THE Chemical Age

VOL. LXXIV 30 JUNE 1956 No. 1929

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Corrugated 'PERSPEX'

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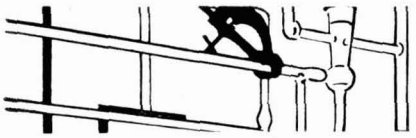

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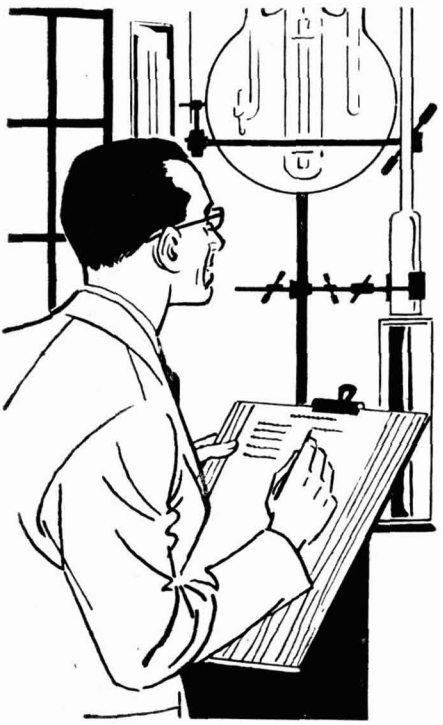

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Volume LXXIV
Number 1929

The Chemical Age

Established 1919

The Weekly Journal of Chemical Engineering and Industrial Chemistry

BOUVERIE HOUSE · 154 FLEET STREET · LONDON EC4

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

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Housewife's Choice

THE synthetic detergent has come to stay, especially in the kitchen. Since 1949 volume-use has had a threefold expansion, thus:

	1,000's of Tons of Active Material		
	Domestic Use	*Industrial Use*	*Total*
1949	10.5	2.5	13.0
1950	12.5	2.7	15.2
1953	29.0	6.0	35.0
1955	33.5	6.5	40.0

Nor is expansion the sole change since the early post-war period. Then most domestic products were based upon the secondary alkyl sulphate type of surface-active substance. Now the alkylarylsulphonate type dominates the market. Thus it is possible for the nature as well as the size of disposal problems to change during a few years, and these changes are decided by manufacturers and housewives. When 50 million people use about 40,000 tons of surface-active material per year, the average concentration of this material in sewage in dry weather will be about 14 p.p.m. Actual figures will vary from this quite widely—according to weather, washing days and other factors.

Set up in 1953, the Committee on Synthetic Detergents has published its final report (HMSO, 3s). The main concern is for effects upon sewage treatment efficiency and water purification. Other feared consequences of this chemico-social change are firmly dismissed, including the much talked-about skin trouble risk. The Committee reviewed evidence on dermatitis incidence and found no grounds for the assumption that this is greater than when soaps and alkalis were more heavily used in washing. It is not denied that some individuals will be particularly susceptible; the coldly comforting view is taken that such people must find out their own non-average reactions to detergents and thereafter choose a product to which their skins are not allergic. This no doubt represents the present state of knowledge on skin troubles fairly enough. It is also pointed out that in the earlier years of detergent invasion many users made the washing solutions too strong, and this encouraged skin troubles.

The sewage problem is not as easily disposed of. Foaming on tank surfaces has steadily increased, and this is more than a nuisance, for the foam can blow about in both the works and its neighbourhood. The Committee's view is forthright enough—the continued production of foam at sewage works 'should not be tolerated indefinitely'. But the remedy is not regarded as a sewage works responsibility. Various means of foam control are discussed—water spraying, which is effective but will usually need more water than can be provided; the use of chemical defoamants, about which nothing is known as to their own effluent-polluting hazards; and major changes in sewage treatment processes which would call for heavy capital expenditures. None of these is recommended for a problem whose nature may one day change. The Committee investigated the possibility of curing foaming in sewage works by eliminating it in wash-tubs, but a solid front of evidence that housewives insist upon detergents which produce soaplike lather makes this sensible approach one that is impracticable. Sales of non-foaming synthetic detergents are very small. Here possibly the Committee gave in too quickly. It could be a matter of domestic education to make it more widely realised that non-foaming surface-active agents can remove dirt efficiently.

But foaming is only the more visible problem. The effect of detergent residues on sewage purification efficiency is serious. The evidence collected by the Committee is adequate to show that biological oxidation is retarded by alkylaryl-

sulphonates. These chemicals are little decomposed by oxidation or bacterial processes, and they are adsorbed by filters only to a limited and initial extent. Their relatively undisturbed existence in sewage flow inhibits the natural intake of oxygen. At the Mogden sewage works, purification efficiency has fallen by about 20 per cent since 1950; to restore the pre-1950 standard of purification now, new plant needed would involve capital expenditure of £600,000. This is no isolated piece of evidence. The total case that detergent residues reduce sewage treatment efficiency, though deductive in nature, is powerful and there can be few people who would not accept it.

This, of course, squares with much other recent evidence that rivers receiving sewage effluents are carrying smaller contents of dissolved oxygen (THE CHEMICAL AGE, 1955, **72,** 885). Occasional surface foaming on rivers may be dramatic, but water that is much less aerated can eventually attract attention by more obnoxious, malodurous developments. The query about toxicity to fish is tentative but it certainly seems that other toxic hazards to fish will be intensified if rivers contain less oxygen. Against this, the substantial addition of phosphates in detergent residues might well encourage greater fish populations; and this point—apparently ignored by the Committee though well substantiated by fish culture research—perhaps explains why there are a few cases of bigger fish catches by anglers during the detergent era. The Committee seems more concerned about the effect of these phosphate additions upon the growth of river weeds, though so far there is no British evidence of this.

As today's synthetic detergents are not substantially removed in sewage treatments, their entrance into rivers also used for public water supplies may bring water purification problems. It seems important to emphasise that no difficulties of this kind have yet been reported here, though two cases have occurred in the US. Nevertheless, it seems a fact that detergent residues, though greatly diluted in river water, will not be much removed by water purification processes now used. On the other hand, the human-toxic risk can be regarded as negligible; ample experimental evidence that synthetic detergents, even at much higher concentrations, are unharmful is given in the report. The Committee's view that there may be long-term toxic hazards, and that this possibility requires investigation, seems somewhat overcautious.

One of the major conclusions is that manufacturers should develop new detergents which will be more certainly and more completely decomposed in sewage oxidation processes. Obviously, it is believed that this solution would also minimize the foaming nuisance. Here, however, there is disagreement, and four members took the view that there is little cause for alarm and that present approaches towards the detergent residue difficulties will prove adequate. These four members also felt that the main impact of detergent residues has already been experienced and there is no greater shape of difficulties to come. It is regrettable that the minority remains anonymous; usually in reports of this kind dissenting opinion is given the form of a signed minority statement. For this omission—important in that the background nature of the minority view is unrevealed—the report may be strongly criticized. Nor is it irrelevant that four members of the Committee also questioned the reliability of methods used for determining detergent residues. It is difficult not to believe that these two minorities of four were in fact one and the same.

It will no doubt be thought that we are prejudiced in favour of chemical industry interests in saying that our own reading of the report leads us to support the minority conclusion. With the possible exception of the effect upon the oxygen content of rivers, most of the evidence gathered by the Committee supports a non-alarmist, *laissez-faire* attitude. By no means need this be regarded as complacency; it is practical common sense to regard the various difficulties as superable in size and nature. The title of this leader in any case presents the basic fact—the presence of surface-active chemicals in sewage and effluent-receiving waters is housewife's choice, and the type of synthetic detergent used (and its cost) will continue to be decided at the sink and by the housewife's purse.

Notes & Comments

TV & Chemistry

TO STRESS again the shortage of teachers of science seems unduly monotonous. Recently yet another report stated that science classes in many girls' schools might disappear unless more female students choose science for their degree subjects. All news on this subject has the atmosphere of bad news. Nor is the problem much less serious in America. A stimulating article in the US *Journal of Chemical Education* (1956, **33,** 257) discusses the use of TV as a partial means of overcoming the teacher drought. It describes an experiment carried out last year by the Pennsylvania State University, when the lectures of a second-year general chemistry course were given on closed-circuit television. It is strange that to date so little attention seems to have been given to this method of making wider use of limited man-power and skill. For details of the TV-lecture arrangements the original article should be consulted. Here it can be said that the results were at least highly encouraging, if not conclusively successful. One such experiment is clearly inadequate; student response is bound to be favourably fostered by the knowledge that the teaching method is one of important novelty. To quote from the article: 'There is little doubt that instruction of chemistry classes by television is quite feasible for the lecture phase. It has a very significant advantage in making the experiments clearly visible. If colour and a large screen were available, it would be entirely practical, perhaps even quite desirable.' Absence of personal contact with the lecturer is not as big a handicap in chemistry teaching as it would probably be in other subjects, for it is compensated by the necessity for personal contact in the practical phase of a college chemistry course. The students displayed close attention and concentration; when questions were asked occasionally, they responded no less keenly than if the lecturer was present. A questionnaire aimed at extracting the students' own reaction produced these results: Eighteen per cent felt they were learning more and 37 per cent about the same; and 28 per cent felt that the interest in TV-lectures was greater, while 24 per cent felt it was about the same. The balance in favour of the TV method was therefore slightly in a majority. With this consumer verdict the fact must be borne in mind that teaching opinion is: The TV method cannot be really effective unless both colour and a large screen are used, and these present limitations prevent immediate development. One additional point of some importance occurs to us. Teaching is not at heart a man-power number task, and really good lecturers will always be scarcer than average ones. The TV method could enable the best lecturers to be widely used. However, emphasis upon this idea might well lead to new kinds of fears about automation.

Federated Market

AN OFFICIAL Canadian publication, *Foreign Trade,* has so tidily summarized the Rhodesia-Nyasaland market facts and prospects for sales of drugs and medicinal chemicals that we have not been able to resist the temptation of re-using some of its wisdom. The new Federation is a large and growing market for pharmaceuticals and antibiotics. Of the population of seven million, 6,500,000 are Africans, 'many of whom know little about ordinary hygiene.' Medical services for Africans are free and inasmuch as natives use these services the Government foots the bill. The needs are high through the incidence of native diseases that can be kept under control by drugs. The average African diet has deficiencies that also require medicinal treatment. The figures given in the Canadian paper show that the United Kingdom is holding a satisfactory share of this export opportunity. Out of the Federation's total 1955 imports of medicinal products (£764,566), UK firms provided £375,731, or almost 50 per cent. This compares with South Africa's share of 44 per cent. The US share was only £13,585 and Germany's £3,937. As for

drugs and chemicals for dispensing, Britain's share was exceptionally high—£53,584 out of a total import value of £63,765, or about 84 per cent. Again for alkaloids, UK exports to the Federation took an 83 per cent share of a £36,000 market. We also dominated the antibiotic trade picture, selling to the value of £132,772 out of the Federation's total of £203,841. Here the US and Holland were our closest competitors with respective shares of 15 and 11 per cent.

Danger in Complacency

ALTHOUGH the article in *Foreign Trade* had the purpose of showing the Canadian producer how small his country's share was in relation to the total opportunity, it certainly showed that the UK producer's share has been satisfactorily large. But 12 other countries are making sales which share the non-British residue, and to judge from the article the factor of price-competition for large purchases by official tender is fully appreciated. This seems to be a market in which we could insidiously fall back, a steadily growing market in which we maintain our volume and value of sales without realizing that more expansion is needed to maintain our share of total sales. This has happened too often in export markets where the British share was once predominant. And when other countries' shares in such markets rise, the characteristics of their products become more familiar and acceptable, so that ultimately it is not even possible to keep the British sales volume-value figure constant. If there is now much to be satisfied with, there is great danger in complacency.

University Reorganization

THREE scientific departments at the University of Leeds are to be reorganized and replaced by a school to be called 'The Houldsworth School of Applied Science'. This school will be constituted of the Department of Gas Engineering & General Fuel Science with Ceramics, directed by Professor A. L. Roberts; the Department of Chemical Engineering, to be directed by the Brotherton Professor, to be appointed shortly; and the Department of Metallurgy directed by the Reader in Metallurgy, Mr. N. J. Patch. The work of the three departments within the school will be co-ordinated by a special committee.

For some years Sir Robert Houldsworth was a senior member of the staff of the Department of Coal Gas & Fuel Industries, and he was familiar with its activities through his work as fuel controller and also with the National Coal Board.

Chemistry & Medicine

SPEAKING in London at a meeting of the British Association of Chemists on 20 June, Mr. John E. McKeen, president and chairman, Chas Pfizer & Co. Inc., said that medicine is indebted to chemistry for many life-saving drugs in her armoury. Conversely, chemistry is indebted to medicine for the great stimulus to research provided by medical problems.

History of this partnership went back a long way. One hundred years ago, W. H. Perkin was looking for a synthetic route to quinine; he discovered aniline dyes and founded the dyestuffs industry. From this industry came the first drug produced on a large scale—aspirin.

Penicillin and the sulphonamides were later additions to the medical armoury.

Mr. McKeen then told how his company dealt with the problem of getting a new antibiotic (Terramycin) into the hands of the medical profession. He added that in the US 35,000 people are now employed in research by the chemical industry. His company spent over seven million dollars a year on research in the grand alliance of chemistry and medicine.

This had also resulted in the development of products for preventing the bacterial infection of certain plants and crops.

Shell Films

Some 5,000 employees of the Shell Petroleum Co. Ltd. saw a special film programme on the petroleum industry in London on 22, 25 and 26 June. Four films were included in the programme. 'Birth of an Oilfield,' 'Look at your World (No. 2),' 'Shell's Progress in 1955,' and 'The Rival World.' 'The Rival World' has won documentary awards at two film festivals. It tells of man's fight all over the world against insects and shows how Shell products are used in this never-ending struggle.

HOME

ICI Fire Brigades

Fire brigade teams from ICI Ltd., Billingham, won all three trophies at the recent competitions in Newcastle of the North-eastern branch, Industrial Fire Protection Association. The annual competition of the Billingham works fire brigades is being held on 30 June, and on the previous evening several employees will receive long service awards to mark 15 years' service as volunteer firefighters.

Change of Address

Electro Chemical Engineering Co. Ltd. moved on 18 June to Forsyth Road, Sheerwater Trading Estate, Woking, Surrey (telephone: Woking 4400).

Implications of Colour

A symposium on 'Some Implications of Colour', organized by the Oil & Colour Chemists' Association, will be held in the Chemistry Theatre of University College, Gower Street, London WC1, on 20 September. The following papers will be given: 'Colour Gamuts of Pigments' by E. Atherton and D. Tough, 'Assessment of Light Fastness' by J. G. Gillan, and 'Personal Experience with the Inter-Society's Colour Council Aptitude Test' by M. Hess. Applications for tickets should be made to the general secretary of the association, Memorial Hall, Farringdon Street, EC4.

Perkin Centenary Exhibition

In view of the marked interest which is being shown in the Perkin Centenary Exhibition in Gallery 46 at the Science Museum, South Kensington, it has been decided to extend the period of opening until 18 July 1956. If interest is still maintained at its present high level at that date a further extension will be considered. The exhibition, which consists of dioramas, many original letters and documents, as well as a presentation of the story of the development of the synthetic dyestuffs industry during the past 100 years, is open on weekdays and on Sundays.

Russians Visit ICI

A party of visitors from the Soviet Union recently toured the fertilizer plant at the Billingham, Co. Durham, factory, and the anhydrite mine 800 ft. below. The tour was arranged through the United Nations and the British Government.

Open Days at East Kilbride

The Mechanical Engineering Research Laboratory, East Kilbride, Glasgow, is to hold its first open days on 20 September and 21 September 1956. Applications for invitations, stating which day is preferred, should be sent to the director. The work on show will cover properties and mechanics of materials, particularly fatigue and creep; fluid mechanics, including water-turbines, pumps and oil pressure mechanisms; lubrication and wear; mechanisms, engineering metrology, and noise-control; machining, extrusion, forging and other metalworking processes; and heat transfer and thermodynamics.

BP Subsidiaries Re-named

The names of several companies of the British Petroleum Group have been changed, as from 1 June 1956, to identify them more closely with the group and its BP symbol. Aden Petroleum Refinery Ltd. is now BP Refinery (Aden) Ltd.; Australasian Petroleum Refinery Ltd. is now BP Refinery (Kwinana) Ltd.; British Tanker Co. Ltd. is now BP Tanker Co. Ltd.; D'Arcy Exploration Co. Ltd. is now BP Exploration Co. Ltd.; D'Arcy Kuwait Co. Ltd. is now BP (Kuwait) Ltd.; Grangemouth Petroleum Refinery Ltd. is now BP Refinery (Grangemouth) Ltd.; Kent Oil Refinery Ltd. is now BP Refinery (Kent) Ltd.; National Oil Refineries Ltd. is now BP Refinery (Llandarcy) Ltd.

SCI Pesticides Group

The summer visit of the Society of Chemical Industry's Pesticides Group will be to Wye College on 7 July, commencing at 11.30 a.m. The tour will include the chemistry department, horticulture department, poultry department and the farm.

Lists of Publications

Two lists of publications made available to the public, Nos. 6 and 7, have recently been issued by the United Kingdom Atomic Energy Authority. Included in these lists are original documents and translations issued by the Atomic Energy Research Establishment and the Industrial Group of the UKAEA, together with articles in periodicals contributed by the authority's staff.

Acetylene's Possibilities

USES of acetylene in the future were discussed by Mr. J. S. Hutchison (British Oxygen Co. Ltd.) at the annual luncheon of the British Acetylene Association in London on 21 June. He said it was a quality product which had great possibilities in the chemical field.

One hundred and eighteen members and guests were at the lunch. The Association's new president, Mr. N. L. G. Lingwood (British Oxygen Co. Ltd.), occupied the chair. Replying to the toast of the Association, proposed by Mr. Hutchison, the president told of the work being done in the production of acetylene from hydrocarbons.

Vice-president, Mr. E. Seymour-Semper, proposed the toast of the guests, to which Mr. W. W. Watt, a former president, and Sir Charles Lillicrap, president, British Welding Research Association, replied.

At the annual general meeting, held immediately before the luncheon, the retiring president, Dr. F. H. Peakin (ICI Ltd.) reported on the 1955-56 session. He said seven new members had joined from the UK and eight from overseas. The council had made Mr. Herman Hirst (president 1949-50 and 1950-51) an honorary member.

The Association had been fully represented at meetings of the Commission Permanente Internationale de l'Acétylène, and was represented at the numerous meetings of the committees of the BSI. The regulations committee had issued an interim report, but the final report was not likely to be available until 1957.

Special tribute was paid to the work of the Association's secretary, Mr. P. L. Taylor.

