THE Chemical Age

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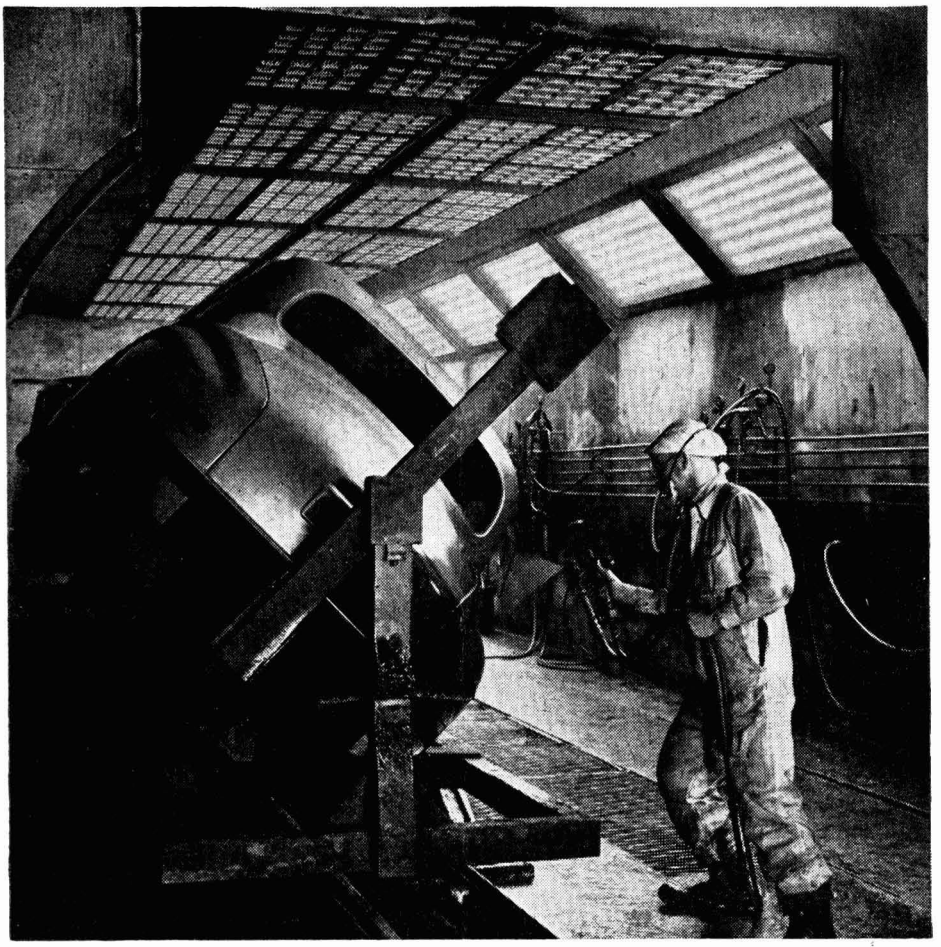

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Science in Industry

THIS week's choice of topic was determined ten years ago in Manchester. If this sounds like a sudden echo from the past, from the truly distant past when it was more frequently and controversially said that 'what Manchester thinks today, the rest think tomorrow,' it is a compliment that modern Mancunians have justly earned. For in 1944 the Manchester Joint Research Council was formed, a fifty-fifty coalition of representatives of Manchester University and of that city's Chamber of Commerce. This organisation appointed a full-time liaison officer, held meetings and discussions on topics concerning the science/industry relationship, and issued printed reports. After four years of promising activity the Council decided to conduct a survey of the use actually made of scientific knowledge by industry in Manchester and the surrounding industrial area. A well-selected cross-section of industry was to be taken and the investigations made personally and confidentially by experienced workers. It is to the credit of the DSIR also that it readily supported this project by offering a £-for-£ addition to whatever sum Manchester could raise.

The survey was carried out over the 1950-53 period, and this week its results are fully discussed and reported in book form: 'Industry and Science,' (Manchester University Press. Pp. 188. 12s. 6d.). Here, not hitherto available, is solid factual information about the utilisation of science by industry. The report carefully avoids claiming that what has been found in the Manchester area is true of other British industrial centres; nevertheless, readers will be prepared to risk their own assumptions on this point and we suggest that most will readily regard the Manchester pattern as representative.

