advantage in cost in purchasing miniature instruments, but smaller instruments did provide a considerable saving in space and cost of the control room. Up to 50 per cent in overall cost could be saved by the use of miniature instruments, together with savings on lighting and heating for the smaller control room.

The provision of adequate workshop facilities must be considered. An overseas refinery, which was remote from sources of supply, must maintain a fully equipped workshop for which annual expenditure would be of the order of £40,000 to £50,000. For a similar refinery at home or on the continent the capital outlay might lie between £20,000 and £25,000.

Mr. Wallis devoted considerable time to an investigation of maintenance charges, which he said fell under two headings; man-power requirements and spare part replacement. The capital cost of equipment was a good guide to 'manning up'. An installation of 50 flowmeters would show a smaller overall maintenance charge than would a mixed installation of 40 flowmeters, potentiometric temperature recorders and analytical instruments, because of the higher grade of labour required in the second case.

In conclusion Mr. Wallis said that the precise extent to which all the various phases of plant operation benefit under instrumentation was impossible to determine in advance. The only sure way to obtain such data was from actual plant experience under the two conditions of automatic and manual operation. It was clear from experience that the improvement in overall operating

costs had been sufficiently pronounced to make a comparative test unnecessary.

The least publicised but very important result of the use of instruments is the effect on plant time efficiency. Revenue is earned only while the plant is operating, and any measures to ensure that equilibrium conditions are established and maintained, and physical and thermal shocks to plant equipment eliminated, will provide the longest period of 'on stream' time, and equally important, the reduction in frequency of plant maintenance and overhauls will effectively reduce the charges against that account.

At the end of both the morning and afternoon sessions of the conference discussions were held in which speakers were able to comment on the papers which had been read and to express their own views.

The morning discussion was opened by Mr. J. E. Braham, of I.C.I., who said that he was perfectly convinced of the importance of automatic control and his firm was active in regard to it. He was concerned with the implementation of it; and if automatic control were to progress as rapidly as we wanted it to progress, then concurrently with the sort of work referred to in the papers, quite a lot of time would have to be spent in working out how it should be done. Had they to go back to the beginning, to the chemical flow sheet? He felt that they should. Who was to do it? Clearly it had to do with the chemists, physicists, chemical engineers and many mechanical engineers involved in chemical plant. He appealed that, concurrently with the technical approach, they should consider the organisational approach.

Register of Work

Mr. D. S. Mitchell (Queen Mary College, London), suggested that it might be possible to compile some form of register of work in process control and allied fields. Such a register would make it possible to avoid overlapping of the work in universities and technical colleges and in the research organisations of industries and some of the larger firms. He wondered if they could arrange for such a list to be built up through the Institution of Chemical Engineers or the Society of Instrument Technology.

Mr. Williams (Northampton Polytechnic, London) brought to the attention of the conference the excellent facilities at the

Polytechnic for training. They had equipment such as frequency response analysers whereby they could investigate simple processes in the laboratory.

Mr. G. J. Minkoff (Chemical Engineering Department, Imperial College, London) asked to what extent chemical analysis and machines which carried out chemical analysis automatically were used.

Mr. E. C. Allberry (I.C.I. Ltd., Alkali Division), replying to the question as to whether the development of continuous methods of chemical analysis would be helpful, said he believed the answer was 'yes', and they should give every encouragement to academic chemists to develop those methods. But he gave the warning that they should not receive the results of their labours with open arms. There was a very long row to hoe between demonstration in the laboratory and demonstration on the plant. There were things which, he felt, could be developed only by the chemists on the plant.

Sampling Lag

Mr. B. W. Balls said the only direct question concerning the paper by Mr. Isaac and himself (Automatic Process Control and Chemical Engineering) was in regard to the need for chemical analysis instruments, and that had in fact been answered briefly. But he underlined what had been said with regard to the removal of the sampling lag, which was most vital to a continuously operated control process for complete reliability on a 300 day-per-year basis. Such matters were the greatest barriers to the introduction of chemical analysis equipment into the control loop; nevertheless, they were necessary and would become of increasing importance.

Commenting on some of the points raised in discussion and which had a bearing on what had been stated in their paper, he said there had been a plea for the instrumentation of existing processes. But what he and Mr. Isaac had tried to stress was that the plant designer was responsible now for thinking about the plant that would be operating five years hence. He was the man who must increase his knowledge and understanding of the problems involved, who must do the work which would increase the mathematical approach, which would bring into the field the tools already available for the design of equipment such as the distillation columns and the heat exchangers mentioned in the paper. Instrument manufacturers and

users were fully aware of the problems with which they were faced and were quite capable of maintaining and increasing their standard of performance. But in many cases they were asked to consider processes which had already been designed. Any man who had operated processes could easily do a tremendous amount already to improve existing processes. But if we were to go forward we must think in terms of re-designing processes which were to be operated five years hence. That was why he had drawn a distinction between what existed and what was new.

Distance Velocity Lag

Commenting on a reference in the discussion to distance velocity lag, he said that too many plant designers were not aware of the serious nature of that lag; he hoped the conference would at least draw their attention to the fact that distance velocity lag was an abomination to the control engineer, and that anything that could be done to effect improvement in that respect would be valuable.

At the end of the afternoon papers the discussion was opened by Mr. G. C. Eltenton, of Shell Marketing & Refining Co. Ltd., who, discussing salesmanship, urged that we should think more in terms of cash in selling instrumentation and control. There seemed to be great reluctance to do that at the meeting; efforts so far appeared to have been more or less on the lines that the use of the instruments would be economic and the users would get something out of instrumentation if they trusted to the instrument people. Surely a man selling a washing machine would urge that it would save £50 in laundry bills and would also save much labour. The purpose of instrumentation was to ensure the largest yield at specification quality, and the instrument people should ask the chemical engineers to discuss with them not only the suitability of the instruments, but also their accuracy and how they saved money.

Dr. J. K. A. Parkin, illustrating some very important aspects of the economics of instrumentation, said he had seen a recently completed recycling plant, and when he was asked how many people he thought would be needed to run it, he had suggested a total complement of between 40 and 50. He was told, however, that the number was four per shift, and that the plant was the most advanced fully automatic unit on earth.

Having reason to doubt that that was the whole complement, he had found that, apart from the four shift men, there were between 25 and 30 day staff. There was the danger, he said, that in our anxiety to press home the argument for automatic control we were apt to forget to mention that there were always a considerable number of administrative and ancillary jobs, apart from the people directly concerned with the running of an automatically controlled plant.

In regard to the reactions of the trade unionist to figures indicating the saving of labour, such as the claim made in Mr. Wallis's paper that at one plant the instruments were doing the work of four extra men per shift, he said, let it be understood that a fully automatic plant would invariably be a new design, and although for comparison it might be a point to score on to state the possible savings in manpower as compared with an existing installation, the new project could not be claimed to displace labour because there was no-one to displace.

Mr. J. O. C. Vick (I.C.I., Plastics Division), being very much concerned with batch processes, agreed heartily with Mr. Goldstein that they should not be the 'poor relations' in automatic control. If a process were continuous, they were almost half way to making it automatically controlled, whereas in batch processes the characteristics of the plant or of the materials being processed changed all the way through, so that it was impossible to apply the type of control which was applied with continuous processes.

Sceptical

He asked if Mr. Goldstein had had experience of running a process with just one controller in the pot or pan, and varying, not the temperature of the circulating water in the jacket, but the rate of flow of the circulating water in the jacket. He had seen it stated that that had been done successfully, but he was sceptical.

Mr. Goldstein, replying to Mr. Vick, said he had not had experience of the type of control mentioned. Varying the rate of flow of circulating water in a jacket did not seem to him as if it would have very much effect on the overall control, for once the volume was there presumably the process would be running at one particular rate of heat transfer. He had read American literature which stated that that was working well, but he had not tried it.

Mr. Wallis, referring to Mr. Eltenton's reference to salesmanship, said he had been selling control systems for the past 30 years and he presumed that by now the users must have had some return on the investment they had made.

Sir Harold Hartley (immediate past-president of the Institution of Chemical Engineers), whose remarks were read by Mr. A. J. Young (President of the Society of Instrument Technology), said the attendance at the conference showed that it was called at an opportune moment. He congratulated the organisers on their success in assembling a series of most interesting and most instructive papers arranged in logical order which gave such a coherent and consecutive survey of the whole field. Many, like himself, would have found them of great value in helping to clarify ideas as to the part which automatic control was likely to play in the process industries.

Synthetic Glycerol Plant

Shell to Build the First in Europe

WORK is to begin shortly on the construction of the first synthetic glycerol plant in Europe. Costing approximately £2,500,000 it will be built at the Shell refinery at Pernis, near Rotterdam, in Holland, and is expected to be in operation towards the end of 1957.

Glycerol is one of the most versatile of the raw materials on which industry and commerce are dependent. Its range of applications extends from tooth paste to dynamite. Harmless when taken internally, it has the property of retaining moisture, and is used in food and pharmaceutical preparations. It is one of the ingredients of the cellophane in which food products are packed and is also used in the production of alkyd resins, synthetic enamels and other protective coatings.

Research carried out by Shell at Emeryville, California, led to the building of a plant soon after the war for the synthesis of glycerol from propylene, one of several hydrocarbon gases yielded by refining petroleum. Synthetic glycerol from this source has been manufactured on a large scale by Shell in the US for several years.