Officials Elected

Officials of the British Acetylene Association (session 1956-57) were elected during the annual general meeting. The results were: *president*, MR. N. L. G. LINGWOOD; *vice-president*, MR. E. SEYMOUR-SEMPER; *honorary treasurer*, MR. F. W. SUMMERFIELD; *council*, MESSRS. G. BENSON, W. K. CAMPBELL, A. HODDLE, C. S. MILNE, F. NEWPORT, E. W. RODNIGHT, S. A. SALES, A. W. SCOTT, E. STEIN, A. STEPHENSON and DR. F. H. PEAKIN (immediate past-president) together with the president, vice-president and honorary treasurer; *secretary*, MR. P. L. TAYLOR.

IN THE EDITOR'S POST

Fundamental Research

I SHOULD like to offer one factual comment on the kindly references you make in your leader of 9 June to the work of research associations. In the last column of your article the figure of £75,000 which you quote as spent by research carried out at universities and technical colleges represents only a small proportion of the effort of research associations on work of this character.

Taken as a whole about one quarter of the total effort of research associations is devoted to fundamental research into the materials, processes and products of the industries they serve. The proportion varies between about 15 per cent and 60 per cent according to the circumstances of the research associations and the research policy of their councils and it has always been the policy of the Department, in paying grants to research associations, to stress the importance of conducting an adequate volume of long-range research.

W. L. FRANCIS, *DSIR*, London SW1.

The only comment we would make is to ask whether 'fundamental research into the materials, processes and products of the industries they serve, is a fair definition of a genuinely fundamental or basic research. By this definition, a good deal of research that many people would classify as applied research can be regarded as fundamental. There is, of course, no sharp dividing-line, but we think it could be sharper than the words of the above letter imply.

Ethylene Plant Project

Imperial Oil Company is reported to be seriously considering construction of an ethylene plant in Sarnia, Ontario's Chemical Valley. Estimated to cost around $10 to $12 million, the plant would be closely integrated with the company's refinery operations at Sarnia and would use hydrocarbon raw materials from its own refinery gas streams. This is one of several new petrochemical projects now being considered by Imperial's petrochemical development division. The company plans to sell the ethylene in gas form to consuming industries in the Sarnia area or to nearby U.S. points.

MAN-MADE RUBBER

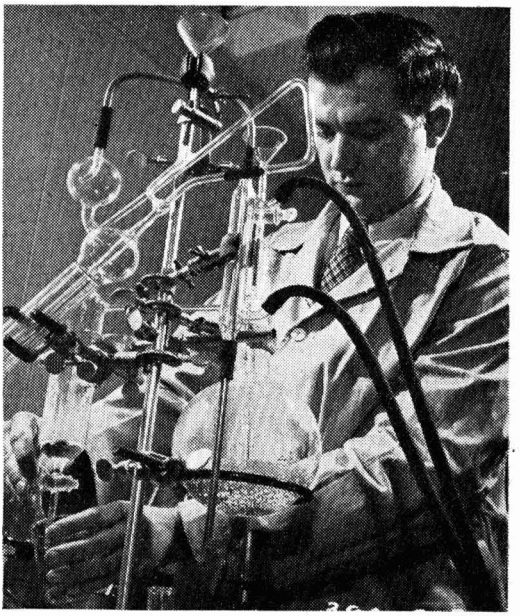
BF Goodrich Research Establishment's Success

THE successful laboratory reproduction in the US of the true molecule of crude or tree-grown rubber (see THE CHEMICAL AGE, 23 June) was carried out in the BF Goodrich Research Centre at Brecksville, Ohio. The discovery was made by a research team assigned to the project by Goodrich-Gulf Chemicals Inc., which is owned jointly by the Gulf Oil Corporation and the BF Goodrich Co.

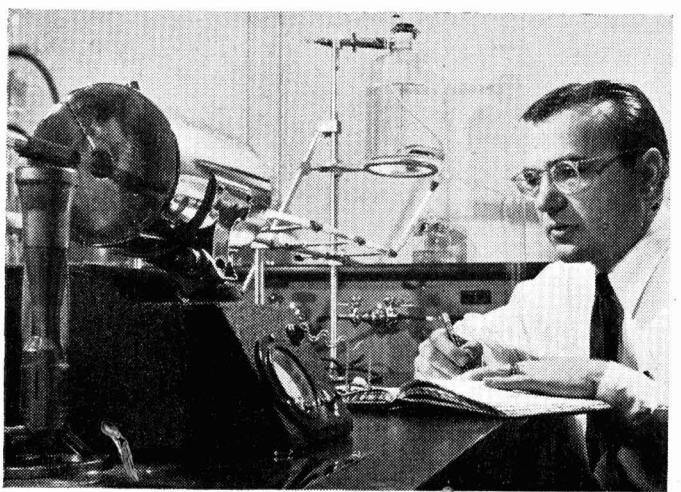
This development will no doubt arouse interest in the Brecksville Research Centre. Completed in 1948, the centre consists of six buildings, all of modern design, located on a 313-acre plot of farmland. They have a total of 144,500 sq. ft. of floor space.

In the main research building considerable emphasis has been laid on the flexibility and arrangement of utilities and equipment. Each room has services such as gas, electricity, water, steam and air.

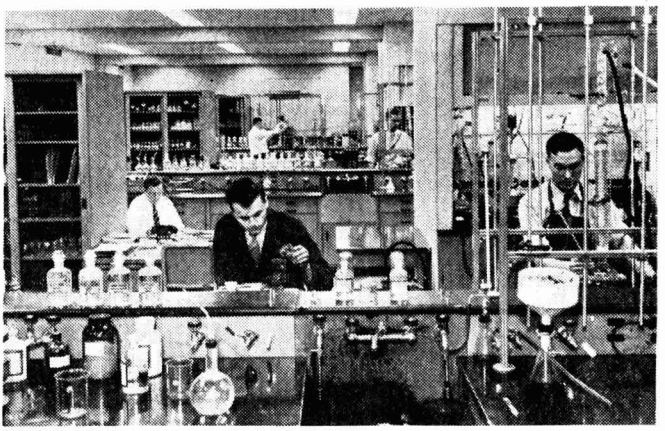
The centre is one of a limited number of leading scientific laboratories in the US using such by-products of atomic energy as radioactive tracers or 'tagged atoms' in its experimental work. The research staff is carrying out work on crude and man-made rubber, in addition to intensive research in such fields as chemicals, plastics, agriculture, horticulture and the application of nuclear energy to rubber manufacturing.



A separate building has been designed and isolated for high-pressure research. Reinforced concrete barricades with walls one foot thick have been provided to shield and protect the staff from the hazards of this kind of operation. The roof and one wall of the barricade units are of light construction, designed to yield at relatively low pressure limits.



Two typical views of BF Goodrich research workers in action are shown on this page. The researcher on the left is conducting micro-analysis for carbon and hydrogen to determine the chemical composition of a research sample



General view of one of the large laboratory units in the main research building where a team of research workers conduct their experiments

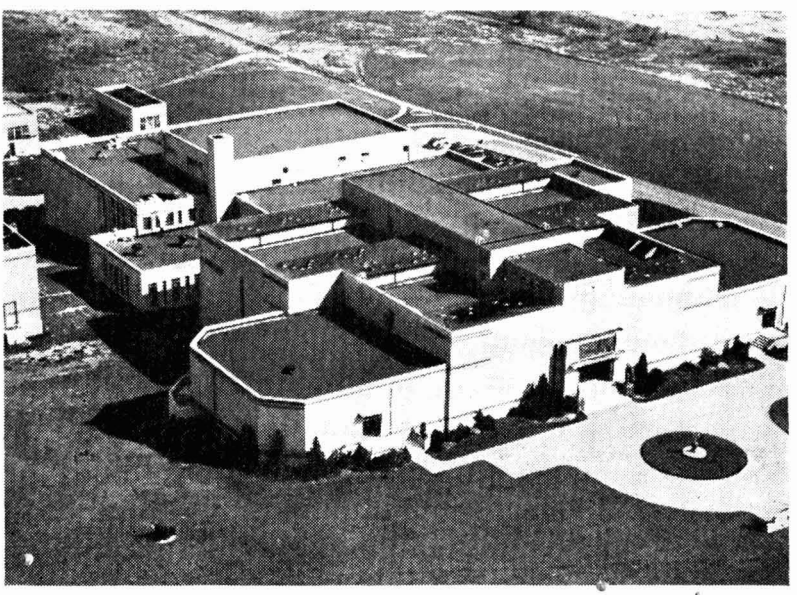
A special high-ventilated laboratory, for research requiring the use of volatile materials or gases, has been constructed at a safe distance from the main buildings.

In addition to the main research laboratory, consisting of two separate building units, the high-pressure, the high-ventilated, and the building for storing volatile solvents, there is a sixth unit designed to cool the water for the air-conditioning system.

The main research unit contains the Charles Cross Goodrich Library, believed to be the largest and most complete in the rubber industry. The present collection of literature in the technical library comprises about 10,000 volumes in the physical chemical and engineering fields. The nucleus of the collection consists of bound volumes of complete runs of the most important technical periodicals extending as far back as 1788.

BF Goodrich Co. was founded by Dr. Benjamin Franklin Goodrich in 1870. His son, Charles Cross Goodrich, who joined the company in 1895, founded the firm's first research laboratory in a small room on the second floor of a three-storey building in Akron, Ohio. This was the first rubber research laboratory in the US. By 1898 the company had grown so rapidly that additional facilities were needed for the research laboratory.

A new two-storey brick building was erected beside the Ohio Canal on a site that



Aerial view of the BF Goodrich Research Centre, Brecksville, Ohio

today is occupied by a building where tanks are lined with rubber by the BFG Vulcalock process of adhering rubber to metal. The second floor of the building was set aside for research operations. To maintain privacy, the laboratory could be reached only by an outside stairway.

One of the chief functions of the laboratory was the testing of raw materials. In the research library that Charles Goodrich founded, he assembled important physical and chemical data concerning materials and products. He demonstrated to the rubber industry the value of science. Under his guidance the art of compounding grew to major importance as the company embarked upon a programme of diversification. Whereas some firms concentrated on rubber shoes and boots, BF Goodrich began to make a wide range of articles. The extensive expansion in production of speciality items continued and today the company manufactures more than 32,000 different articles.

Pest Infestation Research

Developments at DSIR Laboratory

THE formation of a pool of entomologists and chemists which it is proposed should be attached to the Pest Infestation Laboratory at Slough is reported by the Pest Infestation Board in its annual report, 'Pest Infestation Research 1955', published last week (HMSO for DSIR, price 4s). Members of the pool will be available to undertake specific investigations in Colonial territories, on completion of which they will return to the laboratory in readiness for the next assignment.

Particular attention has been paid during the year to the storage of grain under airtight conditions. An experimental underground pit has been constructed at the laboratory and filled with 60 tons of heavily infested maize. Measurements of gas concentrations showed that the oxygen was rapidly used up, but the carbon dioxide concentration did not show the expected increase. Nevertheless, all the insects appeared to have been killed. This confirms laboratory evidence that the insects are killed by lack of oxygen rather than by excess of carbon dioxide.

During 1955 more intensive work on the microbiology of hermetically stored grain has been carried out. It appears from this work that fungi are not an important cause of grain damage in airtight storage. Studies are in progress on the part played by bacterial contamination, but it is too early to derive any conclusions.

Malathion, an organo-phosphorus insecticide of relatively low mammalian toxicity, is being investigated, and appears likely to be useful in the control of stored product insects. It has some vapour toxicity but films on wood remained toxic longer than similar films of gamma-BHC. A wettable powder of 20 mg. malathion per sq. ft. on bricks killed Cacao moth caterpillars more quickly than a similar deposit of gamma-BHC or one of 80 mg. DDT. With the two latter insecticides some caterpillars managed to pupate.

A German fumigation process has been tested by the fumigants section. This consists of adding tablets of aluminium phosphide to grain stored on floors or in silo bins. The aluminium phosphide decomposes on exposure to moist air, producing hydrogen phosphide. Two separate hundred ton parcels of grain have been treated but the results have not yet been assessed.

Biochemical work has been directed along two main lines: the detailed investigation of the chemical reaction of insecticidal materials with different foodstuffs, and basic research into the mode of action of insecticides.

In the first category, it has been shown that the sorption of ethylene dibromide by wheat is largely physical, and desorption on aeration is slow. If wheat is heated before it has been completely aerated, about one-third of the residue is decomposed to ethylene glycol, and the remainder is volatilized.

EPA May Continue

OEEC countries are now considering the question of continuing the European Productivity Agency after its present funds are exhausted.

The agency was set up, as a part of the OEEC organization, in mid-1953. Its finance came from lump sum contributions, totalling about $10 million—$2½ million from the US Foreign Operations Administration and the rest from the contributions of member countries from the conditional aid grants made to them by the FOA.

Two thirds of the latter contributions were made in local non-transferable currencies but it has now been agreed that the whole of these will be made transferable.

OVERSEAS

Uranium in Yemen

An American group has found uranium in the Sufan area of Yemen east of Ma'reb, only 150 kilometres from San'ah, the Yemenite capital, an official source said recently at the Yemenite Embassy in Cairo.

Israel Imports Oil in Bulk

Basic oils used in the manufacture of insecticides will in future be imported into Israel in bulk instead of in barrels, thereby saving at least I£100,000, the Shell Company has announced. Two thousand tons, the company's annual import volume of this commodity, have already been ordered and will be unloaded at the oil dock in Haifa. Annual consumption is about 3,000 tons, most of it used in citrus grove sprays.

Dredging Programme

A £1,400,000 dredging programme has just been commenced in Corio Bay, Victoria, Australia, by the Geelong Harbour Trust, which will enable the largest oil tankers now reaching Australia, including 32,000-ton vessels, to serve Shell's Geelong Refinery. Completion is expected by 1958.

Joint Dead Sea Project

Arab League envoys in Amman on 21 June signed the charter of a potash company which Jordan and Arab League members will launch in the Jericho area to exploit Dead Sea minerals. The scheme is estimated to cost £4.5 million, in which the Arab Governments have shares worth £1 million.

Palestine Potash Deficit

Testifying before the Israeli Parliament's economic committee, the director-general of the Dead Sea plant said that the Palestine Potash plant now has a monthly deficit of I£200,000 (£4,000). The board of Palestine Potash has asked the Minister of Development to nominate a governmental committee to investigate all aspects of the Dead Sea plant, including its equipment orders and installation, and also production problems.

Uranium Expansion Programme

A multi-million dollar expansion programme near Rifle, Colorado, that will greatly increase uranium production by Union Carbide Nuclear Co., has been announced by the Union Carbide & Carbon Corporation. A uranium processing mill will be constructed at Rifle, Colorado, and two ore-receiving stations and chemical upgrading plants will be constructed at Slick Rock in San Miguel County, Colorado, and Green River, Emery County, Utah. The plans were announced following the signing of a contract with the Atomic Energy Commission.

Investment in Australian Oil

British Petroleum Co. (formerly Anglo-Iranian Oil) has invested a further £A2,500,000 in Commonwealth Oil Refineries Ltd., which it controls as a marketing subsidiary. Paid-up capital of COR has been increased from £A4,000,000 to £A6,500,000. The money will be used to finance the company's general expansion programme.

Atomic Oil Processes

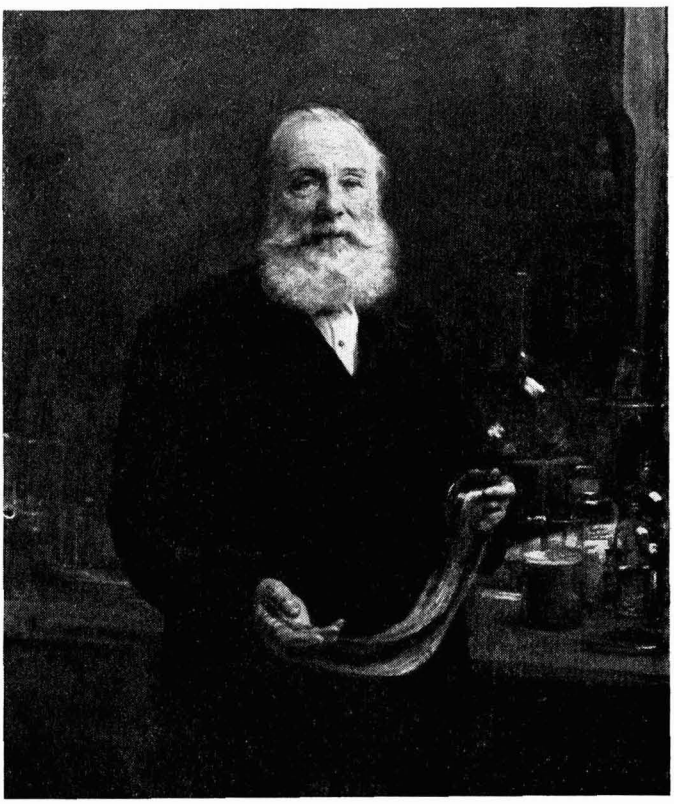
Experiments by the Standard Oil Company of New Jersey, US, indicate that there are 'good possibilities' for the use of atomic energy in processing petroleum and its products. The company reported recently that, on a purely experimental basis, sample quantities of petrol and other oil products had been produced with the aid of gamma radiation. The experiments may also make it possible for oil refineries to operate without using the high temperatures that are now needed. It would also enable refining operations to be conducted at lower temperatures. This would make feasible important savings of materials and reduction of other costs.

Phenol Plant Expansion

BA-Shawinigan Ltd. is expanding its plant in Montreal East to increase the production of phenol by 50 per cent. This was announced recently by Mr. R. S. Jane, president of the company. Work on the expansion is already under way, and is expected to be completed by early 1957. Besides products widely used in the electrical industry, phenol can be processed chemically to produce plasticizers for cellulose film, weedkillers, detergents, rubber antioxidants, and other chemicals. It is a selective solvent in the refining of lubricating oils.

100 YEARS OF THE Chemical Industry

a review in pictures



FOR the chemical industry 1956 is a significant year. One hundred years ago William Henry Perkin discovered the first aniline dye (mauveine) and in doing so he became one of the founders of the great coal-tar dyeing industry. This year also, the Society of Chemical Industry celebrates its 75th anniversary.

To mark the occasion THE CHEMICAL AGE presents on the following pages a pictorial review of the chemical industry's development during the century. Firms and scientific bodies have contributed numerous original and interesting illustrations. To them THE CHEMICAL AGE expresses thanks for allowing this material to be published.