The survey excluded various classes of industry — the building and clothing trades (but not textile manufacture), agriculture and distribution, nationalised industries, and all firms employing less than 50 persons. These exclusions are logical enough, though it is possible to criticise the last exclusion on the grounds that some highly scientific businesses employ small labour forces. However, a line must be drawn at some point if a survey by personal interviews is to be kept within bounds of cost and time.

A letter was sent to the firms selected for the cross-section survey. It is greatly to Manchester's credit again that 76 per cent of the firms approached agreed to co-operate. This is an incredibly high response, one that experts in the sales-letter field can only envy; it sets a standard of public spirit that will be difficult to excel in any other surveys of a similar kind that may follow elsewhere later on.

Much of what has recently been said and written about scientists in industry has drawn a distinction between the scientist and the technologist. No operative distinction of this nature could be found by the investigators; they found scientists acting as technologists and *vice versa* to a sufficient extent to prevent any such classification of duties in the report. Does this not suggest (though the conclusion is not drawn in the book) that if enough scientists are allowed into industry we shall produce enough technologists by experience and adaptation?

Of 225 firms visited, 118 (52 per cent) employed at least one scientist or technologist; the total force of such qualified men was 1,297, made up of 684 graduates and 613 diploma-holders. (A diploma here means such qualifications as A.M.I.E.E., or A.R.I.C., etc., but not diplomas of less-widely accepted status.) The total labour force in the 225 firms was 147,000; of this number, 123,000 were in firms where at least one scientist was employed.

Scientists were found to be employed in a variety of functions; the only classifi-

cation attempted in the Report is that of directorship, and 128 of the 1,297 were directors, almost 10 per cent. It is interesting in this connection that the percentage was higher for graduates; of the graduates employed, 13.6 per cent had attained board-room seating. Lest it be thought that this may be mainly due to university opportunities given to members of a family running a predominantly family business, it should be pointed out that this explanation applied to only 20 per cent of the actual cases.

More important is the revelation that directorships are not won by scientific ability alone. In no single case in the survey 'was it found that a man who had been employed solely on research had been appointed to the board of management of his firm.' In short, day-to-day association with the firm's industrial and commercial activities is a necessary condition for such promotion. This is a total confirmation of the opinions expressed in our recent leader on 'Chemists and Administration' (see THE CHEMICAL AGE, 1954, **70**, 503). It seems not merely unjust, but ultimately unwise, that the research contribution of science to industry should be so unrepresented in top-level management.

A broad classification of scientist-usage in industry is given. In the firms surveyed the division between research and development on the one side, and management and production on the other, was in almost a fifty-fifty balance. This may be a little misleading, for when only those firms with definite research and development sections are considered, the ratio becomes 60:40, a clear indication that as science becomes more fully utilised the proportion employed in research and development will rise.

How much do firms in industry recognise the need to use science? An *ad hoc* diagnosis in the Report suggests that one-third of industry does not in fact require much help from science; another third requires some help in applying established methods; the final third really needs all that science can offer. The survey indicates that in this last section about 80 per cent of such firms are satisfactorily equipped with scientists, but in the middle section there is only about a 40 per cent adequacy. This is perhaps one of the major findings, based though it is upon the personal opinions of the investigators. The disparity between the 80 and 40 per cent estimates is big enough to make errors of judgment insignificant. We are taken back to Sir Henry Tizard's pronouncement that industry above all needs to apply what is already known.

The survey of research and development work by industry showed that 13 per cent of the firms visited were themselves conducting research; also, that very little in the way of long-term fundamental research was being attempted. Few firms visited, however, did not have some form of development work in progress, and about 40 per cent had departments specifically responsible for this work. A list of sources of help in development work is given and it is highly significant that help from suppliers was mentioned twice as often as help from any other single source, including research associations, universities, consultants, and the DSIR. This is surely remarkable, even allowing for the fact that frequency of mention may not accurately reflect amount of help.

One section deals solely with research associations and it is unlikely that any more realistic appraisal of their merits and demerits will become available. Between the lines, a greater need for liaison activities clearly emerges; so, too, does the suspicion that co-operative research cannot bring the full competitive value of research to any individual firm. A majority of firms appear to look upon these associations as complaint investigation centres and information bureaux, not as establishments devoted to research and genuine development. This section needs a very thorough study by the DSIR for it shows that the potentialities of these centres are seriously misunderstood by those firms which could most benefit from them.