Before this development, glycerol could only be obtained as a by-product of the soap or the fatty acid industries. The establishment of a synthetic process in Europe will

provide a new and reliable source of supply.

Plans are also being made by the Shell Chemical Corp. for the construction of another synthetic glycerol plant in the US at Norco, Louisiana, near New Orleans.

Automatic Control Lectures

STARTING Tuesday, 25 October, the Royal Institution of Great Britain, 21 Albemarle Street, London W.1, will sponsor the first of four lectures on automatic control and production. To be continued on successive Tuesdays, the lectures will be given by R. H. Macmillan, M.A., Mem. A.S.M.E., of the University of Cambridge.

The lectures will deal with the development of automatic control; the principles of operation; problems raised by automatic control; and the present influence and future prospects of automatic control.

The approach to these lectures will be entirely non-mathematical and not directed at the specialist, except in as far as he may be interested in the wider aspects and historical development of automatic control.

Members of the Institution will be admitted without ticket and they can purchase books of ten single lecture tickets at reduced rates. Price to non-members is 8s.; 2s. 6d. for a single lecture ticket.

Tallow Acid Lacquers

IN a recent investigation, Battelle Institute chemists found evidence that tallow fatty acids are excellent potential raw materials for use in the formulation of non-drying alkyd resins. Such alkyds are widely used in nitrocellulose lacquers and baking enamels with urea or melamine resins. Mr. G. A. Lutz and Mr. R. F. Schwartz report that they studied the behaviour of the tallow acid alkyd they prepared in both black and white automotive lacquer topcoats. Their investigation disclosed that tallow acid lacquers, when diluted, tolerated a lower viscosity at higher solids than did the control; possessed sanding properties similar to those of the control; had buffing qualities at least equal to those of the control; and had slightly better patching properties.

The chemists consider the tallow acids deserve study for other possible uses and that they might become an important material if a stable and competitive price for tallow can be established.

Hydroforming Catalyst

Dutch Plant Now in Production

ON 25 August, just one year after the decision had been taken to undertake the manufacture of fluid hydroforming catalyst, commercial scale production was begun at the new plant of Koninklijke Zwavelzuur-fabrieken v/h Ketjen NV at Amsterdam, Holland. The catalyst is being manufactured under a licensing agreement made with Standard Oil Development Company which is now Esso Research and Engineering Company.

The demand for this type of catalyst is very great as several new fluid hydroformers are now going on stream at various European refineries. The plant is the only one of its kind in Europe.

On 4 November 1954, the first of the 138 reinforced concrete piles were driven into the ground for the foundations of the new plant. In two months' time the designing and process engineering for the plant had been completed by Ketjen's own engineering department. Standard Oil offered every help but, nevertheless, a great deal of original work had to be done by the Dutch company.

The fluid hydroforming catalyst will be shipped in drums as well as in five-ton tanks. The latter will be provided with the Ketjen-Polysius system for unloading as is used in the tankcars Ketjen use to ship cracking catalyst.

The firm, which is a member of Nederlandsch Verkoopkantoor voor Chemische Producten NV, have also announced that the capacity of their plant for the production of fluid cracking catalyst is to be increased to 20,000 tons per year. This plant went on stream early in 1953.

Kestner's Far East Plans

EN ROUTE for the Far East and Australia is Mr. Brian N. Reavell, managing director of Kestner Evaporator & Engineering Co., of London. The company, which has supplied a variety of chemical plant to the Far East in recent years, plans to extend its activities in this area and establish local agencies. Mr. Reavell will call at Rangoon, Singapore, Hong Kong, Sydney and Melbourne. In Australia the company has established a subsidiary, Kestner Australia (Pty.).

Soda Ash & Caustic Soda

Australian Demand Increases

AUSTRALIA'S requirements of soda ash and caustic soda have increased by 10 per cent during the past six months. This was revealed by a recent survey of the industry by the Australian Department of National Development.

More soda ash is being used in general, it is reported, with a marked additional demand from the glass industry. The Australian Aluminium Production Commission has also taken up its initial requirement.

Increased quantities of caustic soda are being used in petrol refining, and in the production of phenol, and substantial quantities are also used to make sodium silicate in the production of aluminium, in mining, and in water treatment. The two major uses of caustic soda are for soap, and for the production of phenol for the manufacture of plastics.

During the past six months, Australian production of caustic soda increased by about 10 per cent, being equivalent to about 28,000 tons a year. Output is adequate for current and prospective requirements, but pressure of demand for soda ash has exceeded the output in the South Australian plant which manufactures it.

Caustic soda is made by electrolytic plants in several of the States. Additional productive capacity came into operation at the Botany, New South Wales, plant of Imperial Chemical Industries of Australia and New Zealand Ltd. during the last quarter of 1954.

Ninth Dalton Lecture

ON Friday, 28 October, Sir William Ogg, M.A., Ph.D., LL.D., will deliver the Ninth Dalton Lecture on Chemistry and Crop Nutrition in the Manchester Town Hall. Organised by the Manchester and District section of the Royal Institute of Chemistry, the lecture will start at 7 p.m., and admission is by ticket obtainable from Dr. R. E. Fairbairn, I.C.I., Hexagon House, Blackley, Manchester 9.

Coinciding with the lecture will be the Dalton Exhibition on Chemistry and Agriculture to be held in the gas showrooms of the town hall on Thursday and Friday. Admission is free and without ticket.

New pH Instruments

Dutch Firm Enters UK Market

MEASUREMENT of pH has ceased to be a laboratory technique and is rapidly becoming an essential in all process industries where water is used as a medium. Often the measurement and recording of pH is combined in an industrial process with a control function.

The chemical, oil and paper industries have already introduced pH measurement and control to their processes on an extensive scale and a number of other industries such as the sugar industry, the leather industry, the brewing industry, the photographic industry and the steam-raising industry, are coming more and more to appreciate the advantages of controlling this variable.

A particularly interesting application is in the control of industrial effluents. We are becoming increasingly aware of the need to safeguard the health of our people and it may be anticipated that the clean air campaign will be paralleled by an even stricter control of industrial effluents than at present prescribed.

Established in 1945

It is not then surprising that a firm specialising in pH measurement and control has found a wide demand for its services. The company in question, Electrofact NV, was established in Amsterdam in 1945. It manufactures an extensive range of pH measurement and control equipment for both laboratory and industrial purposes and, in the course of its relatively short life, has built up a considerable fund of experience on the industrial application of pH. In 1953 the Dutch Company established a manufacturing affiliate in the United Kingdom which offers the full range of models of the Dutch parent company. The British undertaking, Electrofact Ltd., is not a sales agency but itself constructs instruments to the Dutch designs.

On the occasion of the Joint Conference on Automatic Control in the Process Industries convened by the Institution of Chemical Engineers and the Society of Instrument Technology on 4 October, Electrofact Ltd. took the opportunity to arrange at their offices in Hanover Court, Hanover Square W.1, a display of their full range of pH instruments.

The company manufactures three, laboratory type instruments. There is a portable, miniature, battery-operated meter which has dimensions of only 3 in. by 4 in. by 8 in. and weighs only 4 lb. The electrodes actually fit within the instrument for transport purposes. Measurement from 1-13 pH is provided for with an accuracy of better than 0.2 pH and a reproducibility of better than 0.1 pH. A general purpose instrument is offered providing a full range of pH and millivolt measurements with temperature compensation from 0-100°C. This model is AC mains operated and is stabilised against both voltage and frequency fluctuations in the supply. The third laboratory model is an instrument of the highest precision which has the widest of pH and millivolt functions and has been designed to meet the most exacting research requirements.

A feature of the precision laboratory instrument and of the complete range of industrial pH recorders and amplifiers is that they work on the null balance principle, which is generally accepted as preferable in all electrical measurement applications. AC amplification has been selected for these models and the circuits used eliminate the drift inherent in the more conventionally used AC amplifiers. Industrial recorder-controllers are available suitable for both electric and pneumatic systems.

Irradiation of Cereals

ANNUAL losses in the US of \$300,000,000 caused by insect infestation of grain, flour and other cereal products can be eliminated by irradiation. In a paper given on 27 September before the National Convention of the American Institute of Chemical Engineers at Lake Placid, Mr. L. E. Brownell, supervisor of the Fission Products Laboratory of the University of Michigan, stated that the radioisotope by-products from atomic reactors can provide a low cost source of radiation for this purpose.

Taste panels have approved the flavour and baking characteristics of bread, biscuits, and cakes prepared from irradiated flour. Mr. Brownell stated that facilities designed to treat 27 tons per hour have an operating cost of less than \$6.00 per ton.

Lubrication Films

Vacuum Oil Starts New Library

THE first three in a series of industrial films have been produced by the Vacuum Oil Company Limited. They are 'Lubricating Greases,' 'Cutting Oils' and 'Thin Film Lubrication' and they are to form the nucleus of the new European Industrial Film Library which the company and its European associates in France, Germany and Italy, have established. All three were made in the United Kingdom by Jack Greenwood of Technical and Scientific Films Ltd. in association with the Film Producers' Guild. Many of the scenes were 'shot' in the works of various industrial customers of Vacuum Oil Company.

'Lubricating Greases' illustrates the importance of lubricating greases in modern industry, and gives examples of the many different types of greases in use. The film stresses the necessity for correct manufacture under carefully controlled conditions, demonstrates the advantages of using the correct grease, and explains how it should be selected.