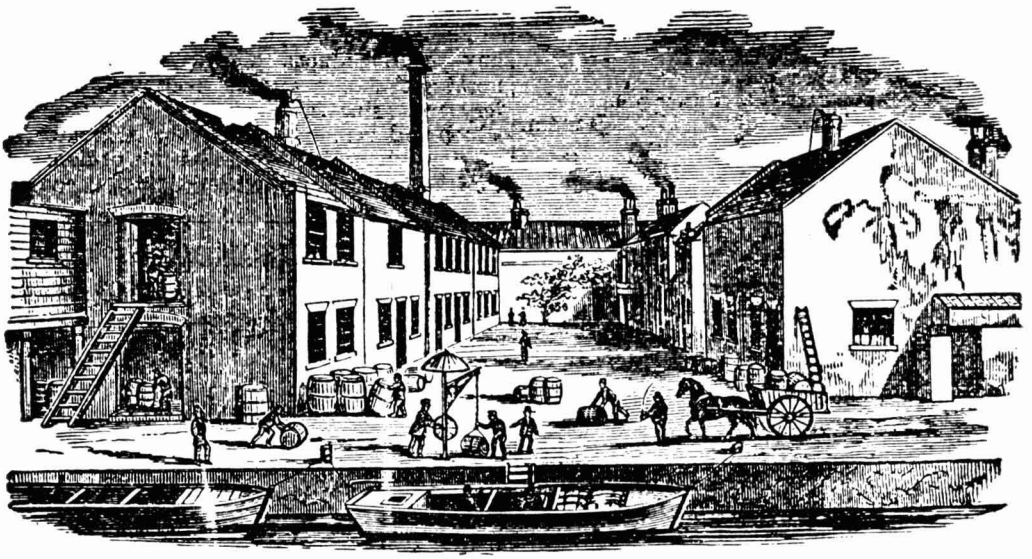
As Sir Alexander Fleck, chairman of ICI Ltd., states in his foreword to *The Life of Ludwig Mond*, the British chemical industry, like many others, has at its foundations the pioneer efforts of determined and imaginative men. Working with what must be regarded, by modern standards, as a primitive knowledge of chemical properties and reactions and very imperfect chemical plant and equipment, they established the basic branches of the new and expanding industry.

How imperfect was the plant used by the pioneers is clearly shown in the following pages. The marvel is that they should have been so successful. But these men possessed sterling qualities of enterprise and industry.

Perkin (whose portrait by A. S. Cope was painted in 1906 and is here reproduced by permission of the National Portrait Gallery) made his discovery when he was 18. He was working in a laboratory which he had fitted up in his own home in London. Then, with the help of his father and brother, he established a factory at Greenford Green, Middlesex, to manufacture aniline. In 1873 he disposed of the concern, thenceforth devoting himself to pure chemical research.

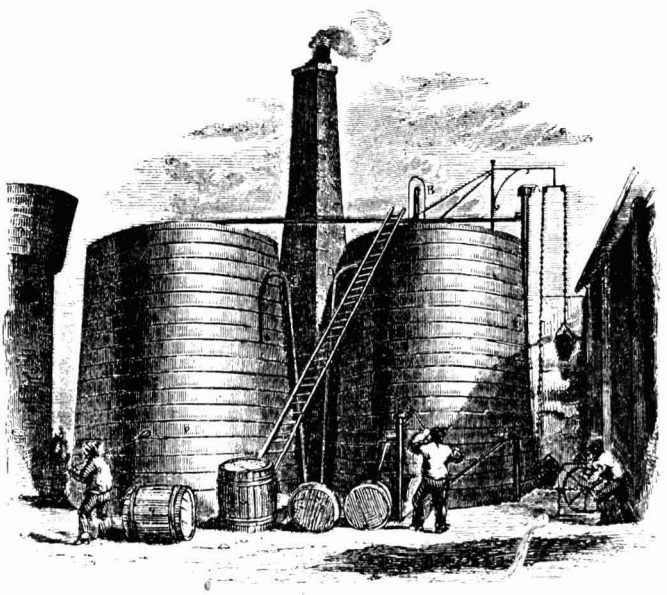
Unlike some pioneers, Perkin received recognition for his services during his lifetime. He was knighted and also honoured by universities and scientific bodies at home and abroad. He was elected president of both the Chemical Society (1883-1885) and the Society of Chemical Industry (1884-1885), and was a founder member of the present Royal Institute of Chemistry. Perkin died at Sudbury at the age of 69.

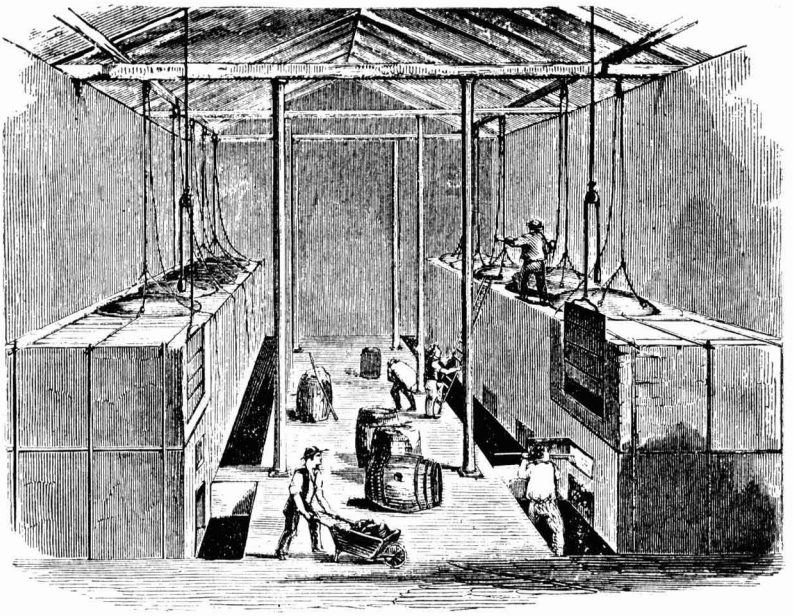
Perkin's three sons all distinguished themselves in the same department of science as their father.



ABOVE: This view of the Battersea Mills of Morgan Brothers (now Morgan Crucible Co. Ltd.) is taken from an early price list issued by the company which this year celebrates its centenary. The primitive type of crane used on the quay-side, which can be seen lifting barrels out of the river barges moored alongside, is worthy of note. The original of this picture has the address 'Battersea Mills, Surrey, SW.' This was, of course, before the formation of the London County Council in 1889. A century ago the county of Surrey, a large part of which is now absorbed in London, extended as far as the Thames

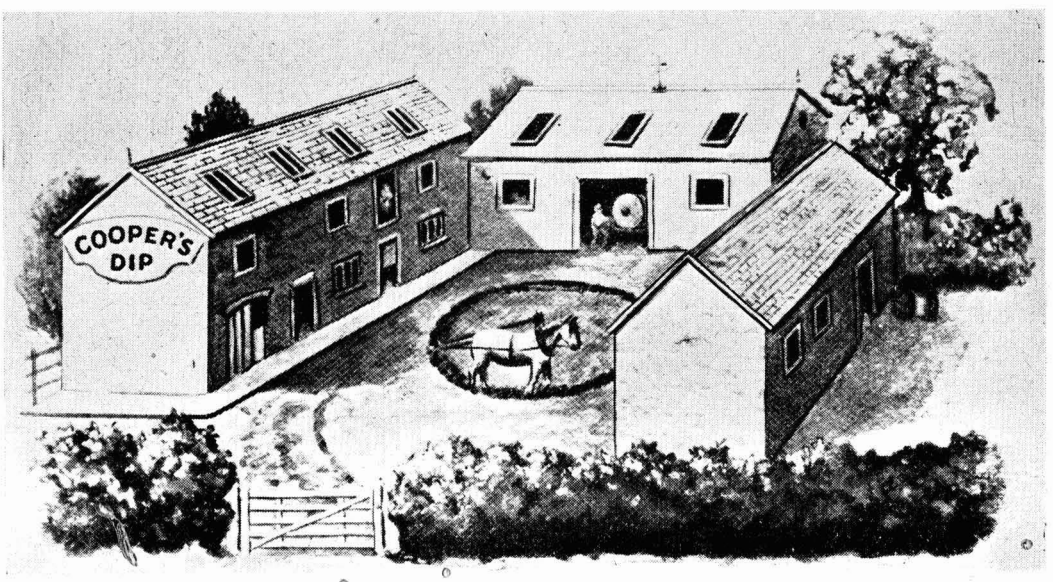
RIGHT: An interesting print, dated 1844, showing two large tuns which formed part of the gas works at the factory of Kurtz, Cropper & Co., of Liverpool. Each tun was capable of holding 14 to 18 thousand gallons of crude gas liquor which, by means of a pump (connected with reservoirs) was raised into the tuns. After a considerable quantity had been pumped, strong hydrochloric acid was introduced with the aid of a pulley, or crane, and gutta percha carboys, as shown in the engraving

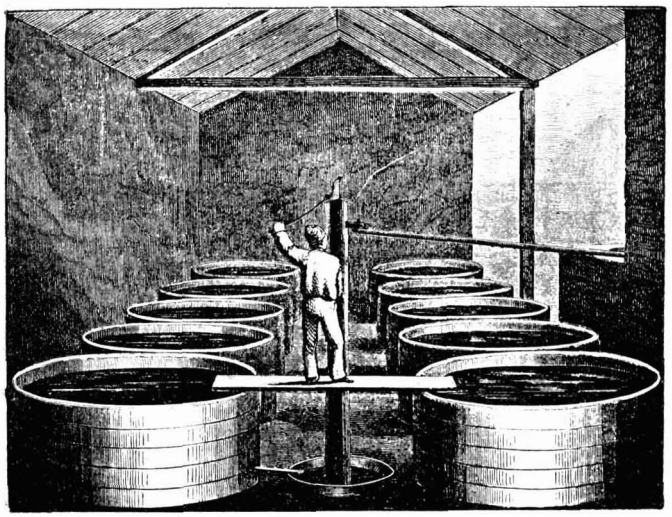




RIGHT: Another view at the works of Kurtz, Cropper & Co., of Liverpool (1844), showing the sublimers and drying furnaces used to get rid of the impurities that existed in ammonium chloride after its first crystallization. Regulation of heat was an important factor in this process

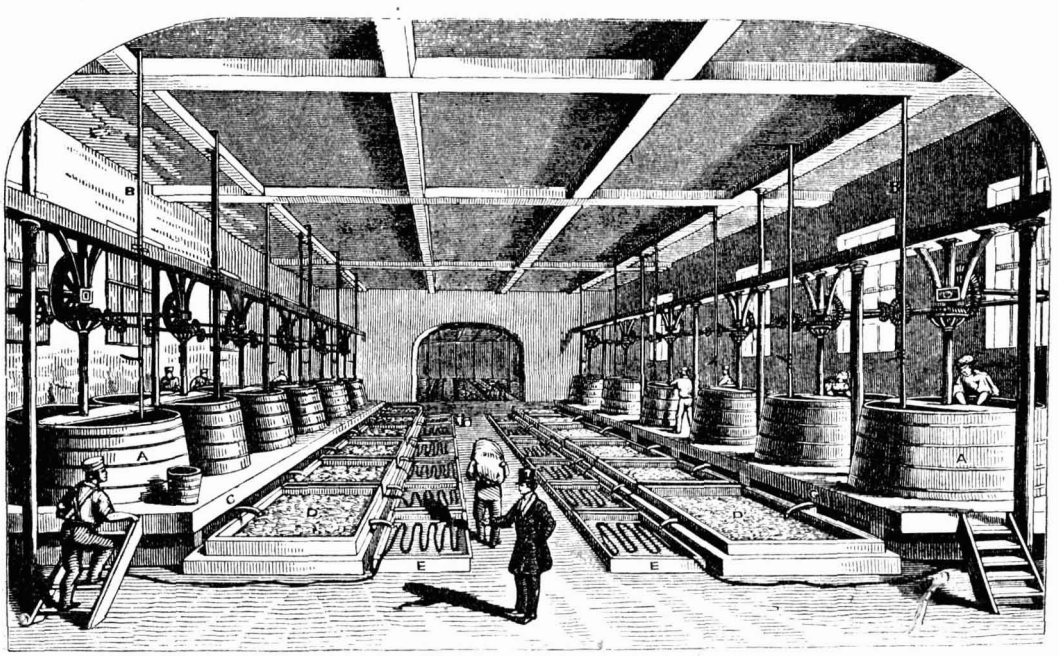
BELOW: The original factory for Cooper's sheep dipping powder, in Raven's Lane, Berkhamsted, in 1852. William Cooper, at one time a veterinary surgeon, was the inventor of the dip which in the first instance was made for his clients. However, its reputation spread rapidly and led to the erection of a factory. First recorded sales for Cooper's dip which survive were for 884 dozen packets in 1856. By 1880, over 30,000 dozen packets were being sold annually, and the dip had spread to all the great sheep-raising countries of the world. Site of the factory shown here is now occupied by offices only

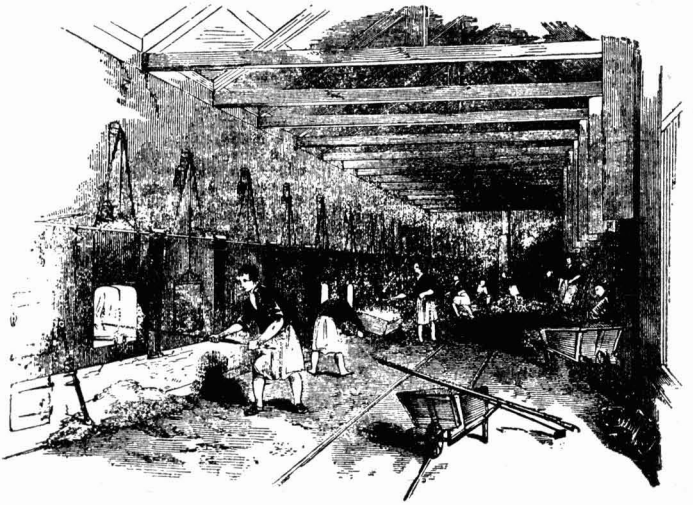




LEFT: Here are shown tubs used in 1844 for crystallizing ammonium chloride. A contemporary account of the process states that the salt crystallized out in four to six days, according to the state of the weather. Note the precarious position which the workman occupies. Would the present day factory inspectors allow this?

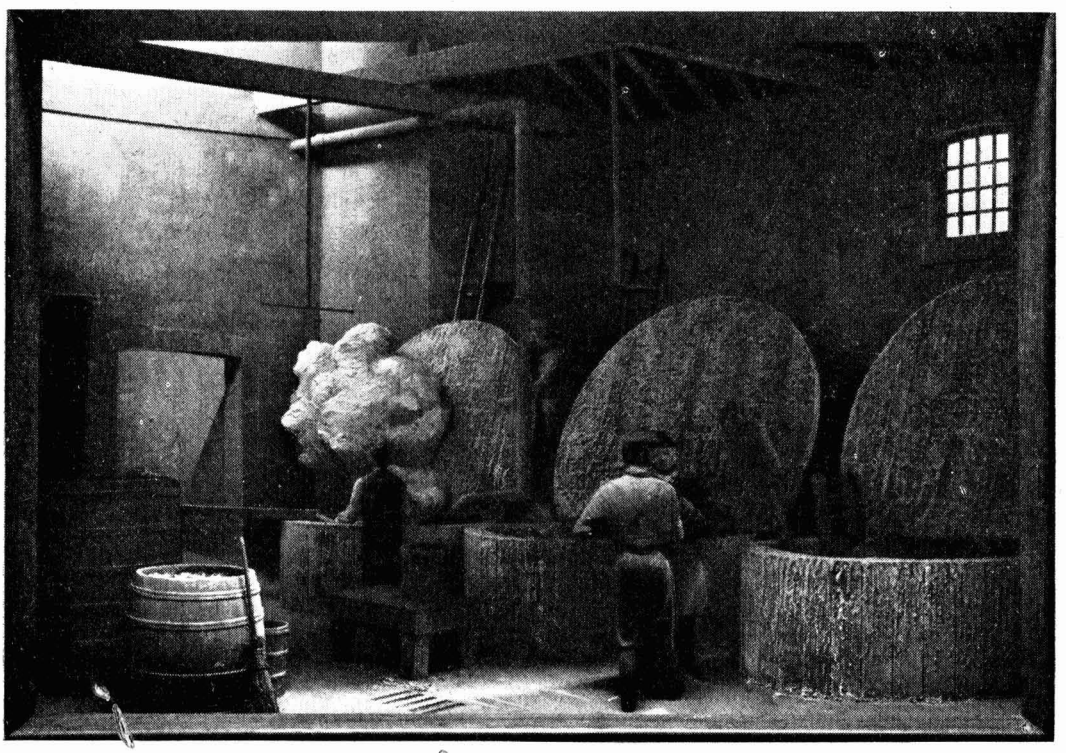
BELOW: The engraving is of a mid-19th century scene at the factory of Firmin & Son, of London and Newton-le-Willows, Lancashire. In this department workers are seen busy with the production of citric and tartaric acids, the processes of which were similar in every respect. The juice to be operated upon was conducted into the decomposing tuns (mounted on platforms) by tubular pillars provided with stopcocks. The pillars communicated with cisterns in the apartment above, into which the contents of casks were emptied. When the tuns were sufficiently filled, decomposition of the juice was effected with a sufficient quantity of well-ground carbonate of lime. The agitators were kept in constant motion by the machinery above the tun, worked by steam power





RIGHT: A row of balling-furnaces at the Felling Chemical Works, near Newcastle (as they existed in 1844) for the conversion of sulphate of soda into ball-soda. At one stage of the process, a low four-wheeled iron carriage, bearing a shallow tray, was wheeled to the front of the furnace. The workmen then drew off the semi-fluid mass into the tray by means of a rake. Shortly after the mass had been removed, innumerable little jets of flame burst out at its surface

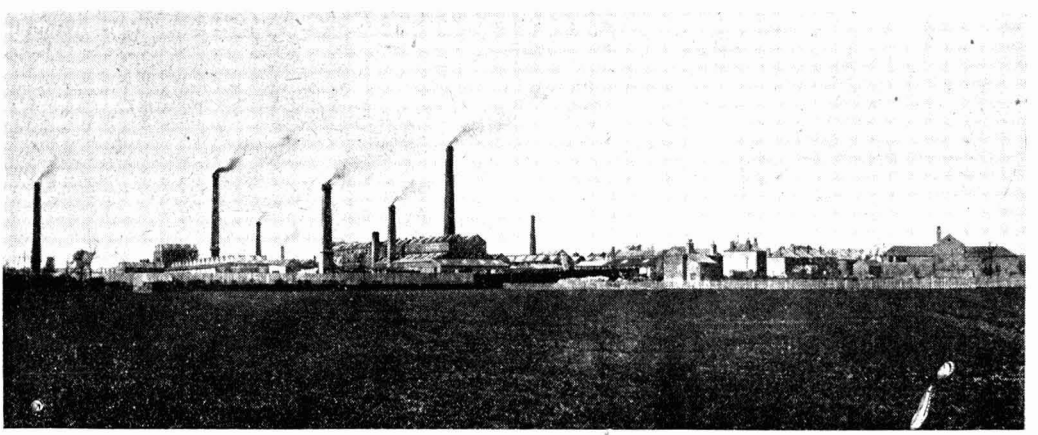
BELOW: The illustration concerns manufacture of soap in 1840. It shows how oils or fats were boiled with caustic soda in deep open-top buts, or pans, known as 'kettles,' to form soap and glycerine. Hot oil or molten fat is being delivered through a duct to a tub near the centre. Alkali is added from large storage tanks on the floor below. The tubs are 20 feet deep below the floor. (By courtesy of the Director of the Science Museum, South Kensington)