There is much more of great value in this book, and appreciation must be limited by space. Manchester has made a superb contribution in fact and thought to the future of Britain as an industrial nation. It is tragic to have to report that the principal investigator, Mr. A. D. Butchart died in 1953.

Notes & Comments

As Good Fish . . .

ANGLERS are usually fearful of the effects of chemicals upon their prey, and perhaps not unjustifiably, so long as cases of cyanide pollution of streams and rivers continue to occur. But most anglers, like most chemists, will be astounded by the sheer size of a new Colonial Office publication, a review and bibliography on 'Fertilisers in Fishponds.' (HMSO. Pp. 156. 25s.). Three hundred and fifty-one original papers and articles are summarised, and in addition there are fifteen sections of commentary. Much of this work was actually carried out before 1940. The subject has been very intensively studied in Germany where commercial freshwater fisheries form a thriving industry. In Britain we hunt freshwater fish as a form of sport and the popular taste is overwhelmingly for seafish; we have sea around us and that is probably the basis of development in our fish-eating customs, although it is no longer the adjacent sea that brings us most of our fish. We have neglected a food production process that more thrifty nations have utilised to both economic and gastronomic advantage. Without fertilisers an acre of fishpond in the USA produces 40-150 lb. of fish per year, a rate of protein production comparing favourably with meat output from grassland. Fertiliser treatment can double the fishpond output.

. . . Out of the Sea

SCIENTIFICALLY, the subject is still in a very empirical state. Fertilisers do not, of course, directly feed the fish population; they greatly increase the growth of water-plant and cellular organisms upon which fish themselves feed. It would seem that by far the most striking results are obtained through the application of liming and phosphatic materials. Responses to nitrogen and potash are variable. The usefulness of lime would seem mainly a matter of *p*H control, and one piece of research claims superior results through the use of sodium bicarbonate as this enables a better CO_2 concentration to be held in the water. As many of our purely sporting freshwater fisheries are in peaty or hilly areas, it is possible that anglers would be seen, both with larger catches and with wider-stretched arms, if calcium carbonate were periodically added. Superphosphate is the most favoured means for adding phosphate, but basic slag, despite its water-insolubility, has also been used with frequent success. German opinion is that phosphate manuring recovers its cost ten times over. Freshwater fish culture in the tropical colonial territories is being intensively fostered; and owing to the absence of dormant winter periods yields from tropical fish 'farms' are ten to twenty times those of European fishponds. The Colonial Office's interest in this technological subject is direct and topical.

Aluminium for Mining ?

STEEL has long been the predominant material for constructing trucks, tubs, and skips used in mining, but the merits of aluminium alloys are steadily gaining appreciation. Duralumin and HE(10)WP, both with about $\frac{1}{3}$ of the density of steel, approach steel for tensile strength. A four-ton mine truck made of aluminium alloy can have a tare weight of 2,700 lb. as against 4,700 lb. for a steel truck of similar capacity. Tubs of the type often used in coal mines, if made of aluminium alloy, can have a load/tare ratio of 6 : 1. The value of these advantages is greatest, of course, where mined material must be carried over long distances or hauled up through considerable heights. The Dominion Coal Company of Canada, whose mines run for long distances under the sea, has increasingly used aluminium trucks since 1949. But virtues based upon aluminium's low density are not the only ones. The Young's Modulus figure for aluminium alloys is also about $\frac{1}{3}$ that of steel. For a given stress, therefore, aluminium alloys should absorb three times as much energy. As trucks in mining suffer many knocks

during their working-life this particular property should give aluminium alloy vehicles a greater durability. This has been confirmed by experience. A second contributory factor for durability is aluminium's greater resistance to corrosion, owing to its natural formation of a resistant non-porous oxide film. This last advantage may not hold good for all minerals, e.g. chlorides or chloride-containing minerals may corrode aluminium particularly severely.