'Cutting Fluids' shows that the correct selection of cutting fluids by a specialist helps to reduce tool wear, prolongs the life of expensive tools and increases cutting speeds and output. The film also explains how a specialist knowledge of metals and the correct choice of cutting fluids results in more continuous production.

The third film, 'Thin Film Lubrication,' defines the basic difference between fluid film and thin film lubrication and explains the reasons for the different properties required by lubricating oils. Animated drawings illustrate the benefits which result from the correct selection and application of lubricants.

Two other films, 'Diesel Engine Lubrication' and 'Lubrication of Hydraulic Systems,' are being made by the company's German and French associates respectively and are expected to be available before the end of the year.

Each of the films is 16 mm., black and white, and runs for 30 minutes. They can be borrowed direct from Vacuum Oil Company's Industrial Sales Department, Caxton House, Tothill Street, Westminster S.W.1, or direct from Vacuum's Industrial Division offices.

Terylene Prices Reduced

REDUCTIONS in the prices of Terylene polyester fibres are to be made with effect from 7 October, 1955.

Terylene, which has been in the development stage, had its price fixed accordingly. Now that the big new plant at Wilton is in production and running smoothly, I.C.I. has decided that the time has come to put Terylene on a commercial price level. It is only five years since I.C.I. decided to go ahead with the Terylene project, in which more than £20,000,000 have been invested.

The price reductions will be of great importance to the textile industry where Terylene has established itself as one of the outstanding synthetic fibres. The significance of the price changes will be felt in many other sections of British industry, for Terylene conveyor belts, industrial hose, laundry fabrics, papermakers' felts, marine ropes, fishing nets, industrial clothing and filter fabrics—to name a few of its industrial applications—are proving satisfactory.

Engineers & Liberal Arts

ENGINEERING methods in combination with strong training in humanistic studies proved the key combination in bringing to an agreement in 1951 the three-year-old Iranian oil dispute according to H. W. Page, a Director of the Standard Oil Company of New Jersey, who was chairman of the negotiating team. Mr. Page in a paper presented to the National Convention of the American Institute of Chemical Engineers at Lake Placid, NY, on 26 September, stated that training in the fundamental principles of problem solving and continuous exercise of these principles for solution of problems of high complexity without losing sight of the main objective is the engineer's daily task.

Training and experience in liberal arts provides the understanding of motives, the history, the aspirations of the peoples involved. Combination of these provides an efficient method for solution of business and human relations problems as attested by the 1951 Iranian oil agreement.

Mr. Page urged engineers to obtain broader training in liberal arts and human relations to provide society greater service in the solution of its problems.

New Exide Battery Cell

No Spillage in Stratosphere

A NEW cell that operates efficiently without electrolyte spillage at the greatly reduced atmospheric pressures encountered in stratospheric flight has been evolved by Chloride Batteries Ltd., of Clifton Junction, Swinton, Manchester.

It is the Exide Z2H11, an unspillable, 'one-shot,' primary cell developed in conjunction with the Ministry of Supply. Used in batteries of three to provide about 6.75 volts, it will power the metering and telecommunication equipment of the Radar Sonde Mark II meteorological balloon. Of special lightweight design, the cells are primed with electrolyte shortly before the balloon take-off.

A lead peroxide/zinc couple is used, the former constituting the positive and the latter the negative electrode. The electrolyte is sulphuric acid of 1.270 specific gravity (at 60°F) to which are added other salts and compounds to assist rapid activation and the delivery of a constant potential output during discharge.

Similar to Lead Acid Cell

The basic construction of the cell element is similar to that of the normal lead acid battery. The fully charged positive plates of standard Exide design and the negative plates fabricated from pure zinc sheet are separated by resin-bonded glass wool.

The element is assembled in a moulded high-impact polystyrene container to which is cemented a lid of the same material. The terminal pillars pass through holes in the lid and are sealed to it by rubber washers held by synthetic resin.

A screw plug in the lid is provided for priming, whilst an integrally-moulded vent hole and shielding skirt enables gases generated during discharge to escape. A splash guard above the element prevents spillage or a large-scale movement of electrolyte swamping the ventilating system. Vertical lugs moulded on each end of the cell container locate in suitable slots in the radar sonde chassis.

The filling plug and vent hole are sealed to prevent the ingress of moisture after the battery is dispatched from Exide works, and the cell itself is hermetically sealed in a protective polythene envelope. In this way its

'dry charge' characteristics are retained for an indefinite period of storage.

Each cell weighs approximately 9½ oz. dry and 13½ oz. primed. Primed cells can stand idle from 15 minutes to seven hours yet still discharge through a fixed resistor of 0.88 ohms for a period of not less than two hours to a final minimum voltage of 2.25. This discharge is in an ambient temperature of approximately 70°F and with the atmospheric pressure reduced progressively during discharge to simulate flight conditions.

Cell dimensions are 1.3/32 in. wide by 3¼ in. long by 4.3/16 in. high (approximately).

Hydrogen from Propane Order

THE Power-Gas Corporation Ltd., of Stockton-on-Tees, has received an order from Unilever Ltd. for the production of high purity hydrogen from propane, using the Hercules reforming process. The plant, which will be capable of producing between 16,000 and 22,000 cubic feet of hydrogen per hour, will consist of a reforming furnace, followed by two stages of CO conversion and CO₂ removal and methanation and, in addition, hydrogen compressors, propane and high-pressure hydrogen storage equipment and a Wiggins gas holder of 7,500 cu. ft. capacity. The hydrogen will be used to harden edible oils at the Purfleet Works of Van den Berghs & Jurgens Ltd.

BAC Lectures

THE London Section of the British Association of Chemists is to sponsor two lectures to be held in the Wellcome Institute, Euston Road, London, at 7 p.m., on 26 October and 23 November.

The first lecture is entitled 'Sewerage and Sewerage Purification' and will be given by E. H. Vick, M.I.C.E., F.I.P.H.E., M.I.S.P., who is the assistant divisional engineer of London County Council's main drainage division.

The second lecture is 'Applications of Photography in Research and Industry' by B. Gorringe, Ph.D., A.R.C.S., A.R.I.C., of the research department of Kodak Ltd. This lecture will be illustrated by a film and, like the earlier lecture, will be followed by a discussion.

Pakistan Developments

To Build National Laboratories

ADDRESSING the Chemical Society of Karachi University recently, the Pakistan Minister for Industries, Mr. Habib Ibrahim Rahimtoola, said that plans for establishing four national laboratories at a cost of R.20,000,000 were under way. The laboratories would be controlled by the Council of Scientific & Industrial Research.

The Minister urged students to take full advantage of the wide range of careers open to young scientists, and thus help the Government in consolidating the industrial development of Pakistan.

Reviewing the Government's activities in applied chemistry, the Minister said that a number of factories had already been established for the manufacture of heavy chemicals. Of the three units making sulphuric acid, two were located in West Pakistan and one in the east.

Nitric and hydrochloric acids, he said, were being produced on a small scale, but demand had resulted in a new plant being built in Karachi. Hydrochloric acid would also be manufactured at Nowshera by burning hydrogen in chlorine. A portion of the chlorine produced at Nowshera was used to manufacture DDT.

Emphasising that the Chemical Society of Karachi University could contribute substantially to the development of the Pakistan chemical industry by undertaking preliminary surveys, Mr. Rahimtoola advised students to first visit the oil refineries at Attock and Rawalpindi before going abroad to study the petroleum industry.

New Delhi Exhibits

THE trade stand of Babcock & Wilcox of India Ltd., at the Indian Industries Fair in New Delhi, from 29 October to 12 December will emphasise the parent company's long association with the Indian sub-continent. The company, which is exhibiting eight scale models and several full-size exhibits, including a pair of Oldbury chain grate stokers suited for Lancashire or Economic shell-type boilers, supplied its first boiler to India in 1884.

Among the scale models on show will be a Cross type oil-fired boiler similar to the one installed at the Burma Shell refinery in

Bombay, and a F. H. integral furnace boiler for pulverised fuel firing.

The tri-drum boiler with spreader stoker which the company will exhibit is a model of the one installed at the Sindri fertiliser factory. This plant went into operation in 1952 and is considered to be the world's largest production unit for artificial fertilisers. Babcock & Wilcox supplied the complete boiler plant.

Special Problems

Atomic Energy & the Insurance Business

THE SPECIAL problems facing both the engineering profession and the insurance business as a result of the expanding commercial development of nuclear power were presented to the National Convention of the American Institute of Chemical Engineers at Lake Placid, NY, on 27 September, by Mr. Matthew M. Braidech, Director of Research for the National Board of Fire Underwriters.

The task of a gradual and safe transfer of the world's greatest government monopoly into private enterprise offers many difficulties to the insurance companies in the matter of insuring against atomic risk from private ownership and commercial operation of nuclear power reactors.

A preliminary study indicates that the catastrophe potential, although more serious than anything heretofore known in industry, is remote because of rapid progress made in engineering and safety. Further, research and commercial reactors are insurable at commercial rates and can be considered in the category of the more hazardous types of chemical operations.

However, studies are still being continued on matters of 'third party liability,' 'business interruption,' and 'use and occupancy' insurance.

The entire nuclear insurance programme is complicated by a lack of forecast liability and formulas for calculating loss potentials as well as a lack of standardisation of atomic equipment. At this stage, good guesses in areas of uncertainty are justifiable provided they are fortified with safety factors.