LEFT: Original Chesterton Road works of the Cambridge Instrument Co. Ltd. at Cambridge as it was in 1895. These premises were specially designed by Horace Darwin, youngest son of the famous biologist, who, together with A. G. Dew-Smith, founded the company in 1881. This first workshop still exists as the nucleus of the present factory which is now greatly extended on the same site

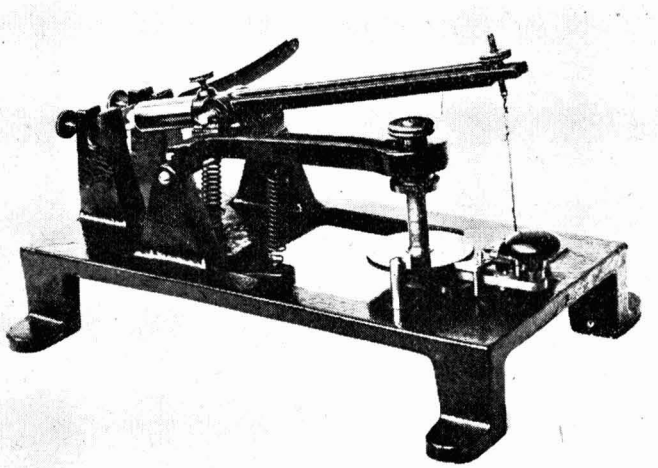
RIGHT: A 19th century view of the interior of the workshop built by the Cambridge Instrument Co. Ltd. in Chesterton Road. The factory was exceptionally well-lighted and laid out. It had many novel features which afterwards became common practice in other industrial undertakings

BELOW: This picture of Perkin's factory at Greenford Green, was taken in 1873—fifteen years after its erection. (By courtesy of the Director, Science Museum, South Kensington)

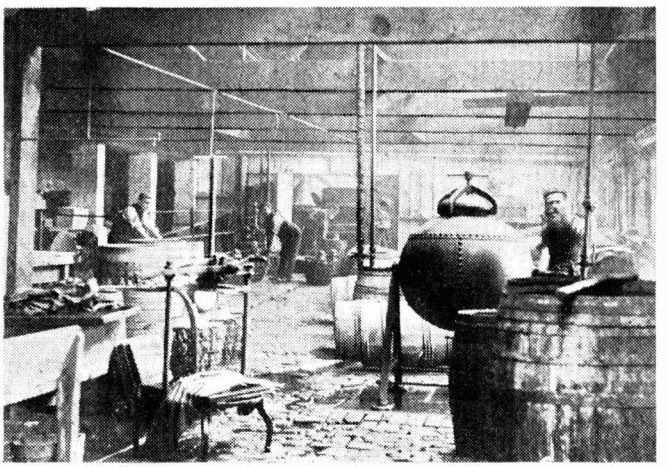


RIGHT: A family of chemical pioneers. The Monds in the eighties. They are (l to r) Robert, Alfred, Adolf Löwenthal, Mrs. Löwenthal, Frida Mond, Ludwig Mond. Ludwig, after first applying himself to various problems in the soda industry, perfected an alternative method of soda manufacture which is followed to this day. He built up the business of Brunner, Mond, the kernel of the present day ICI. In 1881, Mond was appointed one of four honorary secretaries of the newly-formed Society of Chemical Industry, which had begun as a club in Widnes

BELOW: A group of employees of Albright & Wilson Ltd., photographed in the early days of the firm. They are (l to r): G. Harris, W. Horton, C. Parkes, J. Jones, S. Smallwood, G. Guest, D. Bastable, W. Cutler and G. Ankers

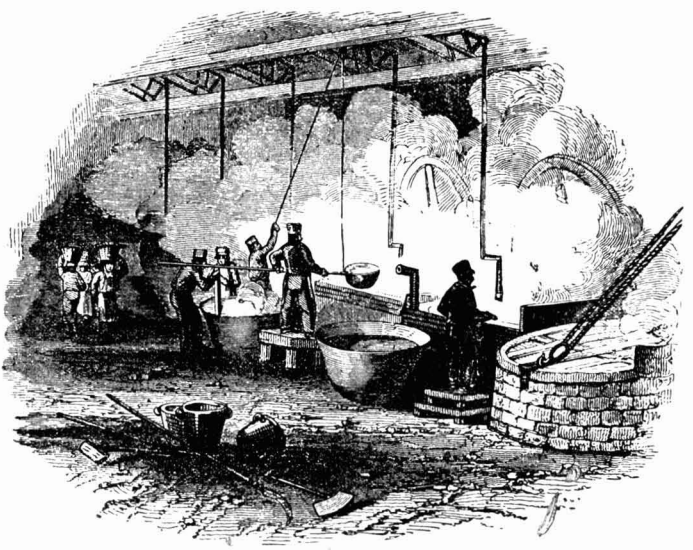


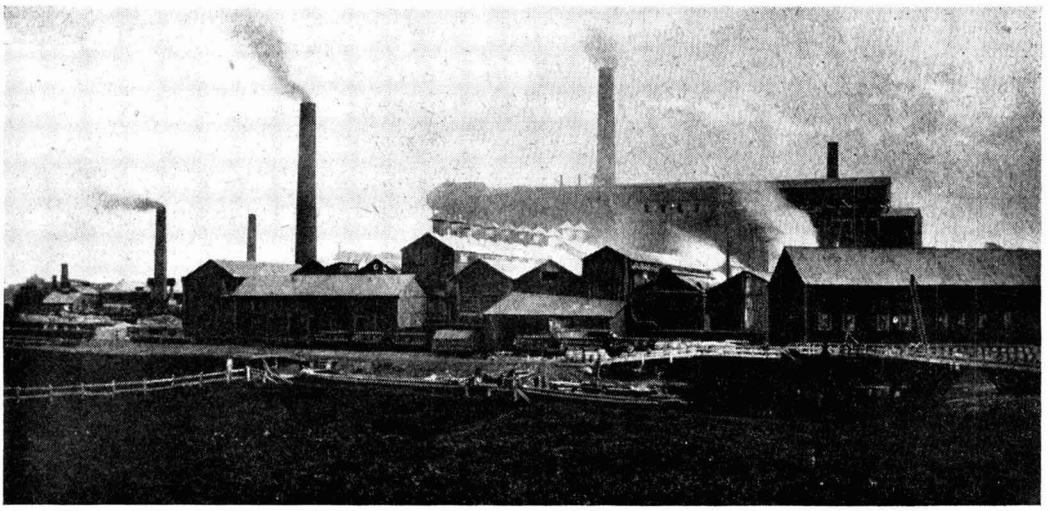
RIGHT: Perhaps one of the most interesting instruments designed by Horace Darwin after he had helped found the Cambridge Instrument Co. Ltd. was this Cambridge rocking microtome. Used for cutting biological specimens that would make a series of sections in ribbon form for microscopic examination, the microtome is still being used today, in fundamentally the same form as Darwin designed it 70 years ago



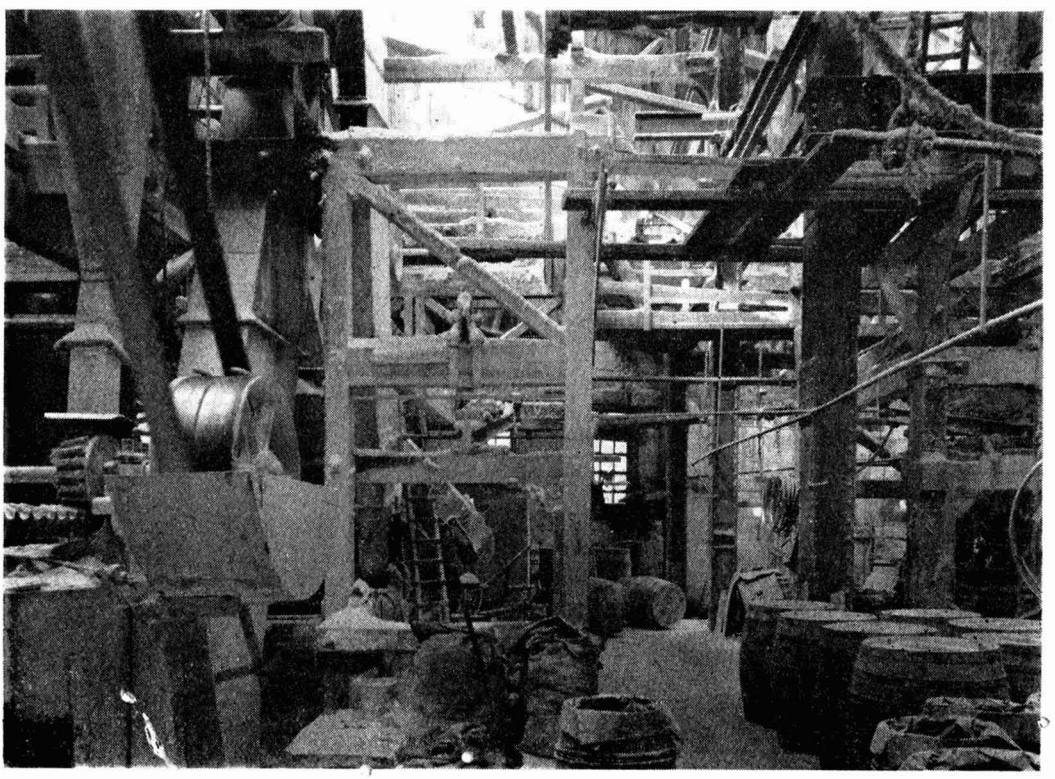
LEFT: This picture was taken in the works of Joseph Storey & Co. Ltd., at Lancaster, between 1900 and 1905. The spherical vessel in the illustration was used for extracting dyes from cochineal bugs or dyewoods. Joseph Storey founded the company in 1869 to manufacture such products as sizes, picric acid, coal tar products, pigments and driers

RIGHT: One of the stages in the process of making soap in 1860 is depicted in this engraving. In the right-hand corner can be seen one of the tubs into which the molten fat was delivered through a duct. Alkali was added from barrels to which it was pumped from storage tanks on the floor below. Between 1634 and 1853 heavy excise duties were levied through Government control of soap manufacture and the consequence of this was the provision of hinged and padlocked lids on the tubs. It will be observed that the tub shown is still equipped with one of these padlocked lids

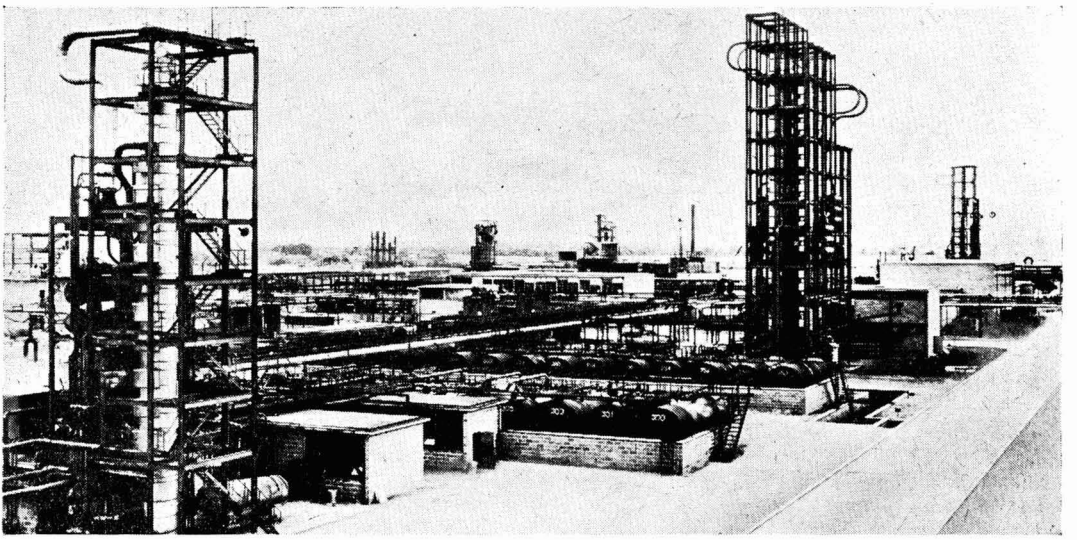




ABOVE: Winnington works of Brunner, Mond (now ICI Ltd., Alkali Division) in 1884, eleven years after its foundation. The first plant was in the second shed from the right. The canal, with barges, is in the foreground. BELOW: Part of the ash-shed at the Winnington works 60 years ago. The factory was established in 1873 on property purchased from Lord Stanley of Alderley. Winnington Hall, used as a residence and offices, was a timbered structure of Tudor date which had been stucco-faced in the early nineteenth century



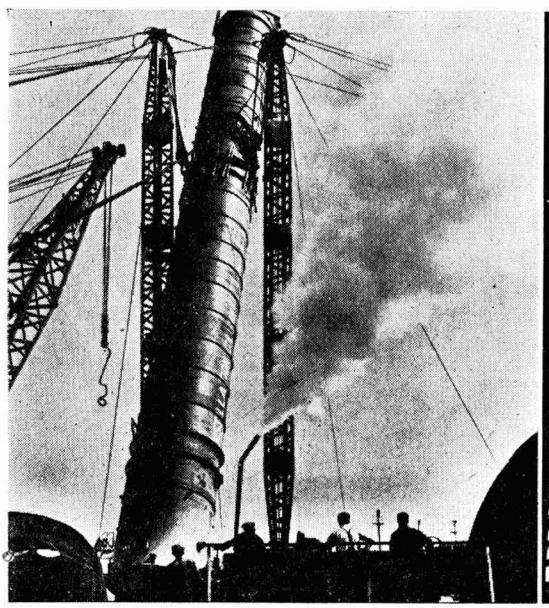
Chemical Industry in 1956

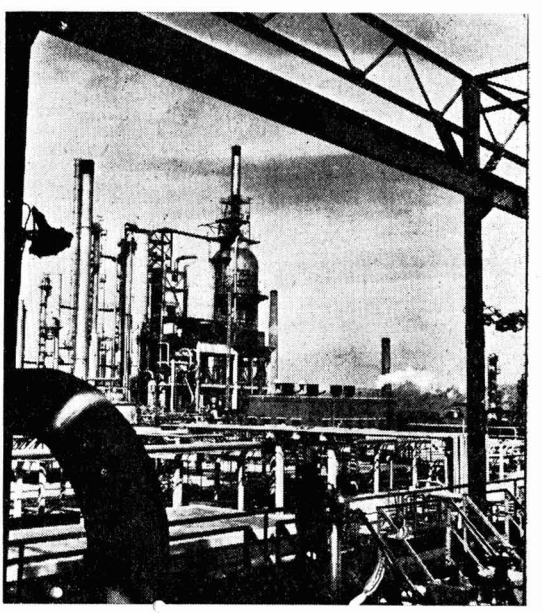


ABOVE: General view of part of the Petrochemicals plant at Urmston, Manchester, showing (left) primary distillation unit, and (right) the re-run and azeotropic distillation unit

BELOW LEFT: An 85 ton, 140-foot distillation column being put up at Grangemouth, Scotland, during expansion programme of Forth Chemicals

BELOW RIGHT: Part of the vast catalytic cracking plant at British Petroleum's Llandarcy refinery where annual capacity has now been increased by expansion to over four million tons





British Heavy Chemicals

Quantitative Survey of 18th & 19th Centuries

THE first attempt to deal with the origins of the heavy chemical industry on a quantitative basis and to explain the delay in the appearance of large scale Leblanc soda manufacture in Great Britain, has been made in a paper originally published in *Economica* and which has now been reprinted in booklet form. The paper was written by T. C. Marker, R. Dickinson and D. W. F. Hardie.

The authors state that their task of endeavouring to draw a quantitative picture of the transition from natural to synthetic alkali was prompted by a desire to check the recitation of the traditional over-simplified account which, they felt, had given distorting over-emphasis to the role of kelp and the Salt Tax.

Role of Kelp

Among the results of their novel approach to the problem, the authors have been able to show the comparatively insignificant role of kelp in supplying the alkali requirements of Britain before the days of alkali synthesis. For example, table three in the publication shows that, at the most, the 100 per cent sodium carbonate equivalent of kelp never exceeded 1,200 tons per year. Thus, the seasonal labour of some 36,000 peasants in the Scottish Highlands and Islands achieved a chemical result equal to that of, say, several dozen workers in a Leblanc alkali factory. Surely, comments Dr. Hardie, this must be one of the most remarkable examples of relative productivity in technological history! The dominant position of potash in the natural alkali economy of the 18th and early 19th centuries is also demonstrated by the three co-authors.

The booklet begins by tracing the origin of the heavy chemical industry, in its modern sense, back to the linking together of the manufacture of sulphuric acid and the synthesis of soda alkali from common salt. The industry, it is contended, primarily depended upon developments in the manufacture of textiles, hard soap and glass—the three main consumers of alkali. As production in these industries gathered momentum, the natural sources of alkali (namely, barilla, kelp and potash) became in short supply.

Previous attempts to explain the long interval between the publication in France of the Leblanc process and its large scale operation in Britain 30 years later had attributed (the paper continues) this remarkable time-lag to the deterring effects of the salt duty. But such an explanation overlooked the rebates of customs duties which were usually granted upon raw materials used by a growing industry. The increase in the demand for soda rose almost entirely from the cotton textile and hard soap industries, and it was of interest to consider to what extent supplies of natural soda were increased to meet the growing demand. Of the two soda alkalis, barilla and kelp, the former was obtained by burning certain plants of the goosefelt family grown overseas. It was a very impure product, usually containing only between 30 and 35 per cent by weight of sodium carbonate. Kelp was the product of burning dried seaweeds and the soda content ranged between a mere five and ten per cent. However, it was able to compete with the richer barilla because, as a native product, it paid no duty. By comparing the soda requirements with the supplies available from kelp and barilla, it would be seen that long before 1823, the year in which the Leblanc process was introduced into Britain on a substantial scale, supplies of soda from natural sources were being greatly augmented.

Demand for Potash

Potash (potassium carbonate) was derived from wood ashes and the process of manufacture was extremely wasteful of natural resources. By the 18th century Britain's resources of wood were such that little could be spared for potash manufacture at home and the needs of the growing textile industry had to be met by imports. The textile needs of other European countries were also growing and the price of potash rose. In 1751 Parliament removed all import duties upon colonial potash and this, together with the rising demand, led to an expanding export from North America. Even certain

restrictions brought about by the War of Independence did not prevent the potash manufacturers of North America from gaining by far the larger share of the British market. War inevitably distorted the pattern of supply of the natural alkalis, caused their prices to rise, and encouraged inventors to contemplate new methods of producing soda. It was also the case in the times of the Revolutionary and Napoleonic Wars.