Opportunity for Exports

THERE are, of course, *cons* as well as *pros*. Aluminium alloy trucks cost nearly twice as much as steel trucks. Maintenance work is more difficult, in that welding and riveting are more cumbersome procedures; however, these problems would tend to ease with greater experience in mine workshops. A particular snag would appear to be the long delay associated with delivery. This, at any rate, has been stressed by one of South Africa's largest gold-mining companies at present actively considering the introduction of aluminium alloy trucks. It is no doubt a natural consequence of new development; initial orders given by any mining organisation are likely to be on a prototype rather than standard production line basis. One conclusion can be clearly drawn. In all large-scale mining, aluminium has a new opportunity and the British aluminium industry should not neglect any resultant export trade prospects. To do so would perhaps mean that orders for British steel trucks were displaced by some other country's aluminium trucks.

'Terylene' Suits on Show

MEN'S suits made from 100 per cent Terylene were displayed at the Men's Trade Fair and Styles Parades held last week at the Royal Festival Hall, London. During the parades two single-breasted, two-piece suits were shown and several more were exhibited by the Terylene Council of Imperial Chemical Industries Limited on their stand. Some of these were 100 per cent Terylene and others were mixtures. Lengths of suitings, neckties, shirts, showerproof golfing jackets and socks were also displayed.

A number of manufacturers featured Terylene shirts on their stands and one was showing shirts made from an Ardil mixture. A shirt containing Ardil which had been washed 40 times attracted a great deal of attention as did a nylon shirt which had also had 40 launderings without ironing.

An official of the exhibition told THE CHEMICAL AGE that keen interest had been shown in Terylene. A representative of I.C.I. stated that men's suits made from 100 per cent Terylene would be on sale in June and would probably retail for £20. At the stand of one of Britain's largest shirt manufacturers it was said that British men were becoming extremely interested in synthetic fibres and that the demand for nylon, Orlon and Terylene shirts was growing rapidly. The housewife's dislike of ironing was said to be largely responsible for this, but the introduction of a wider range of colours was also an important factor.

New Scottish Industry

SCOTLAND has a new industry—the manufacture of 'Rocksil', a long fibre rock wool which is used to make a thick flexible mat type of material for heat, cold and sound-insulating purposes in buildings, ships, road and rail vehicles, aircraft, etc., as well as domestically and in industry generally. Both basic raw materials for its manufacture are available in large quantities in Scotland—dolomite from Argyll and fire clay from Stirlingshire. The Stirling factory in which 'Rocksil' is being manufactured was formally opened last week by the Earl of Home, Minister of State for Scotland. Speaking at a luncheon subsequently, Lord Home pointed out that Scotland had peat, lead, limestone, magnetite, dolomite and silica, and now that the chemist was daily finding new uses for them and as methods of extraction were improved and cheapened, he felt sure it would pay to extract them. Manufactured by the Cape Asbestos Co. Ltd., 'Rocksil' is being marketed solely by William Kenyon & Sons, Ltd.

New Home for High Vacuum

W. Edwards & Co. Open Crawley Factory

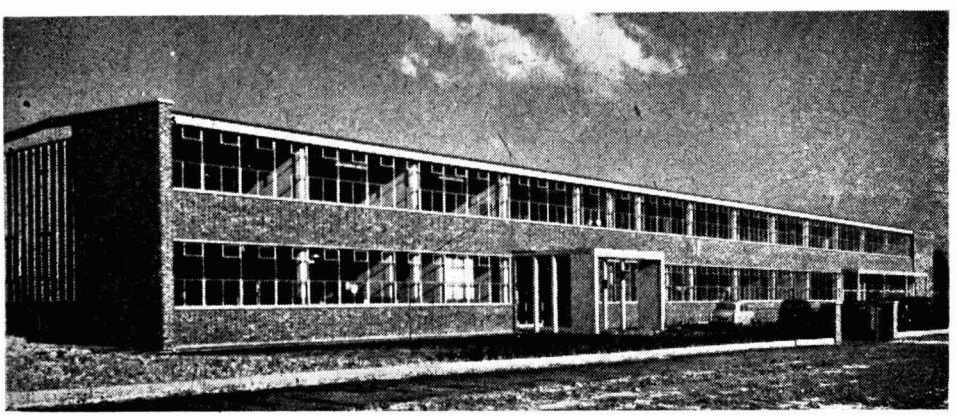
ONE of the achievements of which Britain can be proud is the development of its high vacuum equipment industry. Until the beginning of the last war 90 per cent of the UK's needs were imported from Germany or the United States, but today W. Edwards & Co. is not only able to supply the home demand but exports approximately one-third of its output. The firm has built up a world-wide reputation for well-built and highly efficient equipment and high vacuum workers the world over look to W. Edwards & Co. for advice. In little more than a decade high vacuum technique has progressed from the laboratory to a uniquely important position in industry and much of this development is a result of research carried out by the firm. In Britain, at least, when one says 'high vacuum' one immediately thinks of 'Edwards'.