A continued programme of study between the Atomic Energy Commission and the underwriters should help to resolve the varied problems and promote insurance confidence.

Ash Fouling Problems

Laboratory Tests Developed

ASH fouling is increasingly becoming a problem as more lower-grade fuels are used. Low-quality coals are now being burned by steam-generating plants because of dwindling sources of high-grade fuels, and rising costs and economic studies indicate that they will be employed in increasing amounts over the next 15 or 20 years. The Babcock & Wilcox Company has therefore developed several laboratory tests at its Alliance, Ohio, research centre that predict quickly how the ash of a solid fuel will behave in a boiler. The new tests will enable the company to improve the design of fuel-burning equipment, boilers, heat-transfer apparatus and accessory boiler equipment. They will also enable coals to be classified according to ash-fouling tendencies, and indicate how suitable an untried low-grade fuel is for burning in a steam-generating plant.

In its new tests, the company determines the total alkali content of coal spectrographically, and the amount of sodium oxide and potassium oxide. When the alkali content of a coal is found to exceed 0.5 per cent of the dry weight of the latter, its ash will affect boiler cleaning, tube bank designs and gas temperatures on inner tube banks, and the type and spacing of soot blowers.

Fly Ash Strength

The strength of sintered fly ash is determined by preparing the fuel to be tested in a laboratory furnace, and then subjecting the ash to time and temperature conditions similar to those in a boiler. The ash is then sintered into a small test cylinder and crushed to determine its strength. High-strength fly ash causes fouling. Research workers have used data from these tests successfully to evaluate additives used in alleviating ash fouling, and to measure the effects that different operating conditions have upon the design and arrangement of soot blowers.

The company has also been studying the slag-tapping characteristics of coal. Investigations are being made of ash-fusing temperatures, and viscosity determinations are being conducted on the coal ash. With the results obtained, it expects to utilise the widest possible range of fuels in slag tap units, especially for cyclone furnaces.

The viscometer used in the slag-tapping tests is the first of its kind and was first produced by the US Bureau of Mines; it was refined and adapted for commercial applications by Babcock & Wilcox. Using the viscometer, the company's Alliance research centre has arrived at a set of standards for evaluating any solid fuel.

Good Year for SA Firm

NATIONAL Chemical Products of South Africa reported successful trading during the year ended 25 March. The consolidated net profit after taxation was up £9,574 to £148,575 and the directors recommend an unchanged final dividend of 1s. 3d. a share. The chairman states that the company's products found a ready market. At times demand exceeded supply, mainly owing to the difficulties in transporting molasses (the principal raw material) from Natal. Since 25 March, however, the supply position has been better than during the corresponding period last year and production consequently has been higher.

Poly-resin Products, in which the company has a substantial interest, had a profitable year, largely because of import control, the directors believe. Means of improving the soundness of this company's trading position are being considered. The wholly-owned subsidiary, Umgeni Distilleries, also had a good year, and is experiencing increased demand. The plant for making phthalic anhydride is expected to be commissioned during the last quarter of this year and to prove a profitable venture. Other projects, including acetic acid and crotonaldehyde, are expected to reach production during the first quarter of 1956.

National Chemicals expects to base part of its future expansion programme on the raw materials Sasol will yield for the chemical industry.

Penicillin Plant in Production

First Indian penicillin factory at Pimpri, near Poona, which recently went into full production, will manufacture 20 million mega units annually. Production will be increased in the next five years to 32 million mega units, when India will be in a position to export the drug.

New Furnace Black Unit

Huber Corporation Increases Capacity

PLANS for the construction of a new unit that will increase furnace black production by 15 per cent have been completed by J. M. Huber Corp., have been announced by H. W. Huber, president. The new unit will be built at Huber's Carbon Black headquarters at Borger, Texas. Carbon black is a vital reinforcing agent in the manufacture of rubber tyres and other rubber goods.

'The new unit,' Mr. Huber said, 'will have an output of 20 to 30 million pounds of black yearly, depending on the grade produced.' Huber currently has four furnace black units in operation at Borger and two at Eldon, Texas, in addition to their extensive channel black plant in Borger, Texas, making it one of the leading carbon black producers.

Initial production will be of the SRF (semi-reinforcing furnace) type. SRF is used as a reinforcing pigment in tyre carcasses, tyre sidewalls, V-belts, rubber hose, footwear and motor mounts.

This is the second recent expansion of Huber's furnace black facilities at Borger. A new unit has just gone into production and the currently planned furnace plant is expected to be in full production during the latter part of 1956.

The major raw material used in the manufacture of SRF furnace black is natural gas. Huber draws his important raw material from its own supply in the Texas Panhandle and surrounding areas where it has substantial reserves. By producing its own gas, Huber is one of the few carbon black manufacturers that has complete control over the quality of its product from start to finish.

In its plants at Borger and Eldon, Texas, J. M. Huber produces all of the major grades

of channel and furnace carbon blacks. In recent years Huber has become a major factor in producing silica type pigments at its chemicals division in Havre de Grace, Maryland. The company is also a leading manufacturer of printing inks with nine plants and service stations supplying the United States east of the Rockies.

Co-ordinating Electronics

TO further co-ordinate the interests of various departments concerned with electronics, Metropolitan-Vickers Electrical Co. Ltd. has, from 1 September, transferred the Industrial Process Control Engineering Department to the recently formed Electronics Department.

Mr. R. H. Kelsall, B.Sc., A.M.I.E.E., formerly assistant chief engineer, Industrial Process Control Department, becomes assistant chief engineer (Industrial Process Control), Electronics Department. This section is concerned with the industrial application of closed loop control systems in all its forms, including electronic and magnetic amplifiers; the use of computers and associated techniques in conjunction with control systems will also be within its field.

US Sulphur Production

THE US domestic sulphur industry produced 487,633 long tons of native sulphur and 33,900 tons of recovered sulphur (of a purity of 97 per cent or greater) during the month of July, according to reports of producers to the Bureau of Mines, a US Department of the Interior. Producers' stocks of native sulphur increased slightly over the previous month and at the end of July totalled 2,886,573 long tons.

	June 1955	July 1955	July 1954	January-July 1954	January-July 1955
Native sulphur (Frasch) :					
Production	425,050	487,633	471,594	3,215,534	3,087,279
Mine or plant shipments	528,041	483,857	408,872	2,978,774	3,460,922
Apparent sales ²	474,545	476,447	415,287	2,971,199	3,428,726
Producers' stocks ³	2,875,387	2,886,573	3,258,821	3,258,821	2,886,573
Recovered sulphur¹ :					
Production	32,500	33,900	31,900	209,400	229,500
Mine or plant shipments	33,190	36,870	39,506	197,775	220,248
Apparent sales ²	33,190	36,870	44,506	202,775	218,270
Producers' stocks ³	123,266	120,296	113,969	113,969	120,296

¹ Recovered sulphur of a purity of 97 per cent or greater.

² Calculated from production and change in stocks during the period.

³ Producers' stocks at mines or plants, in transit, and in warehouse at end of period.

HOME

US Firm to Build Factory in Belfast

On 4 October the Ministry of Commerce of Northern Ireland announced that the Mission Manufacturing Co., of Texas, has decided to build a factory in Belfast for manufacturing oilfield equipment.

Lecture Postponed

The Chadwick Trust has postponed the lecture, 'The Centenary of London's Main Drainage System', it was to have held at the Royal Society of Health in London on 17 November.

Report on Courtauld's Works

Progress has been made in eliminating the offensive smells emanating from Courtauld's works at Greenfield, Flint. It is anticipated that by the end of this year about one third of the gases will be 'scrubbed', reducing the total emission of hydrogen sulphide by a similar proportion. This was reported by an inspector of The Alkali Inspectorate to the Wirral Council. He has been asked to submit a further report early next year.

Dyeworks Fire

Fire severely damaged a warehouse belonging to Norman Wood & Son, Ltd., slubbing dyers, of Crown Dye Works, Birshall Lane, Bradford. Although hampered by falling glass and debris, firemen were able to prevent the fire from spreading to nearby buildings.

I.C.I. Works Explosion

Two men escaped injury in an explosion in the mixing house in which they were working at I.C.I.'s Ardeer factory, Stevenston, Ayrshire, on 6 October. It destroyed the mixing hut and damaged buildings nearby. In a statement one of the men said that there had been a minor explosion and a flash and he and his colleague had just time to pull the cord to drown the mixture and run to safety.

Oil & Colour Chemists' Association Dance

The London Section, Oil & Colour Chemists' Association, will hold its annual dinner and dance (Ladies' Night), at the Criterion Restaurant, Piccadilly, London, on Friday, 2 December. Single tickets (£1 11s. 6d.) can be obtained from Mr. H. C. Worsdall, 6 Cold Arbor Road, Bessels Green, Sevenoaks, Kent.

Over-Subscribed

The Rights Issue of 845,113 ordinary 5s. shares by Evans Medical Supplies Ltd. has been over-subscribed. They were offered to ordinary stockholders on a three-for-eight basis at 6s. 9d. a share.

Bakelite Plan Expansion

Bakelite Ltd., plastics manufacturers, are to increase their authorised capital from £2,000,000 to £3,000,000 by creating 1,000,000 six per cent cumulative redeemable preference shares of £1. The capital is needed to finance increased productive capacity.