Prize for Producing Soda

In 1776 the French Académie des Sciences, hoping to lessen the Marseilles soap industry's dependence upon Spanish barilla, offered a substantial prize for a successful method of producing soda from common salt. Among the processes put forward was that of Nicholas Leblanc, then surgeon to the Duc d'Orleans. Fifteen years later (in September 1791), after a thorough investigation, Leblanc was granted a patent. But in February 1794, as a result of the Revolution, the patent was suspended by the Committee of Public Safety and, four months later, a report was published giving full details of all the processes in use for the extraction of soda from common salt. Leblanc's was included in the report, thus revealing what had previously been a closely guarded secret. It was singled out for special commendation and every detail of the plant was recorded. More help to any intending manufacturer could hardly have been given, yet there is no evidence that it was used on any large scale in France for more than ten years after the appearance of the report. When the patent was restored to the inventor in 1801, he was unable to develop it into a profitable concern and his career ended with his suicide in 1806. It was not until 1808, at Marseilles, that full-scale manufacture of Leblanc soda began.

Due to her transatlantic connection, Britain suffered no severe shortage of the two natural alkalis taken together. It was the rising soap industry at Liverpool which first used Leblanc soda and provided the manufacturing chemist with the kind of mass market so essential to the profitable operation of the new process. Then came the time when the appearance of a resourceful industrialist was needed to provide the Merseyside soapboilers with a synthetic soda that would enable them to continue increasing their business—despite the advantage gained by London competitors in the form of the halving of the barilla duties. James Muspratt proved to be the much sought for industrialist. Muspratt's innovation was not in the process but in the scale on which he operated it from the outset. Instead of making the refined and stronger soda ash in small amounts, Muspratt initially manufactured the cruder, less concentrated and foul-smelling black ash. He was able to market this unpleasant and unstable product at a price which caused the soapboilers to abandon their use of natural alkali and such small-scale double decomposition alkali-producing processes as could be carried out on their own premises.

The growing demand for Leblanc alkali soon called other chemical factories into existence. By 1830 Muspratt, and possibly other alkali makers, were turning to the manufacture of the stronger white ash. This purer form of synthetic soda allowed palm oil to be used in soap production in place of the more expensive animal fats, and soon gained for Merseyside the greater share of the British export trade in soap, as well as a large proportion of the sales at home.

From Thames to Mersey

Growth of large soapmaking enterprises on the Mersey in competition with the former traditional home of the industry on the Thames, the reduction of the barilla duty, the abolition of the salt tax and a propitious economic climate, were all factors which favoured James Muspratt and his immediate followers in the field of Leblanc alkali manufacture. And, given these favourable circumstances (the paper concludes), much was due to Muspratt's own ingenuity and enterprise.

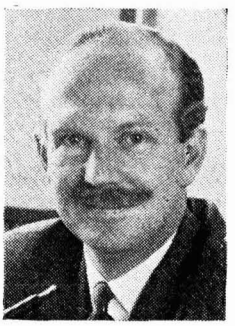
Dyeing Acrilan-Wool Blends

New methods for the dyeing of Acrilan acrylic fibre-wool blends were discussed by Walter H. Hindle, of The Chemstrand Corp., at the Fifth Biannual Textile Seminar of the Textile Technical Federation of Canada. He explained that acid pre-treatment followed by rinsing and dyeing in the presence of a non-ionic dispersant increased the dyeing rate of the wool sufficiently to bring it into line with the Acrilan fibre.

PERSONAL

DR. T. KENNEDY, M.Sc., Ph.D., has been appointed personal assistant to MR. A. C. H. CAIRNS chemical sales director of Joseph Crosfield & Sons Ltd. Dr. Kennedy's former post as manager of Crosfield's technical service department has been taken by MR. J. G. WALKER, ASSOC.M.C.T., F.R.I.C., A.M.I.CHEM.E.

Dr. T. Kennedy



Mr. J. G. Walker

SIR WILLIAM COCKER, O.B.E., M.A., J.P., managing director of Cocker Chemical Co. Ltd., is to receive the honorary degree of Doctor of Laws at University College, Dublin. Sir William is the third member of his family to receive a doctorial degree at this university. His son, DR. ERIC COCKER, holds the degree of Doctor of Philosophy, and a kinsman, PROFESSOR WESLEY COCKER, M.Sc., Ph.D., M.A., Sc.D., F.R.I.C., F.I.C.I., university professor of chemistry, Trinity College, Dublin, is a Doctor of Science at University College.

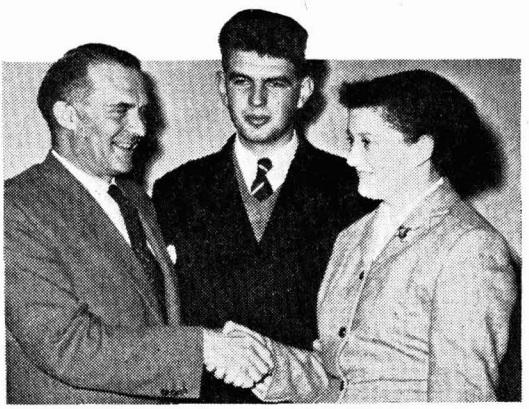
In order to reduce his business activities, MR. G. R. T. TAYLOR has retired as chairman of Pinchin Johnson & Associates, paint and finish manufacturers. Mr. Taylor, who will be 80 next month, has been a director of the company for over 10 years and chairman for the past six years.

MR. E. A. O'NEAL, JR., chairman of Monsanto Chemicals Ltd. since 1949, resigned from that office at the company's annual general meeting on 19 June. SIR MILES THOMAS, D.F.C., who was appointed to the board in March and, as previously announced, had accepted its invitation to succeed Mr. O'Neal, has now assumed full responsibilities as chairman of the company. Mr. O'Neal remains a director. MR. MARSHALL E. YOUNG, a vice-president of Monsanto Chemical Co., has been elected a director of Monsanto Chemicals Ltd.

PROFESSOR M. STACEY, professor of chemistry at Birmingham University and a member of the Governing body of Adam's Grammar School, Newport, Salop, is to open an exhibition of the activities and history of the school which celebrates its 300th birthday at the end of July. Professor Stacey is an old boy of the school. He succeeds Professor H. W. Melville at the end of the present academic year as Mason Professor of Chemistry at Birmingham.

DR. WILLIAM L. EVERS has been appointed assistant manager of fibre research of Celanese Corporation of America. In this capacity, his primary responsibility will be for fibre polymer research in the company's Summit, NJ, research laboratories.

CAPTAIN SURREY D. BUMSTEAD has been appointed commodore to the BP Tanker Co.'s fleet—the shipping organization of the British Petroleum Group—from 1 July.



Mr. E. E. Stimson a member of the Industrial Association of Wales & Monmouthshire education committee, congratulates Miss Sheila A. Hughes, who is the first woman student to receive an Association prize award in chemistry. As reported in THE CHEMICAL AGE of 9 June, Miss Hughes is a research worker at Monsanto Chemicals Ltd., Ruabon. She lives at Oswestry, Salop.

Glasgow RTC Developments

A CHAIR of Chemical Engineering has been created at the Royal Technical College at Glasgow. Chemical engineering has hitherto been taught in the Department of Civil & Mechanical Engineering, with an associate professor, Dr. A. W. Scott, in charge. Dr. Scott, who has been on the college staff since 1925, has been appointed to the new chair.

As many of the subjects, such as applied mechanics and applied thermodynamics, are common to both mechanical engineering and chemical engineering courses, the Chair of Chemical Engineering is one of three chairs in a composite department of mechanical, civil and chemical engineering.

A Department of Food Science has been established at the college under a principal lecturer, Dr. J. Hawthorn. It is intended to raise this department to professorial status in a few years.

Obituary

MR. JOHN ROBIN ALLEN, of Gorstage House, Weaverham, who was manager of Lostock ICI works for 21 years and who recently moved to London as schools liaison officer for the company, died suddenly while on holiday at Sidmouth on 16 June. In his new position, Mr. Allen was responsible for informing school-leavers of careers open at ICI and of further education activities available. After attending school at Liverpool and studying engineering at Cambridge University, he became a fighter pilot in the Royal Naval Air Service during the first World War.

MR. ROBERT SLIMMON, who was connected with the chemical industry for over 70 years, died on 15 June after a short illness, aged 86. For the past 25 years, Mr. Slimmon had been operating his business from the offices of Price, Stutfield & Co. Ltd., London EC3, and from his home address at Lewisham.

MR. HERMAN A. VOSS, managing director of International Minerals & Chemicals Ltd. and of The Anglo-French Phosphate Co. Ltd., died on 20 June. Mr. Voss was also the representative in this country of the Phosphate Acidulating Corporation of New York, promoting sales of the Broadfield superphosphate unit in all parts of the world outside the US.

Chemical Fellowships

A FELLOWSHIP worth £A1,000 is offered in chemical engineering by the British Memorial Fund, established in Victoria, Australia, by public subscription. It provides for 10 months study in Victoria and covers travelling and living expenses.

The fellowship is open to workers in any aspect of chemical engineering research or chemical engineering education.

General direction of research work will be the responsibility of ICI (Australia & New Zealand) Ltd.

Details can be obtained from Col. the Hon. W. W. Leggatt, Agent-General for Victoria and chairman of the British Memorial Fund, London Selection Committee, Victoria House, Melbourne Place, Strand, London WC2. Closing date for applications is 15 September.

Chemstrand Ltd.

In THE CHEMICAL AGE of 23 June reference was made to Chelmsford Ltd. This should, of course, have read Chemstrand Ltd., a wholly-owned subsidiary of the Chemstrand Corporation, US.

Textile Institute's Conference

The 42nd annual conference of the Textile Institute is to be held at Bournemouth from 21 to 24 May 1957.

Wills

MR. HORATIO BALLANTYNE, F.R.I.C., F.C.S., of Copt Hill Court, Burgh Heath, Tadworth, Surrey, former director of Unilever Ltd., and vice-president of the Royal Institute of Chemistry, who died on 25 January last, aged 84 years, left £169,636 2s 9d gross, £165,768 14s 9d net value (duty paid £91,403).

MR. QUENILUS CLAUDE RUSSELL, chemical broker, principal of Bryce & Rumpff, Glasgow, who died on 16 February, left personal estate in England and Scotland valued at £18,373.

MR. STANLEY GRAY WALKER, of White Acre, Oxshott Way, Cobham, Surrey, and Colour House, Manorgate Road, Kingston-on-Thames, Surrey, chemical and colour merchant and agent, founder of Stanley G. Walker & Co. Ltd., who died on 10 March last, left £54,763 5s 6d gross, £54.517 10s 11d net value (duty paid £16,509).

Trends in Polarographic Analysis

This is an abbreviation of the lecture given by Dr. J. Heyrovsky, of the Central Institute of Polarography, Prague, before the Midlands section of the Society for Analytical Chemistry at the University of Birmingham, on 25 November last. Acknowledgment for permission to publish Dr. Heyrovsky's lecture is made to the Society.

ALTHOUGH polarography is a modern branch of science, the first paper having appeared only some 30 years ago, distinguishing trends can be pointed out, in which pioneering work is being started, or which differ from the classical methods and apparatus.

As far as the dropping mercury electrode is concerned, tapping devices are used nowadays to control the drop-time independently of the height of the mercury reservoir. This is applied in theoretical work (in hydrogen overvoltage, in the phenomena of maxima), or in analysis, when twin electrodes are operating.

The first method of obtaining derivative curves, di/dt, was based on applying a small difference of potential (10 mV) to synchronously dropping twin electrodes. Later on another method was introduced by Vogel and Riha (1) (before Leveque and Roth (2)). Although the derivative method denotes both quality and quantity by a single point (of the maximum due to inflexion of the wave), it is not so much used as it deserves. The derivative di/dE may be also obtained through electromagnetic induction if the galvanometer contains two moving coils; when the electrolytic current is passed through one coil, its derivative di/dt is induced in the other. If the applied voltage increases linearly with time, we have $di/dt = k\ di/dE$. Of course, any induction coil may be used to obtain di/dt also. Through the derivative curve, components of close depolarization potentials may be resolved.

Barker 'Square-wave'

Polarography has reached its highest sensitivity in the Barker 'square-wave' polarograph (3), in which the capacity current is entirely eliminated. This largest instrument records curves with a pen and reveals traces of some cations down to 10^{-8}M in a great excess of nobler constituents, e.g. copper or trivalent iron.

There is a tendency in modern polarography to combine the results of chromatography, which is most suitable for qualitative separation, with quantitative polarographic estimation. Lewis and Griffiths (4) determined inorganic compounds by 'paper strip separation' and subsequent solution of a suitable region of the paper for polarographic analysis. This method is promising wide application in microanalytical work. Kemula (5) in Warsaw pursues what he calls 'chromatopolarography'. In his apparatus he combines a chromatographic column with a polarographic cell. The solution to be analysed is poured on to the column and is either eluted by different solvents, or run through the column and cell repeatedly until all components are washed out into the polarographic vessel and there determined.

Non-Aqueous Solvents

There is frequent use of non-aqueous solvents. Sulphuric acid which, even if very concentrated, is indifferent to mercury, has been used by Vlcek (6) in 92 per cent concentration for the determination of SO_2, Cd^{2+}, Ti^{+}; Bergmann and James (7) have investigated the reduction of nitrate in 98.65 per cent sulphuric acid. According to Harrison and Harvey (8) glacial acetic acid with ammonium acetate is suitable for the determination of elementary sulphur, e.g. in petroleum fractions. Alcohols are used more often than acetic acid, e.g. methyl, ethyl, butyl alcohol, or dioxan (75 per cent) with water. In the latter solvent, if quaternary amines are used as electrolytes, the cathodic potential may be extended to almost -3.0V. In the region between -2 and -3V. many conjugated acids and unsaturated hydrocarbons are depolarizers, e.g. benzoic acid, salicylic acid, styrene, naphthalene, anthracene, pyrene.

In recent years there is an increased demand for continuous-service automatic indicators in the control of the concentrations of components in industrial reactors. The indicating electrodes (mostly the dropping mercury ones) and the reference electrodes have to be adapted for continuous service. According to Novak (9) the best electrode is a platinum one dipped into an acidic ferro-ferri-sulphate solution, which

is slowly renewed. In the solution to be controlled either the dropping mercury electrode is immersed, if say CN^- or Ti^{3+} is to be determined, or a stable mercury pool electrode for the estimation of oxygen or mercury ions. The concentration is determined at a constant potential. The dropping mercury electrode may also serve as reference.

The technical development of cathode-ray oscillographs gave to polarography a new direction. Their sensitivity has risen, by suitable amplification, to that of the galvanometers used in polarography. Also very convenient for polarography is the fact that the usual rectangular co-ordinate system of polarograms is shown on the fluorescent screen.

20 Years Ago

The oscillographs some 20 years ago were able to amplify only quickly oscillating voltages or currents. Therefore the alternating voltage of the net had to be applied to the dropping mercury electrode and 30 to 60 ever expanding curves were shown in a second. Here a difficulty has arisen due to the charging current; in ordinary polarography it is negligibly small against the usually recorded electrolytic currents (10^{-7} A), but in oscillography, if the dropping electrode is being charged in 1/100 of a second to 2 V, the charging current is about 60μA, becoming greater than the electrolytic current, and they become indistinguishable. Hence, this direction of Matheson and Nichols (**10**) was soon abandoned and the rate of charging the dropping electrode was slowed down to raise the voltage on one drop by one volt in three seconds.

In the so-called 'cathode-ray polarograph' of Randles and Airey (**11**) the drop-times are longer than eight seconds; during the first five seconds, when a certain e.m.f. is put on, the current is not shown as it consists mainly of the charging current and the electrolytic current due to the deposition of depolarizers of more positive potential. In the sixth second the e.m.f. slowly begins to increase (0.6 V in 2 seconds), and the current-voltage curve appears in the form of a peak. If the e.m.f. is reversed with the same drop, an anodic peak is produced, usually with a shift to positive potentials and irreversibility.

To avoid the large charging currents in oscillography, the present author (**12**) started in another way, *viz.* to record potential-time curves. The alternating current is used from the mains, 120-220V and 50 cycles frequency. Through a large, variable resistance it is regulated to let about 1 mA pass through the dropping mercury cell. Thereby the mercury drop gets polarized from say +1V to −1V from the electrode potential of mercury. To avoid extreme positive values to be imparted to mercury, an external, constant voltage is superimposed on the cell, so that the potential of the mercury drop changes from 0 to −2V.

As soon as a trace of depolarizer is present, e.g. 0.001N Pb^{2+}, time lags during depolarization cause kinks in the primitive potential-time curve (synchronized to a 50 cycles per second time-base) obtained with the pure basic electrolyte (N KCl, KOH, K_2SO_4, M_2SO_4, acetate buffer, etc.). By letting the time-base run more quickly (150,000 cycles per second, i.e. 3,000 times per single period), the kinks are extended to lines of an oscillographic spectra.

To make the method more sensitive, we have to apply the derivative curve dV/dt against time. The current i_c passing through a small resistance in the derivative link is given as $i_c = dV/dt$, and since C is a constant the ordinate gives dV/dt. So the derivative curve dV/dt against time is attained, in which at the same moment of the cycle the sum of the charging current and the electrolytic current is $i_c + i_e = K$ (constant amplitude and frequency). If $i_e = 0$, we have a regular $dV/dt - t$ curve, but as soon as i_e grows, i_c has to diminish. Thus any lowering of i_c in the oscillogram means an increase in the electrolytic current which is noticeable through a cut-in. The area of this cut-in records the coulombs consumed during electrolysis and measures the quantity of the depolarizer.

Position of the Cut-in

In the oscilloscopic diagram of dV/dt against potential, the ordinates of the cut-in show the electrolytic current, and the position of the cut-in on the abscissa denotes the depolarization potential, which is near to the polarographic half-wave value. Thus a complete qualitative and quantitative analysis avails itself.

The oscillograms of the derivative function shrink during the drop time as the capacity of the drop increases. Photographs therefore should be taken at an exact time interval of the growth of the drop. If the

luminescent screen has a longer afterglow, pictures may be obtained which are lit only after a certain interval of the drop so that a steady illuminated oscillogram is shown.

Another way to produce a stable oscillogram is to use the streaming (or jet) electrode. The figures obtained with this electrode are on the whole simpler, because of the quick streaming, which does not allow the same mercury surface to be longer in contact with the solution than for 0.01 second. Consequently the depolarization products are washed away before they can be electrolysed further and no consecutive or side reactions complicate the diagrams. Only the most simple electron transits are shown, particularly in organic depolarization, e.g. of *o*—, *m*—, and *p*-nitrobenzene, or sulphonamides. Atmospheric oxygen need not be removed from solution.

Derivative Character

Thanks to the derivative character of the oscillographic dV/dt—V curves, many isomers which in ordinary polarography are not resolvable may be distinguished, e.g. the acids related to nicotinic acid (picolinic, isonicotinic, dipicolinic) or nicotinic acid and its amide. The kinetics of changes due to photoactivity may be followed. Folic (pteroylglutamic) acid is distinguishable from vitamin B_2 (lactoflavin, riboflavin) and vitamin B_1 (aneurin).

Owing to the widely different conditions under which oscillograms with alternating current are obtained from ordinary polarography, there are new phenomena encountered, which deepen our knowledge. Thus there is the reversible deposition of zinc ions, which is oscillographically irreversible; on the other hand, the irrversible reduction of formaldehyde in polarography is quite reversible in oscillography. This oscillogram shows also the peculiar cut-in, in the form of an obtuse angle, indicating the kinetic character of formation of the depolarizer. Folic acid behaves polarographically irreversibly, which oscillographically is a reversible redox. Al^{3+} cations which form waves in polarography, are not shown oscillographically in ordinary electrolytes. Penicillin, which is not shown polarographically, gives a prominent cut-in on the oscillogram as soon as it begins to decompose.

Another phenomenon specific for oscillographic analysis is the formation of artefacts. The vapours of carbon disulphide give on the dV/dt—potential curve the cut-in of S^{2-} anions or of hydrogen sulphide distinctly. Evidently carbon disulphide is reduced at negative potentials above −1.5v to S^{2-} anions, which depolarize at a more positive potential (−0.6V) forming, anodically, mercuric sulphide which in its turn is cathodically reduced. The artefact here is the S^{2-} anion. If we adjust the direct voltage so that the applied potential does not reach −1.5V, the artefact is not formed and the sharp cut-in does not appear.

A surprise was the marked oscillographic depolarization effect caused by acetylene in strongly alkaline solution. Here the sharp cut-ins are formed by the reduction of a mercury acetylide which has to be formed at very positive potentials, at which mercury passes into solution. The cut-ins are entirely irreversible, as only the compound $HgC{\equiv}CHg$ can be reduced.

The variety of phenomena which are displayed at the streaming or dropping mercury electrode in oscillography with alternating current make it exceptionally suitable for analysis. There are many more depolarizers which may be followed oscillographically better than by ordinary polarography, so that for qualitative analysis this method means an enrichment. From the quantitative point of view, however, oscillography with alternating current is not so accurate and sensitive as polarography. One quantitative method hitherto applied (**13**) consists of measuring the depth of the cut-in by shifting a luminous horizontal axis on the oscillogram vertically until it coincides with the lowest point of the cut-in. This shift is produced by turning a potentiometer around a scale. According to a calibration curve, constructed by plotting the concentrations of the depolarizer against the scale divisions, the quantity is determined.

Comparative Method

A more exact way is the comparative method of Kalvoda and Macku (**14**) who compare the oscillogram of a solution containing an unknown concentration of a component with that of a known variable concentration until the cut-ins overlap. The two solutions have twin electrodes and their oscillograms are shown on the screen alternatively every 25th of a second. In these comparative titrations an accuracy of 2 to 3 per cent is attainable. To increase the sensitivity of the method attempts are made to deposit electrolytically on one mercury

drop traces of metals in solutions and to submit the drop to oscillographic analysis.

Although its sensitivity and accuracy cannot surpass that of polarography, oscillographic polarography with alternating current is much used, especially in pharmaceutical analysis, owing to the simplicity of preparing the solutions and the quickness of attaining the results.

REFERENCES

(1) Vogel, J., & Riha, J., *J. Chim. Phys.*, 1950, **47**, 5.
(2) Leveque, P., & Roth, F., *Ibid.*, 1949, **46**, 480.
(3) Barker, G. C., & Jenkins, I. L., *Analyst*, 1952, **77**, 685.
(4) Lewis, J. A., & Griffiths, J. M., *Ibid.*, 1951, **76**, 388.
(5) Kemula, W., *Roczn. Chem.*, 1952, **26**, 281.
(6) Vlcek, A. A., Sbornik Mezinarod. Polarog. Sjezdu Praze, 1st Congr., 1951, Pt. III, Proc., 373.
(7) Bergmann, I., & James, J. C., *Trans. Faraday Soc.*, 1954, **50**, 60.
(8) Harrison, S., & Harvey, D., *Analyst*, 1954, **79**, 640.
(9) Novak, J. V. A., *Coll. Czech. Chem. Comm.*, 1955, **20**, 1076.
(10) Matheson, L. A., & Nichols, N., *Trans. Electrochem. Soc.*, 1938, **73**, 15 pp. (preprint).
(11) Randles, J. E. B., *Analyst*, 1947, **72**, 301; Airey, L., *Ibid.*, 304.
(12) Heyrovsky, J., & Forejt, J., *Z. phys. Chem.*, 1943, **193**, 77.
(13) Kalvoda, R., *Coll. Czech. Chem. Comm.*, 1955, **20**, 1503.
(14) Kalvoda, R., & Macku, J., *Ibid.*, 8955, **20**, 245.

Simon-Carves Record Year

GROUP CURRENT assets of Simon-Carves, coke oven constructors, etc., on 31 December totalled £7,846,000 (£1,695,000 a year earlier), outlay on contracts in hand being £4,085,000 (£4,220,000); debtors, £1,953,000 (£2,817,000); and cash, £1,470,000 (£351,000). Current liabilities were £4,375,000 (£5,330,000), creditors acounting for £2,574,000 (£3,126,000), and payments in advance on contracts in hand, £1,109,000 (£1,619,000). Group trading profits were £1,601,225 (£1,102,432), and net profits, after tax, dealt with in the accounts of the parent company, £659,351 (£438,693). As known, the final dividend is 17½ per cent on £1 million of capital; an interim of 11¼ per cent was paid on £525,000. For 1954, 20 per cent was paid on £524,958 and 10 per cent on £477,235. Dividends require £134,586 (£85,306), and allocations to reserves took £367,000 (£205,000), of which £100,000 (nil) was placed to nuclear power development reserve. Balance forward is £600,170 (£441,469). Once again, states Mr. R. B. Potter, the chairman, results were a record. The total volume of contracts in hand, he adds, including those barely started and those nearly finished, is also a record.

New Refining Process

A NEW oil refining process that gets more gasoline out of crude oil has recently come into operation at Shell Oil Company's new Anacortes refinery, Washington, US.

The development—a two stage catalytic cracker—increases the yield of gasoline from crude oil up to 15 per cent. At the same time, it raises efficiency and thus helps keep down the rising costs of refining.

The two-stage process prevents overcracking and undercracking. In the first stage, hot catalyst strikes oil for a short time, causing it to vaporize and begin to crack. This partially-cracked oil then goes through a separating system which removes gasoline and gas formed in the first stage. The remaining uncracked oil goes on to the second stage reactor. The second stage is a conventional process employed by standard 'cat crackers'. It lasts longer than the first stage and is conducted at lower temperatures.

Besides high gasoline yields, the two-stage cracking system has resulted in lower coke yields and greater flexibility than conventional methods. It is capable of processing about 1 million gallons of oil a day.

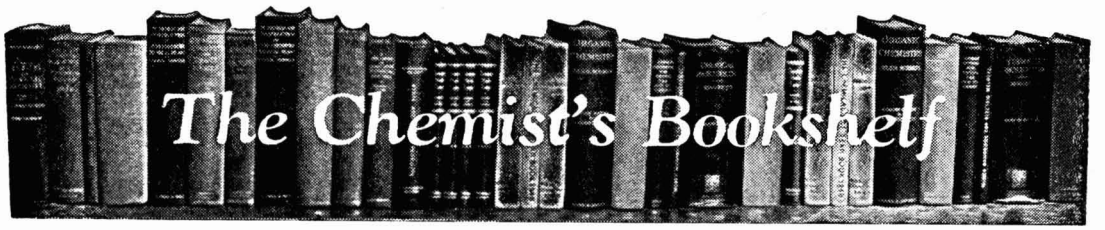
The new refining system is the climax of several years' intensive research in Shell's Houston research laboratory. First experiments were conducted in small pilot units. Later, a pilot plant unit processing eight barrels of oil a day was used.

Rumanian Reed Harvest

A NEW source of raw material, the reeds that grow along the banks of the Danube, is to be exploited by the Rumanian chemical industry, according to an article in the April issue of the Information Bulletin of the Rumanian Chamber of Commerce.

The hydrolysis of reed waste yields furfural, a selective solvent in the petroleum industry and a raw material in the synthetic rubber and plastics industry. Fermentation will yield ethyl alcohol, providing an alternative source to grain and potatoes.

The estimated annual output of reeds is expected to be 2.4 million tons, yielding 720,000 to 1,200,000 tons of cellulose. For the same quantity of cellulose approximately 4.5 million tons of softwood would be required. Reed is regenerated every year; the time for the regeneration of the same quantity of wood is considerable.



THE DETERMINATION OF TOXIC SUBSTANCES IN AIR. Edited by N. Strafford, C. R. M. Strouts and W. V. Stubbings. W. Heffer & Sons Ltd., Cambridge. 1956. Pp. xxvii + 226. 35s.

Sub-title of this book is 'A Manual of ICI Practice.' The material has been assembled under the guidance of the analytical chemists committee of that company so the reader may have no doubt whatsoever of the value and practicability of the methods described. Very full directions are given for the estimation of 49 toxic substances in air, alternative methods being frequently quoted. There are excellent diagrams and descriptions of the apparatus used, and the manner in which the final result is to be calculated is included at the end of each section. This book must be considered as a supplement to the series of DSIR pamphlets on the subject some years ago. Attention is given in a preliminary chapter to the sampling of contaminated atmospheres, as poor sampling or absorbing techniques can lead to gross errors in the analysis. A table of limits for many of the substances is provided.

Although the book is a considerable advance on the previous scanty publication and, without doubt, will contribute significantly to safety in chemical factories where its recommendations are not yet carried out, nevertheless it represents only a transient phase in the monitoring of toxic atmospheres. In the text there are apologetic references to the complicated nature of some of the tests and an admission in the preface of the need for simpler methods.

If for no other reason than the shortage of skilled analysts, much of this work will be taken over by instruments. The investigations of the National Coal Board have produced a number of instruments capable of determining the dangerous constituents of mine atmospheres and sounding an alarm when a predetermined dangerous concentration is reached. In addition there is commercially available in this country an instrument capable of indicating and recording the concentration of mercury vapour in air without any of the absorbing and estimation procedures involved in the methods quoted. The need for the adoption of instrumental methods is stressed in the foreword which expresses envy of the physicist and the simplicity of his detection techniques. The statement that 'a beginning has already been made in the tagging of poisonous materials with radioactive versions' must be considered as an understatement in view of the decision of the editors of the *Handbuch der Mikrochemischen Methoden* to devote a 400 page volume to what is virtually a list of the references to radioactive tracer techniques in micro-chemistry.—J. R. MAJER.

INDUSTRIAL RESEARCH 1956-1957. 3rd edition. Advisory Editor: Percy Dunsheath, C.B.E., M.A., D.Sc. Todd Publishing Group Ltd., London. 1956. British distributors: George G. Harrap & Co. Ltd., London. Pp. 444. 63s.

This new edition of one of the most valuable works of reference in science and industry has been greatly enlarged.

In the course of his introduction, Dr. Percy Dunsheath refers to the ever-increasing numbers of scientists and engineers being employed to ensure that the stream of scientific discoveries is rapidly applied to production. He expresses the hope, which will undoubtedly be realized, that these research workers will find a book of this kind not only an aid to their daily work, but a means of contact between those employed in different areas.

Existing sections have been completely revised and brought up to date, and a number of helpful and interesting new features have been added. For example, appearing for the first time are articles by Sir Ben Lockspeiser, secretary to the Committee of the Privy Council for Scientific and Industrial Research (1949-1956); and by Sir Nor-

man Kipping, director-general, Federation of British Industries. Readers will no doubt turn eagerly to the new special contribution by E. Jones, accountant, National Research Development Corporation, on 'Income Tax in Relation to Industrial Research and Patents'.

Among the 17 authoritative sections which comprise the 'body' of this book, particular mention should be made of the two new ones: (2) Atomic Energy, and (10) Directory of Commonwealth and Overseas Organizations Interested in Industrial Research.

The other 15 sections are: (1) Careers in Professions Associated with Industrial Research, (3) Directories of Government and Public Bodies with Research Divisions, statements, respectively, from: (4) Government and Public Bodies with Research Divisions, (5) Research Associations and Other Bodies under the Aegis of the DSIR, (6) Development Associations serving Industry, (7) Professional and Learned Societies and Other Bodies interested in Industrial Research, and (8) Producers, Manufacturers and Other Organizations interested in Industrial Research.

Then follow (9) Directory of British Organizations interested in Industrial Research, (11) Industrial Research in University Laboratories, (12) Industrial Research in Technical Colleges, (13) Research Laboratories of Private Firms, (14) Directory of Industrial Research Consultants, (15) Recent Scientific and Technical Books, (16) Periodicals concerned with Industrial Research, and (17) Abstracts of Current Literature on Industrial Research.

In the section on careers, pages 36 and 37 deal with chemical engineering which, it is stated, has now assumed the position of a fourth principal branch of engineering.—H. V. MILLER.

PHYSICAL CHEMISTRY. By N. K. Adam. Oxford University Press, London. 1956. Pp. xii + 658. 50s.

Although there are many excellent books dealing with various aspects of physical chemistry, there has been a lack of general textbooks which are, at the same time, sufficiently comprehensive and sufficiently readable to be recommended without reservation to honours students at universities. Professor Adam's book seems to be an excellent attempt to fulfil this need.

Task of covering the basic subjects in physical chemistry in one volume requires considerable care in the selection and presentation of the material. The expansion of the subject in the years since World War II has increased the difficulties for authors of volumes of this type and for lecturers charged with the duties of teaching physical chemistry to an honours level in universities. In both cases, much of the historical approach to the topics has to be included in order to provide a proper perspective; also some attempt has to be made to include new techniques and new results, lest the author or lecturer be charged with allowing his volume, or course, to appear somewhat behind the times.

In this volume, Professor Adam has achieved to a remarkable extent this balance between the new material and the old. He has taken tremendous care to present the material with clarity and has produced a most readable and instructive book. Furthermore, he has resisted the temptation to turn the volume into a sort of handbook with snippets of information about various developments which do not properly fall within the scope of a basic course.

This may be a disappointment to those who expect to be able to look in the index and be directed to half a page on say, nuclear magnetic resonance, ultrasonic absorption or flash photolysis. But, if the author had attempted to write a volume giving the coverage of an encyclopaedia, integration of the subject would not have been achieved in such an admirable way and the volume would have been less attractive as a basic textbook.

The amount of space devoted to particular topics must, to a certain extent, depend on the preference of the individual. In fact it would be almost impossible, in these days of specialization, to achieve a balance which meets with universal approval. Thus while approving of the design of the volume as a whole, it is possible to comment on the shortness or length of certain sections. For instance, in the chapter on colloids a fair amount of detailed description is included, probably because this subject is not treated well in many other textbooks. Yet in the chapter on chain reactions, only a couple of pages are devoted to polymerization and no details are given of the kinetics of a typical reaction, including the effect of catalyst concentration on rate of formation and molecular weight of the product.

The volume is well supplied with references to original papers and other more specialized textbooks. The standard of the figures is excellent and the index is good. Extensive use is made of small type for giving detailed treatments and dealing with the more advanced parts of the subject. This is helpful for the reader who wishes to grasp the essentials without worrying about the details on a first reading. At the moderate price of 50s, the volume can be recommended most strongly for use as a standard textbook of physical chemistry.—C. KEMBALL.

Canadian Production

PRODUCTION of chemicals and allied products in Canada totalled $881,500,000 in 1953, compared with $796,600,000 in 1952, an increase of about 10.6 per cent. Net value of production, or the value added by manufacturing, also advanced, being 8.3 per cent higher than in 1952.

Gross values of production by industries were as follows: Acids, alkalis and salts, $127,300,000; fertilizers, $84,400,000; medicinal and pharmaceutical preparations, $93,600,000; paints and varnishes, $113,200,000; primary plastics $44,500,000; soaps, washing compounds and cleaning preparations, $89,200,000; toilet preparations, $30,400,000; vegetable oils, $50,800,000; inks $12,800,000; adhesives $12,100,000; polishes and dressings $17,200,000; compressed gases $15,700,000; coal tar distillation $13,600,000 and miscellaneous chemical products, $176,500,000.

In the entire group there were 1,105 plants in 1953 with approximately 50,000 employees and aggregate pay roll of $165,000,000. The 539 works in Ontario accounted for 56 per cent of the production and 49 per cent of employees, and the 368 plants in Quebec accounted for 32 per cent of the total output and 41 per cent of workers. Materials used in manufacturing processes cost $403,700,000; fuel and electricity cost $29,500,000.

Exports of chemicals and allied products showed an increase in 1953, the value of $137,900,000 being about 10 per cent higher than $124,,600,000 in 1952.

Imports at $221,800,000 were about 18 per cent higher than in 1952. About 87 per cent of the imports came from the United States and Britain accounted for 8 per cent.

Humanizing Science

THE UNIVERSITY College of North Staffordshire, at Keele, by the establishment of a broader curriculum than is at present customary, is attempting to avoid the increasingly intensive specialization of existing university courses. News of how the college is achieving this end is given in an article which appears in the current issue of the M. & B. laboratory bulletin, published by May & Baker Ltd., of Dagenham. Commenting on the article, the bulletin's editorial draws attention to the fresh line of thought which expresses the need for the highly trained young chemist to be given, prior to his entry to industrial laboratories, a general view of the cultural and social scene into which he has been born. The editorial writer feels that the introduction of the new course is a striking move towards closing the gap between the paths of the scientist and the humanist, a gap which had seemed to broaden ever since the Renaissance. Indeed, until recently, the scientist had tended to turn his back on every kind of humanist—and *vice versa*. Now the pendulum had passed its apogee and the swing would be towards a closer understanding on all fronts.

Society of Chemical Industry

SOCIETY of Chemical Industry announce that a symposium on 'Recent Studies in Yeast & their Significance for Industry is being arranged jointly by the Dublin section and the Food and Microbiology Groups of the Society. It will be held in the Rupert Guinness Hall, Dublin on 17 and 18 September. The Biochemical Society, who are meeting in Dublin on 14 and 15 September, are arranging a local sightseeing tour if there are enough participants. Members attending the symposium can join these tours. Hotel accommodation can be arranged with the honorary secretary, Dublin Section (Dr. A. K. Mills, Arthur Guinness, Son & Co. (Dublin) Ltd., Chemists' Laboratories, St. James's Gate, Dublin).

The telephone number of the General Electric Co. Ltd. research laboratories at Wembley is now ARNold 1262.