F. W. Berk & Co. Ltd.

Underwriting is now in progress for the issue of 1,920,000 ordinary shares of 5s. each to be offered by way of rights to existing ordinary shareholders in the proportion of three new ordinary shares for every five shares held. The issue is being underwritten by J. Henry Schroder & Co., and the brokers are Williams, de Bröe & Co. The price is expected to be 6s. 3d. per share.

Accidents & Disease

There were 19 cases of epitheliomatous ulceration (skin cancer) reported during August. Of these, 18 were among workers in pitch and tar. Eight cases of chrome ulceration, and four cases of lead poisoning were reported. Other cases of poisoning recorded were three from aniline, and one from benzene. Two deaths were reported from benzene poisoning and epitheliomatous ulceration. Number of fatal accidents in the chemical industry reported during the month was two. One was also recorded in the metal extracting and refining industry.

Blast Furnace Record Output

During the week ending 2 October, Europe's largest blast furnace, the Queen Victoria at the Scunthorpe works of Appleby-Frodingham Steel Co., a branch of The United Steel Companies Ltd., produced a world record output for lean-iron ores of 11,160 tons of pig iron. Working entirely on low-grade British ores, averaging 20 per cent iron content, it is believed that this achievement has not been equalled by larger American blast furnaces, which operate with ores containing 55 per cent of iron.

. OVERSEAS .

Americans Attend Oil Board Meeting

Mr. H. H. Arnold, Jr., vice-president of the California Texas Corp. (Caltex), and Mr. H. F. Davies, of Standard Oil, are in Australia to attend board meetings of the West Australian Petroleum Co., in Perth.

West German Crude Oil Output

West German crude oil production in September was 269,519 tons, compared with 275,949 tons in August.

Zinc Oxide Production Still Rising

Production of zinc oxide (lead-free and leaded) in the US increased in July for the fourth successive month. Totalling 17,200 short tons (or three per cent more than in June), it represented the largest monthly total since April 1953, reports the Bureau of Mines, US Department of the Interior.

Nyasaland Tung Prices Up

A spokesman of the Nyasaland Tung Board recently announced that this year's crop is estimated at 1,000 tons and that some of the crop has already been sold forward at approximately \$400 per ton. This is higher than last year's price (\$340) and is considered a direct result of the action of the Chinese Government in withholding exports of tung oil from China.

Requests Fertiliser Factory

Andhra State has asked the Indian Government to establish a fertiliser factory at Bezwada. Andhra consumes nearly 20 per cent of India's total production of fertilisers. Last year the State consumed about 70,000 tons of ammonium sulphate, and consumption so far this year is estimated at more than 75,000 tons.

Petrol From Coal

The first petrol from the oil-from-coal plant at Sasolburg, in South Africa, will probably be marketed by the end of November.

French & German Firms Get Contract

Cie, Fives-Lille, of France, and Mannesmann-Rohrbau, of Western Germany, have been granted contracts for supplying the technical equipment to the Finnish State-owned oil company, Neste Oy, which has been established in Helsinki to refine crude oil. Value of the combined orders is £3,500,000.

Sulphur Found Off Louisiana Coast

A major sulphur deposit has been discovered off Grand Isle on the Louisiana coast. Announcing the find, Mr. Carl E. Reistle, vice-president of the Humble Oil & Refining Co., said: 'It is a very rich layer over 200 feet thick and extending over several hundred acres. The deposit might hold between 30,000,000 and 40,000,000 tons of sulphur.'

Austrian Magnesite Production Increases

Austrian production of raw magnesite in July amounted to 95,952 tons, compared to the July output of 83,300 tons last year. A total of 574,322 tons raw magnesite was produced from January to July, 1955, showing an increase of 88,637 tons for the same period in 1954.

The Shawinigan Water & Power Co.

The directors of The Shawinigan Water & Power Co. have declared a dividend of 30 cents a share on the no par value common shares of the company for the quarter ending 30 September, 1955, payable 25 November to shareholders of record 15 October.

Austrian Nitrate Fertiliser

The export programme of the Austrian Nitrate Works Inc., Linz, was considerably extended during the first half of this year, and for the first time agreements were entered into with China for nitrate fertiliser. Intensified exports of Austrian nitrate fertiliser to Ireland, Hungary, Greece, Yugoslavia and the Near East have also been reported. Exports for 1954-55, ending 30 June, totalled 356,000 tons of nitrate fertiliser, representing 65.7 per cent of all Austrian sales. Home consumption totalled 185,900 in this period, sufficient to meet all local demands. Egypt is the biggest buyer of Austrian nitrate fertilisers.

Value for Money

The Commonwealth Scientific & Industrial Research Organisation has cost the Australian nation £A33,000,000 since its inception in 1926, and its annual budget is now around £A5,000,000. But financial benefits from research of CSIRO in one year exceed the whole cost of working over the past 30 years, and these gains are made year after year.

PERSONAL

MR. A. D. SMART, chief accountant, has been appointed secretary of the British Oxygen Co. Ltd. in succession to MR. H. COBURN, who has been appointed secretary and director of British Oxygen Gases.

DR. J. W. McDAVID, C.B.E., D.Sc., F.R.I.C., M.I.Chem.E., a former director of the Nobel Division of I.C.I., has retired from the board of directors of Scottish Agricultural Industries. DR. J. CRAIK, M.A., B.Sc., Ph.D., has been appointed to one of the three vacancies on the board which recently became vacant.

A delegation of seven Hungarian scientists will arrive in Britain on 22 October to visit scientific establishments and for individual meetings with British scientists as guests of the Association of Scientific Workers. The party which includes PROFESSOR BRUNO STRAUB, biochemist; PROFESSOR PAL GOMORI, medical scientist; PROFESSOR ELEMÉR SZADECKY-KARDOSS, geologist; DR. PETER FARAGO, physicist; MR. SANDOR LENGYEL, physical chemist; PROFESSOR KAROLY POLINSZKY, professor of inorganic chemistry, and MR. ZALAN BODO, physicist, will remain about two weeks.

MR. LAURANCE S. ROCKEFELLER has been elected a member of the board of directors of Olin Mathieson Chemical Corp. Mr. Rockefeller is president of Rockefeller Brothers, Inc., an investment and research organisation founded in 1946 to survey the needs for venture capital in such fields as aviation, electronics and housing. He is a director of the Chase Manhattan Bank, Eastern Airlines Inc., International Basic Economy Corp., International Nickel Company of Canada, a member of the New York Stock Exchange and chairman of the board of Rockefeller Centre Inc.

At the recent annual general meeting of the National Smoke Abatement Society at Bournemouth on 30 September, SIR ERNEST SMITH, C.B.E., the retiring president, was invited to continue in office for a further year in view of the death of the president-elect, LORD HORDER. Sir Ernest accepted the invitation. New vice-presidents elected were

ALDERMAN J. J. MILTON, of Bristol; DR. W. R. MARTINE, Senior Administrative Medical Officer, Birmingham; and MR. JAMES LAW, who until his recent retirement was chief smoke inspector, Sheffield, Rotherham & District Smoke Abatement Committee.

The council of the Fertiliser Manufacturers' Association Ltd. has announced the following election of officers for the year 1955-56: *president*, MR. J. WATSON NAPIER, B.Sc., M.I.Mech.E., M.I.Chem.E., of Fisons Ltd., and *vice-president*, MR. P. K. PROCTOR, of H. & T. Proctor Ltd. These appointments rate from 29 September.

MR. G. F. GREAVES, M.C., A.C.A., retired from his position as financial director of Joseph Crosfield & Sons Ltd., on 30 September having reached the retiring age. He has been succeeded by MR. R. D. CAMERON. MR. W. J. DEVERALL, B.Sc., A.M.I.Chem.E., resigned his position as technical director of the firm on the same date to take up another appointment.



W. J. Deverall



R. D. Cameron

DR. ALEXANDER KING, Chief Scientific Officer to the Department of Scientific and Industrial Research, left on 8 October for Yugoslavia to lecture in Ljubljana, Zagreb and Belgrade on labour productivity. His visit is under the auspices of the British Council at the invitation of the Yugoslav National Institute for Labour Productivity. Dr. King, who was born in Glasgow, was from 1943 to 1947 head of the United Kingdom Scientific Mission in Washington and from 1947 to 1950 of the Scientific Secretariat of the Office of the Lord President of



Mr. Glanvill Benn, chairman of Benn Brothers Limited, proprietors of THE CHEMICAL AGE, boarding his plane on route for Australia as an official delegate to the Commonwealth Press Conference. On his journey he will visit Benn Brothers' agents in several important cities, including Istanbul, Cairo, Bombay and Colombo and he will return via New Zealand, the United States and Canada

the Council. He is chairman of the governing body of the European Productivity Agency of OEEC and a member of the executive committee of the British Council. He was formerly hon. secretary of the Chemical Society.

MR. J. T. PROCTER, of Hy. Richardson & Co. (York) Ltd., has been elected president and MR. T. WILLIAMS, of the Eaglescliffe Chemical Company, vice-president of the Superphosphates Manufacturers' Association Ltd. for the year 1955-56, with effect from 13 September.

LORD STRATHALMOND, British Petroleum Co. Ltd.'s chairman, accompanied by LADY STRATHALMOND, has left by sea for Australia. He is due to arrive at Fremantle, Western Australia, on 20 October, and will attend the official opening of BP's new 3,000,000 tons-a-year Kwinana refinery by FIELD-MARSHAL SIR WILLIAM SLIM, Governor-

General of Australia, on 25 October. Kwinana refinery, which began operating on 1 February this year, is 17 miles south of Fremantle.