National Enamels Ltd., 53 Norman Road, Greenwich, London SE10, state that their works will be closed from 9 to 14 July inclusive.

Publications & Announcements

FOREST Products Research Bulletin No. 20, 'Requirements and Properties of Adhesives for Wood', was published last week in its third edition by HM Stationery Office for the Department of Scientific and Industrial Research (price 2s 0d). The publication outlines the uses of glues, the requirements of a glue and the processes by which adhesives set. The six main types of adhesives in common use for wood are described in detail and the purposes for which they are best suited are also given.

* * *

THE basic principles of cathodic protection are outlined in 'The Application of Cathodic Protection to Chemical Plant' by F. D. Murphy, which is published in leaflet form by F. A. Hughes & Co. Ltd., Devonshire House, Piccadilly, London W1, makers of 'Guardion' cathodic protection equipment. Full and economic protection can be given to chemical plant, the author claims, for what may be regarded as all practical periods. In the oil industry alone this has brought about the saving of many thousands of tons of steel a year simply because no factor of safety for corrosion need be included when computing necessary pipeline wall thicknesses. When a metal corrodes electric current flows and the corroding surface in contact with soil or water forms a multitude of galvanic cells similar in action to the ordinary torch cell. If a current can be prevented from leaving the surface of the structure, however, no corrosion will take place. To accomplish this a voltage is applied to the surface so that a current flows through the ground or water to those places where the metal is exposed. The whole of the structure is thus rendered cathodic and incapable of corroding.

* * *

A WEALTH of news, features and illustrations appear in the handsomely-produced June edition of the British Petroleum magazine, and the reader is taken on an absorbing tour of many fascinating parts of the globe. One of the major articles outlines the revolutionary changes brought about in the shipping world by the advent of oil fuel, and the important role BP has played in the development of this motive power for ships from the very earliest times. Another feature describes how, in 1955, the company (through its subsidiary BP Exploration Company) was granted a concession by the Protectorate of Gambia to search for oil in that territory. In order to obtain some quick idea of the structural prospects, it was decided to carry out an underwater reconnaissance along the Gambia River itself and thus initially avoid an arduous and protracted land survey which might or might not be necessary in the light of information gained by the river exploration. In the February issue of the BP magazine, a short account was given of the company's assistance to the Transantarctic Expedition, led by Dr. Fuchs. As a sequel to this story, the June number contains pictures of m.v. *Theron* and those on board her at the Shackleton Base in the Weddell Sea and in the Port of London on her return to the UK. A feature entitled 'A Reindeer Round-Up' depicts in words and pictures this most fascinating sight which occurs three times a year throughout Lapland and Northern Scandinavia. It was witnessed by the test team from Sunbury Research Station which went to northern Sweden early this year.

* * *

A BOOKLET on 'The Non-Destructive Testing of Engineering Materials' published by A. E. Cawkell, electronic engineers, describes two instruments for testing non-destructively certain properties of engineering materials, mainly of non-homogeneous types, such as concrete, plastics, coal, ceramics, wood and others. In certain cases these methods give results not obtainable by any other means. The non-destructive tests may also replace, or supplement, well know destructive methods. Both instruments measure the dynamic modulus of the material, or a related property. The type UCT instrument is suitable for non-destructive measurements on complete structures *in situ*, or for production control or research in the laboratory. The SCT instrument is more suited to research and control work in the laboratory. Accurate results can be obtained with this instrument but careful preparation of the specimen is required.

British Chemical Prices

(These prices are checked with the manufacturers, but it must be pointed out that in many cases there are variations according to quantity, quality, place of delivery, etc.)

LONDON.—Home buying interest continues to be spread over most sections of the industrial chemicals market and good quantities are being taken against contracts. The export demand is also well maintained. While there have been no outstanding price changes on the week the tone of the market is firm. Among the coal-tar products there continues to be a good outlet for creosote oil and cresylic acid both on home account and for shipment.

MANCHESTER.—Holiday influences are now at work in the Manchester chemical market and this has been reflected in contract deliveries during the past week to the textile and allied trades and also to other industrial users in the Lancashire towns affected. The coming weeks will see this seasonal factor operating on an increasing scale. Meanwhile, a fair movement of supplies of the alkali products and other leading heavies is reported at firm rates. Fertilizers are mostly a quiet trade, but there is a continued good demand for carbolic acid, creosote oil and other tar products.

GLASGOW.—A slight lull has been experienced this week in the Scottish market. However, business has by no means been poor and trading for the week has been satisfactory. Shortages of some raw materials are still being experienced but this, it is understood, will be temporary. Prices in certain products have firmed but, on the whole, there is very little change to report in the price structure. The demand for agricultural chemicals is quite normal, and the export market continues to furnish considerable interest.

General Chemicals

Acetic Acid.—Per ton : 80% technical, 10 tons, £83 ; 80% pure, 10 tons, £89 ; commercial glacial, 10 tons, £91 ; delivered buyers' premises in returnable barrels (technical acid barrels free) ; in glass carboys, £7 ; demijohns, £11 extra.

Acetic Anhydride.—Ton lots d/d, £123 per ton.

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

Aluminium Sulphate.—Ex works, £14 15s per ton d/d. MANCHESTER : £15 to £17 15s.

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

Ammonium Bicarbonate.—2-cwt. non-returnable drums, 1-cwt. non-returnable kegs ; 1-ton lots, £50 5s per ton.

Ammonium Chloride.—Per ton lot, in non-returnable packaging, £29 2s 6d.

Ammonium Nitrate.—D/d, £31 per ton (in 4-ton lots).

Ammonium Persulphate. — MANCHESTER : £6 2s 6d per cwt., in 1-cwt. lots, delivered. £112 10s per ton, in minimum 1-ton lots, delivered.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £106 and £97 10s per ton.

Antimony Sulphide.—Crimson, 4s 4d to 4s 9½d ; golden, 2s 7½d to 4s 0¾d ; all per lb., delivered UK in minimum 1-ton lots.

Arsenic.—Per ton, £45 to £50 ex store.

Barium Carbonate.—Precip., d/d ; 4-ton lots, £41 per ton ; 2-ton lots, £41 10s per ton, bag packing.

Barium Chloride.—£54 per ton in 2-ton lots.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £42 10s per ton d/d ; 2-ton lots, £43 per ton d/d.

Bleaching Powder.—£28 12 6d per ton in returnable casks, carriage paid station, in 4-ton lots.

Borax.—Per ton for ton lots, in hessian sacks, carriage paid : Technical, anhydrous, £61 10s ; granular, £41 ; crystal, £43 10s ; powder, £44 10s ; extra fine powder, £45 10s ; BP, granular, £50 ; crystal, £52 10s ; powder, £53 10s ; extra fine powder, £54 10s.

Boric Acid.—Per ton for ton lots, in hessian sacks, carriage paid : Technical, granular, £70 ; crystal, £78 ; powder, £75 10s ; extra fine powder, £77 10s ; BP granular, £83 ; crystal, £90 ; powder, £87 10s ; extra fine powder, £89 10s.

Calcium Chloride.—Per ton lots, in non-returnable packaging : solid and flake, £16.

Chlorine, Liquid.— £38 10s per ton, in returnable 16-17-cwt. drums, delivered address in 3-drum lots.

Chromic Acid.—2s 0⅝d per lb., less 2½%, d/d UK, in 1-ton lots.

Chromium Sulphate, Basic.—Crystals, 7⅞d per lb. delivered (£73 10s per ton).

Citric Acid.—1-cwt. lots, £10 5s cwt.

Cobalt Oxide.—Black, delivered, bulk quantities, 13s 2d per lb.

Copper Carbonate.—3s 3d per lb.

Copper Sulphate.—£100 10s per ton f.o.b., less 2% in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., about £11 12s.

Formaldehyde.—£37 5s per ton in casks, d/d.

Formic Acid.—85%, £86 10s in 4-ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1.260 SG, £12 9s 0d per cwt. Refined pale straw industrial, 5s per cwt. less than chemically pure.

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

Hydrofluoric Acid.—59/60%, about 1s 6d per lb.

Hydrogen Peroxide.—27.5% wt., £128 10s per ton. 35% wt., £158 per ton d/d. Carboys extra and returnable.

Iodine.—Resublimed BP, 17s 7d per lb., in 28-lb. lots.

Iodoform.—£1 6s 7d per lb., in 28-lb. lots.

Lactic Acid.—Pale tech., 44 per cent by weight, 14d per lb. ; dark tech., 44 per cent by weight, 9d per lb., ex-works ; chemical quality, 44 per cent by weight, 12¼d per lb., ex-works ; 1-ton lots, usual container terms.

Lead Acetate.—White : About £150 per ton.

Lead Nitrate.—About £135 1-ton lots.

Lead, Red.—Basis prices per ton. Genuine dry red, £143 15s ; orange lead, £154 15s. Ground in oil : red, £161 10s ; orange, £173 10s.

Lead, White.—Basis prices : Dry English in 5-cwt. casks £147 15s per ton. Ground in oil : English, 1-cwt. lots 194s per cwt.

Lime Acetate.—Brown, ton lots, d/d, £40 per ton ; grey, 80-82%, ton lots, d/d, £45 per ton.

Litharge.—£144 15s per ton, in 5-ton lots.

Magnesite.—Calcined, in bags, ex-works, about £21 per ton.

Magnesium Carbonate.—Light, commercial, d/d, 2-ton lots, £84 10s per ton, under 2 tons, £92 per ton.

Magnesium Chloride.—Solid (ex-wharf), £16 per ton.

Magnesium Oxide.—Light, commercial, d/d, under 1-ton lots, £245 per ton.

Magnesium Sulphate.—Crystals, £16 per ton.

Mercuric Chloride.—Technical Powder, £1 3s 6d per lb., in 5-cwt. lots ; smaller quantities dearer.

Mercury Sulphide, Red.—£1 9s 3d per lb., for 5-cwt. lots.

Nickel Sulphate.—D/d, buyers UK £170 per ton. Nominal.

Nitric Acid.—80° Tw., £35 per ton.

Oxalic Acid.—Home manufacture, minimum 4-ton lots, in 5-cwt. casks, about £130 per ton, carriage paid.

Phosphoric Acid.—Technical (SG 1.700) ton lots, carriage paid, £100 per ton ; BP (SG 1.750), ton lots, carriage paid, 1s 3½d per lb.

Potash, Caustic.—Solid, £93 10s per ton for 1-ton lots ; Liquid, £34 15s.

Potassium Carbonate. — Calcined, 96/98%, about £74 10s per ton for 1-ton lots, ex-store.

Potassium Chloride.—Industrial, 96%, 1-ton lots, about £24 per ton.

Potassium Dichromate.—Crystals and granular, 1s 1d per lb., in 5-cwt. to 1-ton lots, d/d UK.

Potassium Iodide.—BP, 14s 1d per lb. in 28-lb. lots ; 13s 7d in cwt. lots.

Potassium Nitrate.—In 4-ton lots, in non-returnable packaging, paid address, £63 10s per ton.

Potassium Permanganate.—BP, 1-cwt. lots, 1s 9d per lb. ; 3-cwt. lots, 1s 8½d per lb. ; 5-cwt. lots, 1s 8d per lb. ; 1-ton lots, 1s 7¾d per lb. ; 5-ton lots, 1s 7¼d per lb. ; Tech., 5-cwt. packed in 1-cwt. drums, £8 14s 6d per cwt. ; packed in 1 drum, £8 9s. 6d per cwt.

Salammoniac.—Per ton lot, in non-returnable packaging, £45 10s.

Salicylic Acid. — MANCHESTER : Technical 2s 8½d per lb. d/d.

Soda Ash.—58% ex-depot or d/d London station, about £16 8s per ton, 1-ton lots.

Soda, Caustic.—Solid 76/77% ; spot, £32 6s 6d per ton d/d (4 ton lots).

Sodium Acetate.—Commercial crystals, £91 per ton d/d.

Sodium Bicarbonate.—Per ton lot, in non-returnable packaging, £17.

Sodium Bisulphite. — Powder, 60/62%, £42 15s d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—Per ton lot, in non-returnable packaging, paid address, £57.

Sodium Chlorate.—About £80 per ton in 1-cwt. drums, carriage paid station, in 4-ton lots.

Sodium Cyanide.—96/98%, £113 5s per ton lot in 1-cwt. drums.

Sodium Dichromate.—Crystals, cake and powder, 10¾d per lb. Net d/d UK, anhydrous, 1s 0½d per lb. Net del. d/d UK, 5-cwt. to 1-ton lots.

Sodium Fluoride.—Delivered, 1-ton lots and over, £5 per cwt. ; 1-cwt. lots, £5 10s per cwt.

Sodium Hyposulphite.—Pea crystals £35 15s a ton ; commercial, 1-ton lots, £32 10s per ton, carriage paid.

Sodium Iodide.—BP, 17s 1d per lb. in 28-lb. lots.

Sodium Metaphosphate (Calgon).—Flaked, loose in metal drums, £133 per ton.

Sodium Metasilicate.—£25 per ton, d/d UK in ton lots, loaned bags.

Sodium Nitrate.—Chilean refined granulated over 98% 6-ton lots, d/d station, £28 10s.

Sodium Nitrite.—£32 per ton (4-ton lots).

Sodium Percarbonate.—12½% available oxygen, £8 6s 9d per cwt. in 1-cwt. kegs.

Sodium Phosphate.—Per ton d/d for ton lots : di-sodium, crystalline, £40 10s, anhydrous, £84 ; tri-sodium, crystalline, £39 10s, anhydrous, £86.

Sodium Silicate.—75-84° Tw. Lancashire and Cheshire, 4-ton lots, d/d station in loaned drums, £10 15s per ton ; Dorset, Somerset and Devon, £3 17s 6d per ton extra ; Scotland and S. Wales, £3 per ton extra. Elsewhere in England, excluding Cornwall, and Wales, £1 12s 6d per ton extra.

Sodium Sulphate (Desiccated Glauber's Salts).—d/d in bags ton, £18.

Sodium Sulphate (Glauber's Salt).—£9 5s to £10 5s per ton d/d.

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

Sodium Sulphide.—Solid, 60/62%, spot, £33 2s 6d per ton, d/d, in drums in 1-ton lots ; broken, £34 2s 6d per ton, d/d, in drums in 1-ton lots.

Sodium Sulphite.—Anhydrous, £66 5s per ton ; commercial, £25 5s to £27 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground £20 to £22, according to fineness.

Sulphuric Acid.—Net, naked at works, 168° Tw. according to quality, per ton, £10 7s 6d to £12 ; 140° Tw., arsenic free, per ton, £8 12s 6d ; 140° Tw., arsenious, per ton, £8 4s 6d.

Tartaric Acid.—Per cwt. : 10 cwt. or more £13 10s, one cwt. £13 15s.

Titanium Oxide.—Standard grade comm., with rutile structure, £172 per ton ; standard grade comm., £152 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d, white seal, £115 ; green seal, £113 ; red seal, 2-ton lots, £110 per ton. White factice 1s 7¾d to 1s 11½d per lb.

Solvents & Plasticizers

Acetone.—Small lots : In 5-gal. cans : 5-gal., £125, 10-gal. and upward, £115, cans included. In 40/45 gal. returnable drums, spot : Less than 1 ton, £90 ; 1 to less than 5 tons, £87 ; 5 to less than 10 tons, £86 ; 10 tons and upward, £85. In tank wagons, spot : 1 to less than 5 tons (min. 400 gal.), £85 ; 5 to less than 10 tons (1,500 gal.), £84 ; 10 tons and upward (2,500 gal.), £83 ; contract rebate, £2. All per ton d/d.

Butyl Acetate BSS.—£159 per ton, in 10-ton lots.

***n*-Butyl alcohol, BSS.**—10 tons, in drums, £143 per ton d/d.

***sec*-Butyl Alcohol.**—5 gal. drums £159 ; 40 gal. drums : less than 1 ton £124 per ton ; 1 to 10 tons £123 per ton ; 10 tons and over £119 per ton ; 100 tons and over £120 per ton.

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

Diacetone Alcohol.—Small lots : 5 gal. drums, £177 per ton ; 10 gal. drums, £167 per ton. In 40/45 gal. drums ; less than 1 ton, £142 per ton ; 1 to 9 tons, £141 per ton ; 10 to 50 tons, £140 per ton ; 50 to 100 tons, £139 per ton ; 100 tons and over, £138 per ton.

Dibutyl Phthalate.—In drums, 10 tons, 2s per lb. d/d ; 45-gal. drums, 2s 1½d per lb. d/d.

Diethyl Phthalate.—In drums, 10 tons, 1s 11½d per lb. d/d ; 45 gal. drums, 2s 1d per lb. d/d.

Dimethyl Phthalate.—In drums, 10 tons. 1s 9d per lb. d/d ; 45 gal. drums, 1s 10½d per lb. d/d.

Dioctyl Phthalate.—In drums, 10 tons, 2s 8d per lb. d/d ; 45 gal. drums, 2s 9½d per lb. d/d.

Ether BSS.—In 1 ton lots, 1s 11d per lb. ; drums extra.

Ethyl Acetate.—10 tons lots, d/d, £128 per ton.

Ethyl Alcohol (PBS 66 o.p.).—Over 300,000 p. gal., 2s 9d ; 2,500-10,000 p. gal., 2s 11½d per p. gal., d/d in tankers. D/D in 40/45-gal. drums, 1d p.p.g. extra. Absolute alcohol (75.2 o.p.) 5d p.p.g. extra.

Methanol.—Pure synthetic, d/d, £43 15s per ton.

Methylated Spirit.—Industrial 66° o.p. : 500 gal. and over in tankers, 4s 10d per gal. d/d ; 100-499 gal. in drums, 5s 2½d per gal. d/d. Pyridinized 64 o.p. : 500 gal. and over in tankers, 5s 0d per gal. d/d ; 100-499 gal. in drums, 5s 4½d per gal. d/d.

Methyl Ethyl Ketone.—10-ton lots, £133 per ton d/d ; 100-ton lots, £131 per ton d/d.

Methyl *iso*Butyl Ketone.—10 tons and over £159 per ton.

***iso*Propyl Acetate.**—In drums, 10 tons, £123 per ton d/d ; 45 gal. drums, £129 per ton d/d.

***iso*Propyl Alcohol.**—Small lots: 5-gal. drums, £118 per ton ; 10-gal. drums, £108 per ton ; in 40-45 gal. drums ; less than 1 ton, £83 per ton ; 1 to 9 tons £81 per ton ; 10 to 50 tons, £80 10s per ton ; 50 tons and over, £80 per ton.

Rubber Chemicals

Carbon Disulphide.—£61 to £67 per ton, according to quality.

Carbon Black.—8d to 1s per lb., according to packing.

Carbon Tetrachloride.—Ton lots, £79 10s per ton.

India-Rubber Substitutes.—White, 1s 7¾d to 1s 11½d per lb. ; dark, 1s 4d to 1s 6¾d per lb. delivered free to customers' works.

Lithopone.—30%, about £55 per ton.

Mineral Black.—£7 10s to £10 per ton.

Sulphur Chloride.—British, about £50 per ton.

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

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

Coal-Tar Products

Benzole.—Per gal., minimum of 200 gals. delivered in bulk, 90's, 5s ; pure, 5s 4d.

Carbolic Acid.—Crystals, minimum price 1s 4d per lb. delivered in bulk, ½d per lb. extra in 40/50 gal. returnable drums. Crude, 60's, 8s per gal. Manchester : Crystals, 1s 4d to 1s 7d per lb., d/d crude, 8s naked, at works.

Creosote.— Home trade, 1s to 1s 9d per gal. according to quality, f.o.r. maker's works. MANCHESTER : 1s to 1s 8d per gal.

Cresylic Acid.—Pale 99/100%, 6s 4d per gal. ; 99.5/100%, 6s 6d per gal. D/d UK in bulk : Pale ADF from 7s 3d per imperial gallon f.o.b. UK, 95 cents per US gallon, c.i.f. NY.

Naphtha.—Solvent, 90/160°, 5s per gal ; heavy, 90/190°, 3s 11d per gal. for bulk 1000-gal. lots, d/d. Drums extra ; higher prices for smaller lots.

Naphthalene.—Crude, 4-ton lots, in buyers' bags, £18 1s 6d to £29 12s per ton nominal, according to m.p. ; hot pressed, £41 10s 6d per ton in bulk ex-works ; refined crystals, £60 10s per ton d/d min. 4-ton lots.

Pitch.—Medium, soft, home trade, £9 per ton f.o.r. suppliers' works ; export trade about £10 10s per ton f.o.b. suppliers' port.

Pyridine.—90/160, 20/- to £1 2s 6d per gal.

Toluole.—Pure, 5s 9d ; 90's 5s 0d per gal. d/d. 1000 gal. lots in bulk. MANCHESTER : Pure, 5s 9d per gal. naked.

Xylole.—5s 10d to 6s 3½d per gal., according to grade, in 1,000 gal. lots d/d London area in bulk.

Intermediates & Dyes
(Prices Nominal)

***m*-Cresol 98/100%.**—4s 9d per lb. d/d.

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

***p*-Cresol 34/35° C.**—4s 9d per lb. d/d.

Dichloraniline.—4s 3½d per lb.

Dinitrobenzene.—88/99° C., 2s per lb.

Dinitrotoluene.— SP 15° C., 2s 0½d per lb. ; SP 26° C., 1s 4d per lb. ; SP 33° C., 1s 2d per lb. ; SP 66/68° C., 1s 10d per lb. Drums extra.

***p*-Nitraniline.**—4s 10d per lb.

Nitrobenzene.—Spot, 10d per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—2s 4d per lb.

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

***p*-Toluidine.**—5s 9½d per lb., in casks.

Dimethylaniline.—3s 3d per lb., drums extra, carriage paid.

Chemical Exports for May

FIGURES published in 'Accounts Relating to Trade and Navigation of the United Kingdom', May 1956 (HM Stationery Office, 17s 6d), show that exports of chemicals in May were valued at £20,974,146, a slight increase on the value for April, £20,140,621. India was by far the largest importer, £1,976,973, with Australia second at £1,567,591.

Other substantial importers were:—The Union of South Africa (£1,194,283), the Netherlands (£858,313), the United States (£850,787), New Zealand (£746,208), Canada (£737,895), Italy (£702,896) and France (£667,184).

A more detailed analysis shows that exports were divided up as follows:—

Chemical elements and compounds ..	£5,106,811
Coal tar products	£330,679
Synthetic dyestuffs	£814,631
Paints, pigments and tannins ..	£2,115,600
Medicinal and pharmaceutical products	£3,031,248
Essential oils, perfumes, soaps, polishes etc.	£2,312,299
Fertilizers	£43,380
Plastics	£2,488,594

German Exhibition

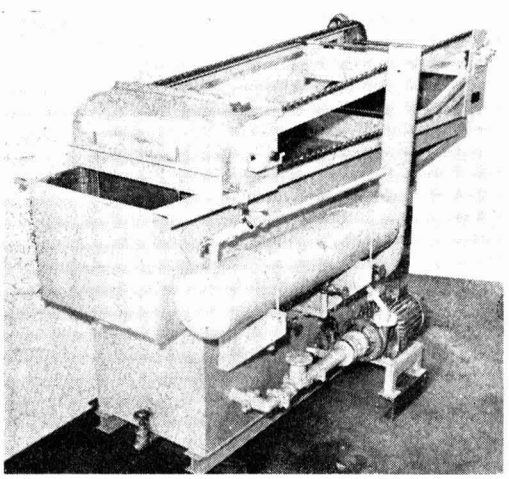
Due to the mis-interpretation of a Press communiqué from Germany, the 16 June issue of THE CHEMICAL AGE contained a reference to the 12th Chemical Apparatus and Equipment Congress and Exhibition as having already taken place in Frankfurt am Main. In point of fact, this event (organized by DECHEMA, Deutche Gesellschaft für Chemisches Apparatewesen) is to be held in 1958 from 13 May to 8 June. Some 10,000 visitors are expected.

Gibbs Flotation Unit

Rights Acquired by L. A. Mitchell

MANUFACTURING and selling rights in the UK and the Commonwealth and Empire of the Gibbs flotation unit have been acquired from F. S. Gibbs Inc. of the US by L. A. Mitchell Ltd., chemical engineers, of Manchester.

The unit is said to give dependable and economical clarification of industrial wastes and water supplies in the form of a packaged piece of equipment over a range of sizes and capacities. In has a wide field of application, being suitable for the removal and, if desired, recovery of waste matter in water which is made buoyant by the effect of a cloud of finely dispersed air bubbles. Examples of its applications are the recovery of oils and greases from vegetable oil, animal greases from processing plants and mineral oils from refinery and airport operations.



Gibbs flotation unit

In the Gibbs unit air flotation is performed in a rectangular vessel so designed that the flows through the unit are maintained in a near quiescent state and volumes of tiny air bubbles are continuously released from solution on the unit inlet section and throughout the flotation zone.

A portion of the clarified water is recirculated for air induction from the atmosphere, pressurization of the air-water mixture, and controlled distribution of the air solution. Sludge and grease carried to the surface are continuously removed by a mechanical scraper device. The unit is self-contained, compact and, being a packaged unit, has little or no installation costs. Units are built having capacities ranging from 60 g.p.m. to 1,000 g.p.m.

Mr. L. A. Mitchell, chairman and managing director, L. A. Mitchell Ltd., is a well-known member of the Society of Chemical Industry and the company states that it wishes to couple this announcement with its felicitations to the SCI on its 75th anniversary.

Plastics Education

FUNDS in support of education in plastics technology in 1956-57, allocated at a recent meeting of the trustees of the Plastics Industry Education Fund, disclose a number of new projects.

In addition to the grants for the seven students at the Borough Polytechnic, London, who last September started a full-time course for two years leading to the diploma of the Plastics Institute, a further £1,000 for grants to students who wish to take up this course next September has been allotted.

Birmingham College of Technology is being offered £1,000 to start a sandwich course in plastics technology which will last four years.

To enable a lecturer in plastics technology at Birmingham College to visit firms in Europe and study and report on recent developments in new materials and polymerization processes, a grant of £175, to cover travelling expenses, has been made.

The trustees have agreed to provide funds for Acton Technical College to award a research studentship in plastics technology.

There will again be available from the fund during 1956-57 a sum of £1,000 for training grants to young men or women working in the plastics industry to study full-time for a degree in science or engineering.

It was agreed to finance one of the scholarships (£300 a year) offered to university standard men of advanced level in chemistry, physics and mathematics by the National College of Rubber Technology for a three-year full-time course.

A grant of £500 for the purchase of equipment for teaching plastics technology has been made to Cardiff College of Technology and Commerce.

In addition, expenditure to the extent of £200 by the Plastics Institute on its sections' libraries at technical colleges were agreed by the trustees.

Chemical & Allied Stocks & Shares

FLUCTUATING prices have featured in stock markets but, nevertheless, the general trend as compared with a month ago has been downward, both in the industrial and gilt-edged sections. War Loan 3½ per cent at £71¾ compared with £72 a month ago. Although the general assumption in the City is that fresh measures to combat inflation will not be necessary, there is a widespread belief that it may not be possible to assess the position adequately until September.

Uncertain Trend

Meanwhile, it seems, markets may continue their uncertain trend. It is clear that industry generally is feeling the effects of rising costs more fully, and many well-known companies have warned that profits are unlikely to show a further rise this year. It is because of factors such as these that business in stock markets has now become much more selective. Oil shares were a strong exception, the £63 million American bid for the Trinidad Oil Co. having emphasized that oil shares are moderately valued in relation to the value of plant and equipment and scope for future earnings expansion of the companies. In particular, Shell and British Petroleum have been in demand at higher levels, especially BP, which have reflected renewed talk of a free scrip issue. Chemical and kindred shares were generally lower with the surrounding trend in markets. Most annual statements of the big chemical groups have emphasized that although business is expanding, costs are still rising and competition growing. This is, of course, the general pattern in industry at the present time.

Compared with a month ago, Imperial Chemical have come back from 47s to 45s 3d. Monsanto 5s shares were 26s 6d, compared with 26s 9d, while despite the good impression created by the financial results, Laporte 5s shares moved lower on balance at 18s 1½d, compared with 19s. In other directions, Albright & Wilson 5s shares which were 18s 7½d a month ago, have rallied to 19s. On the other hand, Anchor Chemical 5s shares reflected the general trend in stock markets, and were 12s 3d, a decline of 9d compared with a month ago. Yorkshire Dyeware & Chemical 5s shares were 9s 6d. xd, compared with 10s, and Reichhold 5s shares 15s 6d, compared with 17s 9d.

Hickson & Welch have come back from 31s to 28s 9d, but Hardman & Holden 5s shares rose from 11s to 11s 6d helped by the good impression created by the financial results. Boake, Roberts 5s shares at 16s moved higher following the dividend and profit figures, and in other directions Coalite & Chemical 2s shares at 4s 1½d have strengthened in response to the results and chairman's annual statement. Elsewhere, however, Brotherton 10s shares reflected a little selling and were 30s 7½d compared with 35s 6d a month ago. British Glues 4s shares at 11s 6d moved stlightly higher on balance. British Chrome Chemicals 4s shares, however, receded from 12s to 10s 9d, while F. W. Berk 5s shares at 7s 7½d lost a few pence. Plastics shares also showed the downward trend in stock markets. British Xylonite were 25s, compared with 32s 3d a month ago, and Bakelite 10s shares 27s 9d compared with 29s 9d. British Industrial Plastics 2s shares at 5s 1½d moved 4½d easier on balance for the month.

Borax Consolidated

Borax Consolidated have remained an active feature and moved up from 200s to 201s 10d. Fisons lost 1s on balance at 54s 9d. Boots Drug 5s shares at 15s were 1s lower, despite the good impression created by the financial results and expansion in turnover referred to in the chairman's annual speech.

Steel shares have lost ground because of labour troubles and fears that the heavy expenditure on new plant may leave little scope for higher dividends. Nevertheless, on the basis of last year's dividends, most steel shares give good yields, and it can be expected that prices will respond when there is a general rally in markets. Among oil shares, BP have advanced on the month from 145s to the new record level of 167s 9d. and Shell from 172s 6d. to 181s 3d.

MR. H. C. FAIRLIE has resigned as a director of British Chrome and Chemicals (Holdings) and of its subsidiaries.

Law & Company News

Commercial Intelligence

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

Mortgages & Charges

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

HEMINGWAY & CO. LTD., London E, chemical manufacturers.—24 May, further charge supplemental to a debenture dated 13 March, 1953, to Westminster Bank Ltd. increasing the amount secured by said debenture from £75,000 (not ex.) to £125,000 (not ex.); general charge. *£100,000. 25 November 1955.

MICRO-BIOLOGICALS LTD., London SW.—25 May, series of £10,000 debentures, present issue £2,000; general charge.

Satisfaction

ULTRAMAR CO. LTD., London EC, oil company.—Satisfaction 31 May, of a Trust Deed (dated 17 January, 1950) registered 23 January 1950 (fully).

New Registrations

James Young & Sons (Springfield) Ltd.

Private company. (31,564). Registered 31 May. Capital £100 in £1 shares. Objects: To carry on the business of merchants, dealers in and agents for soap, starch, water softeners etc. The directors are: W. L. F. Shaw, 76 Gower Street, Pollokshields, Glasgow; and H. Young, 6 Fullarton Drive, Troon. Secretary: W. L. F. Shaw. Registered office: 19 Tyndrum Street, Glasgow C4.

Birfield Industries Ltd.

Private company (567,790). Registered 20 June. Capital £100,000 in £1 shares. To buy and sell, import, export and otherwise deal in any products or substances capable of being produced by or used in connection with any of the business carried on by Birfield Ltd., or any of its subsidiary companies; and to carry on the business of engineering in all its branches, mining, smelting, refining, forging, casting, pressing, machining or otherwise treating or fabricating metals, ores, plastics; chemists, analysts, dyestuff manufacturers, electroplaters, painters and finishers, manufacturers of automobile, aircraft, aero engine, railway and steamship equipment and parts etc. The subscribers (each with one share) are: Marian Beadle and S. A. Score-Smyth, both clerks of 6 Austin Friars, London EC2. The first directors are to be appointed by the subscribers. Solicitors: Linklaters & Paines, 6 Austin Friars, London EC2.

Company News

Whessoe Ltd.

A record profit of £414,789 has been reported by Whessoe Ltd., plant manufacturers, for the year ended 31 March 1956. The figure for the corresponding period last year was £319,366. In January an interim dividend of five per cent was paid on the ordinary stock of £1 million and the directors now recommend a final dividend of 15 per cent. In his statement, which is being circulated with the report and accounts, the chairman, Mr. C. M. Spielman, says that in recommending a very moderate increase for an outstandingly successful year, the directors have had in mind the continuing need for capital expenditure in costly up-to-date plant. Earlier in his statement Mr. Spielman spoke of the steel situation. 'Fundamental to everything that Whessoe does is the assurance of steel in the quantity and kind required. For 10 years this has not been the case and the future is not encouraging. . . . We have nothing but admiration for the British steel industry in the quality of its products and in its response to demands for new steels; and our good friends and suppliers have given us generous help in so far as they have been able. It cannot be too often emphasized, however, that the steel industry is growing too slowly and planning for the future on too small a scale. It has, since the war, lagged behind the growth of engineering as a whole and very far behind the big steel using industries, particularly petroleum.' The 36th annual general meeting of Whessoe Ltd. will be held in London on 17 July.

Company News

[continued from page 1466]

A. Boake, Roberts & Co. (Holdings)

The annual general meeting of A. Boake, Roberts & Co. (Holdings) will be held in London on 18 July. With cash resources fully extended in running the business at its present level the board is considering raising the additional money required for future development and expansion, probably in the form of loan capital, says Mr. F. G. Pentecost, the chairman. Group net profit for the year ended 31 March 1956, was £252,866, compared with £200,250 in the previous year, and a bonus of 2½ per cent is being added to a maintained 15 per cent dividend. During the year £189,530 was spent on acquiring fixed assets, which, with an increase of £276,787 to £2,483,371 in stocks and debtors, imposed a strain on resources. This compelled the disposal of holding of £74,340 Treasury bills, and a reduction in cash by £53,293 to £191,804. During 1956-57 the company will have to find some £253,073.

Boots Pure Drug Co. Ltd.

A turnover of more than £66 million is reported by Boots Pure Drug Co. Ltd. for the year ended 31 March 1956, an increase of 11½ per cent over the previous year. After providing for tax the net profit is £2,029,454, compared with £1,912,142 last year. Of this profit, £293,439 is retained by subsidiary companies, the net profit to Boots Pure Drug Co. being £1,736,015.

Two three per cent dividends were paid earlier in the year and an eight per cent final dividend is proposed by the directors, making 14 per cent on the year.

In his statement, which is being circulated to shareholders, the chairman, Mr. J. P. Savage, says that the company has suffered a great loss through the death of Lord Trent.

Elsewhere in his statement Mr. Savage discusses research and development. 'In the field of chemical and pharmaceutical manufacture', he says, 'the present climate is one of continually increasing competition brought about by the growth of competitors at home, the great resurgence of industry in Europe and the enormous manufacturing potential of the United States.'

He goes on to say that the research division of antibiotics and fermentation has just been rehoused in a new block of specially designed laboratories, and that work will shortly begin on the construction of a large new laboratory building in Nottingham for the pharmaceutical and bacteriological research units which are at present occupying inadequate premises.

As an example of the greatly increased scientific contribution from research and development which is necessary today, Mr. Savage takes the case of the manufacture of cortisone, hydrocortisone and the latest member of the group, delta-hydrocortisone. These products are manufactured by Boots, claims Mr. Savage, without the use of hard currency intermediates.

The Permutit Co. Ltd.

Speaking at the 41st annual general meeting of The Permutit Co. Ltd. on 12 June, the chairman, Mr. R. T. Pemberton, said that the profit for the year ended 31 December 1955, was £409,888 before taxation. After allowing for taxation and adding the balance of £97,718 from the previous year the total sum available to the account is £312,856. The directors recommend that £150,000 be put to general reserve and that a dividend of 12½ per cent less tax be paid on the ordinary shares, leaving a balance of £122,489 to be carried forward. Early last year Permutit secured two large contracts in Canada and it was decided accordingly to register a Canadian company. In August 1955 Ion Exchange (Canada) Ltd. was formed.

Greeff-Chemicals Holdings Ltd.

After allowing for taxation, the net profit of Greeff-Chemicals Holdings for 1955 was £67,897, compared with £66,006 in 1954. In his statement to shareholders made at the annual general meeting, 21 June, the chairman, Mr. Stanley Bayliss Smith, said that turnover was again a record, but that margins were lower and competition and overheads continued to increase. A final dividend of 11 per cent was recommended on the ordinary capital making, together with the interim dividend paid in November 1955, a total dividend equivalent to 15 per cent on the increased capital or to 18¾ per cent on the ordinary capital as at 31 December. Mr. Smith went on to say: 'The holdings of our subsidiary under the heading Trade Investments remained unchanged during 1955. British Titan Products Co. Ltd. has since further increased its capital by the allotment at par to existing shareholders of 1 million ordinary shares of £1 each, of which our share is 89,290.'

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Unused Single **TROUGH MIXER** by Lang—22 in. sq. by 28 in. deep. Mild steel galvanised construction with cast ends. Sigma-type contra-rotating agitator driven through spur gearing.

Double-Trough Mixer—34 in. by 27 in. by 26 in. deep. Twin "Z" blades. Single spur gearing. Hand tilting, hinged cover. Motorised 400/3/50.

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