DR. D. A. W. ADAMS, B.Sc., has been appointed research and technical director of Hickson & Welch Ltd. and John W. Leitch & Co. Ltd. He has been on the board of Hickson & Welch Ltd. for the past 15 months as works manager. He is succeeded in this post by MR. S. C. JONES, B.Sc., who has been in charge of the intermediate section of the plant since 1946.

MR. M. D. M. FRANKLIN has been appointed one of the joint secretaries of the Food Standards Committee of the Ministry of Agriculture, Fisheries & Food in place of MR. F. W. SIDWELL.

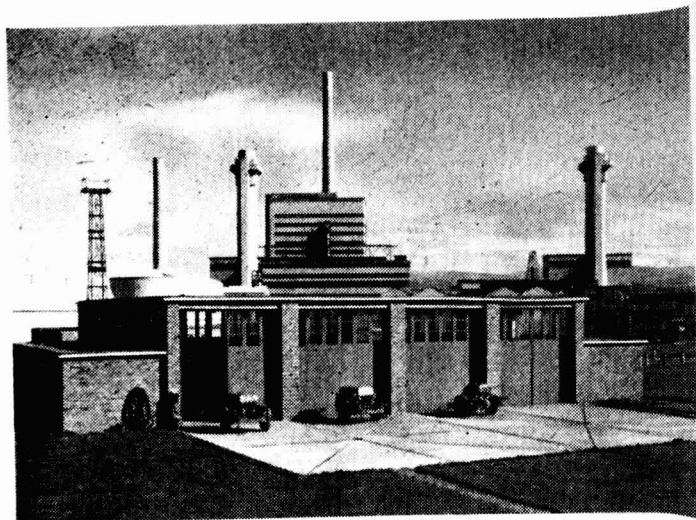
Visiting French Scientists

TEN senior French university scientists who have been visiting Britain to observe British higher technical education and research and the application of research to industry, concluded their tour on Saturday, 15 October.

Their visit began on 10 October with a general discussion led by Sir Alexander Todd, chairman of the Lord President of the Council's Advisory Council on Scientific Policy, followed by a visit to the Imperial College of Science and Technology.

After visiting the National Physical Laboratory at Teddington and the Federation of British Industries to meet members of the Industrial Research & Education Committees, the party spent two days in Manchester where they visited Metropolitan-Vickers, Manchester University, the Shirley Institute and the College of Technology. On their return to London the scientists visited the National College of Rubber Technology and the Northern Polytechnic.

Members of the group included M. Joseph Pérès, Dean of the Faculty of Science and M. Jean Wyart, Professor of Crystallography & Mineralogy, of Paris; M. Joseph Cathala, Professor of Chemistry, National College of Electrical & Hydraulic Engineering, of Toulouse; M. Marcel Prettre, Professor of Industrial Chemistry, Lyons; M. Philippe Olmer, Director of the National College of Metallurgy & Mines, Nancy; and M. Roger Schwobb, Inspector General, Industry & Commerce.



Britain's Atomic Factories



The whole of the pipework in the highly and medium radio-active areas on the primary separation plant and vessels in the highly active section of Britain's Atomic Factories were fabricated in stainless steel and installed by Ashmore, Benson, Pease & Company. Using many welding sets, in conjunction with Argon arc sets, Ashmore's installed over ten miles of pipework with 40,000 butt-welded pipe joints and completed five miles of plate and sheet welding. Twenty-five X-ray sets were employed and extensive use made of radio-active isotopes. Approximately 60,000 radiographs were filed.



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Publications & Announcements

STYRENE Co-Polymers Ltd. announce a further addition to their range of styrenated alkyd resins. The new resin is designated Scopol 41HM/70 and is a higher viscosity version of Scopol 41, an established medium for printing inks. The new resin is also available as a base resin. A long oil length styrenated alkyd, Scopol 41HM/70 is specifically designed as a medium for high class decorative finishes, and its properties which make it suited for this type of work include: a speed of set which provides satisfactory drying under adverse weather conditions during or immediately after application, resistance to conditions promoting bloom formation, and gloss retention and resistance to chalking. The company has made considerable investigations into the production of combinations of Scopol 41 and nitrocellulose.

* * *

SECTIONAL list No. 3 of publications of DSIR is now available free of charge. This list contains only those publications which are issued by HM Stationery Office or the Department and are still in print. Revisions are made from time to time and copies of future editions will be sent as they appear if application is made to the Director of Publications (Section SP), HM Stationery Office, Atlantic House, Holborn Viaduct, London E.C.1. Many earlier publications of DSIR are now out of print but copies of most of these may be obtained on loan by application to the above address. They may also be consulted at the reading room of the Technical Information and Documents Unit, Cunard Building, 15 Regent Street, London S.W.1.

* * *

BRIEF notes outlining the research being undertaken in British universities and university colleges is contained in 'Scientific Research in British Universities 1954-55' published by DSIR, price 12s. 6d. (\$2.25 in the US). The material was collected by the British Council but the heads of the university departments concerned are responsible for the entries. It was decided to limit entries to (a) the head of department, (b) permanent members of the staff actively engaged in supervising research. It was also decided that the description of the

nature of research should be framed to include a broad description sufficient to indicate the scope of activity of the department and of each research team, and should be limited to work which was being pursued during 1954-55. The entries are arranged in alphabetical order of university and indexes of both subjects and research workers are included.

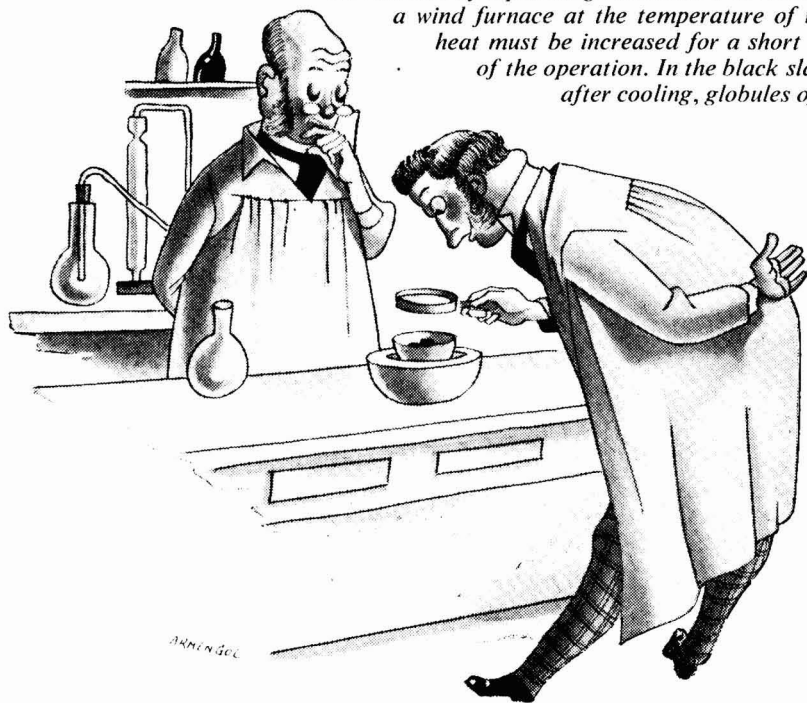
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BULLETIN No. 151 issued by Aero Research Ltd., a Ciba company, contains details of the various forms and uses of Araldite epoxy resins, developed by Ciba Ltd., of Basle, and introduced into Great Britain eight years ago. The potentialities of this resin in industry, claim the makers, are extensive beyond assessment. From the basic forms of Araldite Type 1 rods and powder, a surface coating and a casting resin available in 1948, the manufacturers have developed a whole range of epoxies for bonding, sealing, impregnating, potting, filling and coating. Their main application is in the manufacture of electrical and electronic components, with important and rapidly extending uses in paint manufacture, aircraft assemblies, motor vehicles, scientific instruments, etc.

* * *

THE first catalogue of their general laboratory equipment has been published by the Loughborough Glass Co. Ltd., of Leicestershire. A 44 page booklet, it covers a wide range of laboratory ware and contains a loose-leaf folder describing the new Teflon sleeves for interchangeable ground glass joints. These were shown at the British Instrument Industries Exhibition at Earls Court, London, from 28 June to 9 July, and are now in quantity production. Truncated cones of Teflon film (0.003 in. thickness). Teflon sleeves taper one in ten and are designed for making ground glass joints vacuum tight without the use of grease. Among their advantages, claim the makers, is that there is no contamination of the product as no lubricant is needed, the waxy surface of Teflon acting as a lubricant. The sleeves are attacked by molten alkali metals and fluorine, but are not affected by any known solvents, and they will withstand temperatures in the region of -75° to 300°C .

M. Peligot has communicated to the Annales de Chimie et Physique (xvii, 363) a short note on the preparation of uranium. A mixture of 75 grammes of uranous chloride, 150 grammes of dry potassium chloride, and 50 grammes of sodium in fragments is introduced into a porcelain crucible, itself surrounded by a plumbago crucible. The reaction is effected in a wind furnace at the temperature of redness; but the heat must be increased for a short time at the close of the operation. In the black slag may be found, after cooling, globules of fused uranium.



M. Peligot finds uranium

The new method of producing uranium was announced in the first issue of *Nature* in 1869. Monsieur Peligot, who twenty-eight years before had first isolated the metal, discovered by Klaproth in 1789, was opening the door a little more widely to the possibility of an Atomic Age a century later.

To-day the priority attaching to the

atomic energy programme puts uranium compounds among the few that B.D.H. cannot supply in unlimited quantities. The B.D.H. catalogue contains more than 6,000 laboratory chemicals and reagents. Of these some hundreds in addition to 'AnalaR' and 'M.A.R.' chemicals, are labelled with specifications of purity.

B.D.H. LABORATORY CHEMICALS

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Next Week's Events

MONDAY 17 OCTOBER

SCI (London Section)

Dartford: Technical College, Lowfield Street, 7.30 p.m. Joint meeting with Kent sub-section of the RIC. 'The Importance of Analytical Chemistry in Industry' by J. Haslam, D.Sc., F.R.I.C.

SCI (Pesticides Group)

London: Mezzanine Cinema, Shell Mex House, Strand, W.C.2, 5.30 p.m. Film show.

The Chemical Society

Durham: Science Laboratories, South Road, 5.15 p.m. Joint meeting with the Durham Colleges Chemical Society. 'New Aspects of Aromatic Character' by Professor Wilson Baker, D.Sc., F.R.I.C., F.R.S.

Leicester: University College, 4.30 p.m. Joint meeting of Nottingham branch with University College, Leicester. 'Hydrogen Transfer Reactions' by Professor E. A. Braude, Ph.D., A.R.C.S.

British Ceramics Society

Stoke-on-Trent: North Staffordshire Technical College, 7.30 p.m. 'Ceramics in the Electronic Industry' by P. Popper, B.Sc., A.M.I.E.E.

TUESDAY 18 OCTOBER

SCI (Chemical Engineering Group)

London: Geological Society, Burlington House, Piccadilly, W.1, 5.30 p.m. 'The Decolorisation of Sugar Liquor by Solid Absorbents' by H. C. S. de Whalley, F.R.I.C., M.I.Chem.E., F.C.S., F.R.S.A., M.R.I., M.I.Biol.

WEDNESDAY 19 OCTOBER

Royal Institute of Chemistry

London: King's College, Strand, W.C.2, 6.30 p.m. 'Some Recent Advances in Physical Organic Chemistry' by Professor H. C. Longuet-Higgins, M.A., D.Phil.

SCI (Newcastle Section)

Newcastle-on-Tyne: Chemistry Department, King's College, 6.30 p.m. 'Some Points in the Development of Wilton Works of I.C.I. Ltd.' by G. M. Power, B.Sc., A.M.I.Chem.E.

Oil & Colour Chemists' Association

London: Royal Society of Tropical Medicine & Hygiene, Manson House, Portland Place, W.1, 7 p.m. 'Particle Size Assessment' by L. O. Freeman, Ph.D., M.Sc., A.R.I.C. (Paint Research Station).

The Chemical Society

Gloucester: The Technical College, Brunswick Road, 6.30 p.m. 'Some Newer Plastic Materials' by Dr. E. M. Evans, B.Sc., A.R.I.C.

THURSDAY 20 OCTOBER

The Chemical Society

Bristol: Chemistry Department, The University, 7 p.m. 'Organic Inclusion Compounds & their Uses' by Professor Wilson Baker, D.Sc., F.R.I.C., F.R.S.

Edinburgh: North British Station Hotel, 7.30 p.m. Joint meeting with the RIC and Society of Chemical Industry. 'Some Fatty Acids of Recent Description' by Dr. F. D. Gunstone, B.Sc.

Belfast: The Queen's University, 7.15 p.m. Joint meeting with RIC and Society of Chemical Industry. 'Silicones. Their Chemistry & Technology' by Dr. G. G. Freeman, B.Sc., F.R.I.C.

London: The Institution of Civil Engineers, Great George Street, S.W.1, 7.30 p.m. Centenary lecture 'The Photosynthetic Carbon Cycle' by Professor M. Calvin, Ph.D. (University of California).

FRIDAY 21 OCTOBER

Society of Chemical Industry

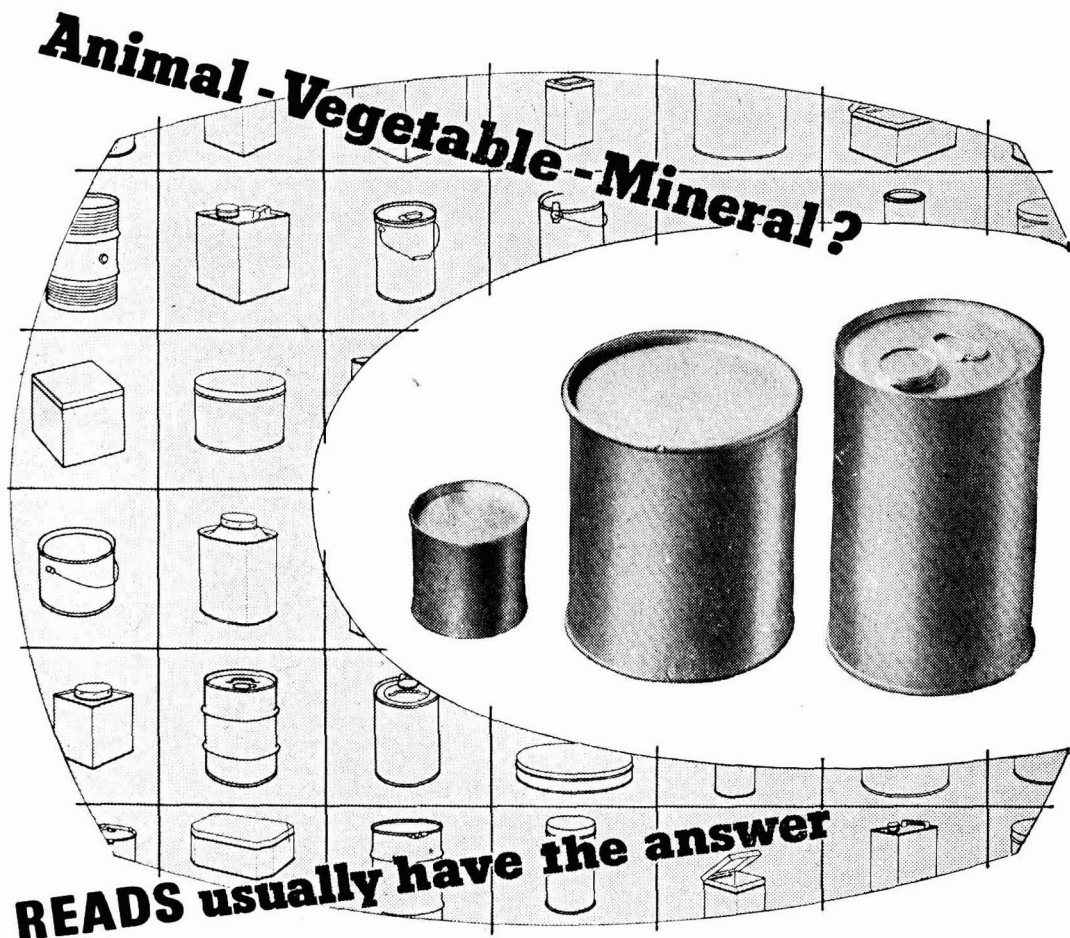
Cardiff: Park Hotel, 7.30 p.m. Joint meeting with RIC and annual dinner and dance.

Plymouth: Technical College, 5.30 p.m. 'Germanium' by G. R. Davies, B.Sc., Ph.D.

Educating the Young Worker

LECTURES on the chemical industry will be given by Mr. H. A. Collinson, F.R.I.C., during the Sixth Oxford Conference on The Education of the Young Worker at Oriol College, Oxford, from 7 to 13 April next year.

Organised by the department of education in the University of Oxford, the Conference will consider the needs of young workers preparing for relatively unskilled jobs. Inclusive fee for the course is £12, although a few non-residents will be accepted for four guineas. Applications for registration to The Secretary, Young Worker, 15 Northam Gardens, Oxford.



... if it's contained in metal

Each market and product have their own packaging problems. Whatever you are selling, in whatever part of the world, there is a container which answers your needs. Reads have 85 years' experience in the manufacture of plain and decorated tin boxes, steel drums and metal containers. From a $\frac{1}{2}$ -ounce stamped box to a 50-gallon or 500-lb. open top drum in tinsplate, terneplate, steel or aluminium, Reads can usually supply or design the correct container for your product and its specific market. Consult Reads of Liverpool about metal packaging.

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Law & Company News

Commercial Intelligence

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

Mortgages & Charges

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

NORTH BRITISH RAYON LTD., London E.C.4.—13 September, charge supplemental to a trust deed dated 12 June, and registered 18 June, 1947; charged on land and premises known as Fearnought Mill, Throngside, near Huddersfield, Yorks, comprised in a conveyance dated 18 November, 1949. *£294,590: 9 December, 1954.

Changes of Name

BRIMSDOWN CHEMICAL WORKS LTD., 11-12 St. Swithins Lane, London E.C.4, to Derby Luminescents Ltd.

SHELL CHEMICALS LTD., St. Helens Court, London E.C.3, to Shell Chemicals (Sales) Ltd.

PEST CONTROL (CHEMICALS) LTD., Bourn, Cambs, to Pest Control Ltd.

Increases of Capital

F. W. BERK & CO. LTD., chemical manufacturers and merchants, etc., 1/19 New Oxford Street, London W.C., increased by £400,000, in 2s. 6d. ordinary shares, beyond the registered capital of £600,000.

BEECHAM GROUP LTD., 55/6 Pall Mall, London, S.W.1, increased by £2,000,000, in £1 4½ per cent redeemable cumulative preference shares, beyond the registered capital of £8,000,000.

New Registrations

M.F. (Bradford) Company Ltd.

Private company. (554,810). Capital £1,500 in £1 shares. To carry on the business of finishers, sizers, pressers, chemical manufacturers and grease extractors,

bleachers, scourers, carbonisers, etc. The subscribers (each with one share): James R. Phillips and Evelyn E. Tremain. Registered office: Argus Chambers, Hall Ings, Bradford.

British Oxygen Chemicals Ltd.

Private company. (554,820). Capital £1,500,000 in £1 shares. To acquire the manufacturing and trading business in chemicals carried on by the British Oxygen Co. Ltd. at or from Vigo Lane, Chester-le-Street, etc. Directors: Frederic C. S. L. Lewin-Harris and Richard F. Goldstein. Registered office: Bridgewater House, Cleveland Row, St. James's, London S.W.1.

Company News

Redferns (Bredbury) Ltd.

A subsidiary company of Redferns's Rubber Works Ltd., of Hyde, Cheshire, has now commenced trading as a separate entity. Administrative arrangements were transferred from the parent company at the beginning of October, and all communications should be addressed to Redferns (Bredbury) Ltd., Bredbury, near Stockport. Telephone: Woodley 2687. The Bredbury works were established in August 1954, when a production unit of the mechanicals division of the parent company moved from Hyde to Bredbury. Existing plant has been re-planned and supplemented by additional equipment to extend production facilities. Redferns (Bredbury) Ltd. specialise in the lining and covering of chemical plant with corrosion-resistant rubber and ebonite; roller coverings; tank linings; chemical-resistant utensils; and fabricated parts in natural and synthetic rubber and ebonite.

Lafarge Aluminous Cement Co.

At the recent annual general meeting of the Lafarge Aluminous Cement Co. in London, the chairman, Mr. John G. Kay, presiding, said: The company has plans in hand for the purchase of additional grinding plant at the West Thurrock, Essex, works. Trading profit of the company for the year was £337,756 compared with £260,242. After payment of the preference dividend it is proposed to distribute a final dividend of 30 per cent, less tax, to ordinary shareholders, leaving a carry forward of £18,603.

[continued on page 860]



Headaches from Emulsion Breaking?

Sequestrol (ethylene diamine tetra-acetic acid Geigy) completely inhibits the action of polyvalent metal ions such as those of calcium, aluminium, iron, etc., which so often cause instability in oil-in-water emulsions. Also, by its solubilising action on many inorganic substances in aqueous suspension, Sequestrol can reduce the tendency to emulsion breaking by large particles. Enquiries are welcomed.

*A pinch of
SEQUESTROL
may be the
answer.*

THE GEIGY COMPANY LTD., Rhodes, Middleton



MANCHESTER

Company News

continued from page 858]

Glaxo Laboratories Ltd.

Glaxo Laboratories Ltd. announce that, subject to completion of audit, the profits of the group for the year ended 30 June, 1955, amount to £1,556,000 (£1,484,189) after providing for all charges including £1,121,000 (£1,227,200) for UK taxation. The proportion of these profits attributable to outside shareholders is £11,000 (£21,000). Group profits include profits of previous years £75,000 (£12,948). The directors have proposed to place £500,000 to capital reserve and to recommend a final dividend of 10 per cent on the ordinary stock (making 12½ per cent for the year) compared with the equivalent of 7½ per cent on the doubled capital. The final dividend requires £183,160 (£131,398) after Income Tax, payable on 14 December, 1955, leaving £438,772 (£420,130) to be carried forward.

The General Electric Co. Ltd.

At the recent annual general meeting in London, Sir Harry Railing, chairman of the company, said: 'The company has already installed special electric furnace equipment in Government establishments which is producing the bulk of the metallic uranium in this country required for nuclear purposes. Although the atomic power station activities of our company are centred at our Fraser & Chalmers engineering works, all other works of the company are playing their full part, as are our Wembley laboratories which have a long association with Harwell in research. We have also received enquiries from abroad for complete atomic stations and for electric furnace installation for the production of pure uranium.' The directors of the company have recommended an increased dividend on the ordinary stock of 14 per cent for the year just ended.

Chemstrand

THE Chemstrand Corporation of America plans to form an English subsidiary.

Mr. Henry Bitler, president of the Corporation, said Chemstrand expects to manufacture its acrylic fibre Acrilan in England within the next two years. In the meantime, Acrilan will be available on the English market and will be imported from Chemstrand's plant in the US.

Acrilan is one of the newest man-made fibres and gives fabrics a combination of stability, strength and luxurious hand. It can be woven into blankets, cashmere soft flannels, and fabrics for both women's and men's wear.

The Chemstrand Corp. is a jointly owned associate company of American Viscose Corp. and Monsanto Chemical Co. Its corporate headquarters, research centre and Acrilan plant is at Decatur, Alabama; the nylon plant at Pensacola, Florida. Sales headquarters are in New York City.

Officials of Chemstrand now in England preparing for the new company are: Mr. Edward O'Neal, director; Mr. William G. Luttge, vice-president in charge of sales; and Mr. Arvon L. Davies, assistant to the president and co-ordinator for the English project.

Market Reports

LONDON.—There have been no outstanding developments in the week either as regards conditions or prices and the demand for industrial chemicals on home and export account continues at a good level. The call for fertilisers has been well maintained and among the coal-tar products pitch is attracting more interest. Quotations generally display a firm undertone.

MANCHESTER.—A continued steady demand for contract deliveries of pretty well all descriptions of heavy chemicals products has been reported on the Manchester market during the past week, with replacement business coming forward satisfactorily as the need arises. A fair number of inquiries on export account have been dealt with. From the point of view of prices the undertone is firm throughout the range, although no actual changes of any consequence have occurred since last report. Fair buying interest is being shown in the compounds and a few other fertilisers. Most of the par products, both light and heavy are meeting with a continued steady demand.

GLASGOW.—The past week has been an extremely busy one in the Scottish market and covered most sections of the industry. Both contract and spot deliveries were well maintained and the materials covered quite a wide range. With the exception of a few price increases the majority have remained steady, with copper sulphate showing a reduction. On the agricultural side the demand here again has been consistent.



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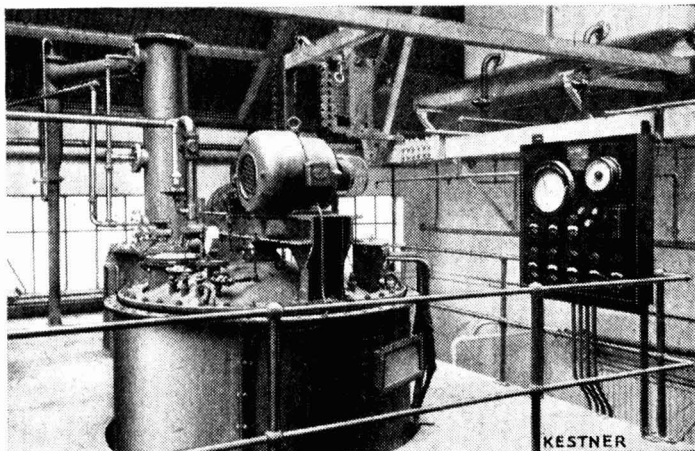
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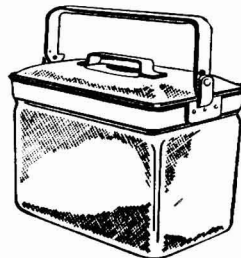
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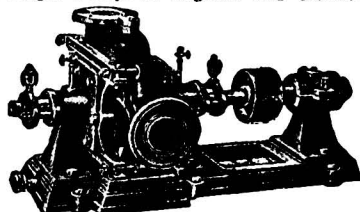
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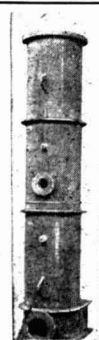
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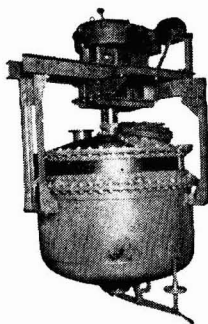
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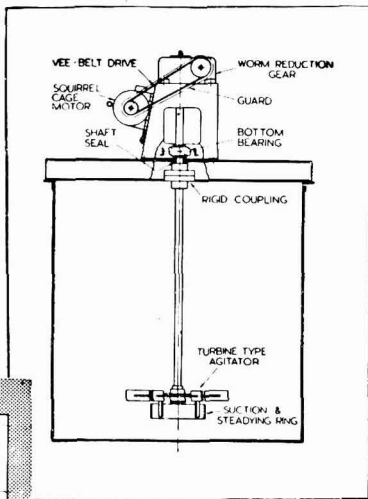
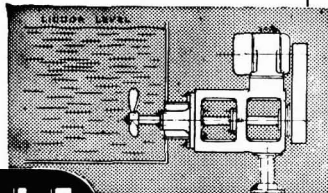
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