Ever since the firm was founded in 1919 by Frederick D. Edwards, it has suffered from inadequate accommodation. Adequate capital was never available and premises were small, crowded and ill-suited for the purpose for which they were needed. In 1947 a Government official reported that nowhere had he seen 'the degree of congestion that prevailed at Messrs. Edwards' factory.'

These facts are well known by users of high vacuum equipment and it was, therefore, with pleasure that the firm's many friends heard some time ago that a new, spacious and attractive factory was being built at Manor Royal, Crawley, Sussex. It was with even greater pleasure that over 300 guests attended the opening of the new Allendale Works on Friday, 5 March. They applauded freely when two commemorative trees were planted by Sir Ben Lockspeiser, Secretary to the Department of Scientific and Industrial Research, and Mr. Frederick D. Edwards, managing director and founder. They gave an equally enthusiastic support to the praise which Professor E. N. da C. Andrade gave to the firm and Mr. Edwards when responding to the toast 'The Guests,' proposed by the chairman of the firm, Lord Wilmot of Selmeston.

The site for the factory is the industrial area of Crawley New Town and it covers about 11 acres. Of the total building area, 15,000 sq. ft. are given over to administration and 85,000 sq. ft. to factory space, including research, development, production, stores, boiler house, etc. A separate building houses the freeze drying development section and there is also a special section for the development of vacuum coating located next to the general development floor. The factory throughout is equipped with the most modern machines and equipment and is well-provided with the latest testing equipment. It has been designed for the comfort and welfare of workers as well as for efficient production.

Edwards manufacture equipment for



A front view of the new Allendale Works of W. Edwards & Co.

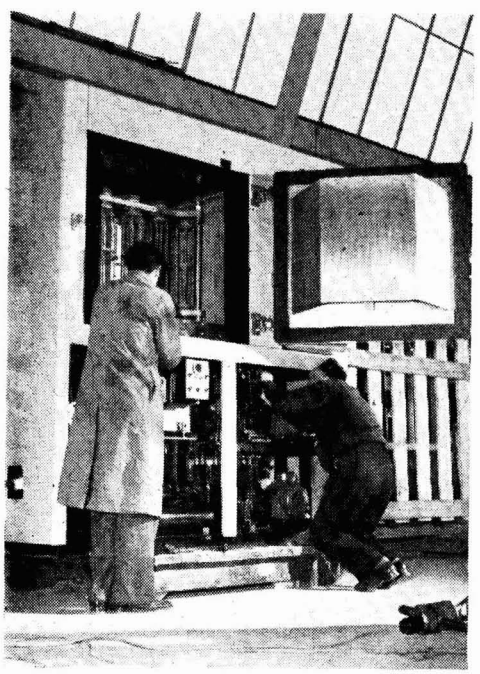
every high vacuum application and claim to have the most complete range of vacuum equipment in the world. The range falls naturally into four main groups:—

(1) Means of Producing High Vacua: Both rotary vacuum pumps, the basis of every high vacuum system, and vapour pumps, for gaining the lowest possible pressures.

(2) Means for Measuring, Indicating and Controlling High Vacuum: A complete range of instruments of all types measuring pressures from atmospheric to 10^{-8} mm. of mercury.

(3) Vacuum Systems, Apparatus and Plant: Those applicable to every use of high vacuum including standard units for the deposition of thin films; freeze drying for heat sensitive and biological materials; scientific instruments such as the electron diffraction camera; custom built equipment for specific applications ranging from a complete exhaust system for television tubes to nuclear plant for which large pumps of very high pumping speeds are involved.

(4) Accessories: The numerous valves, control devices, demountable unions, refrigeration equipment, vapour traps and other components necessary to build up a complete vacuum system.



Final assembly being carried out on a blood plasma plant ordered for Indonesia

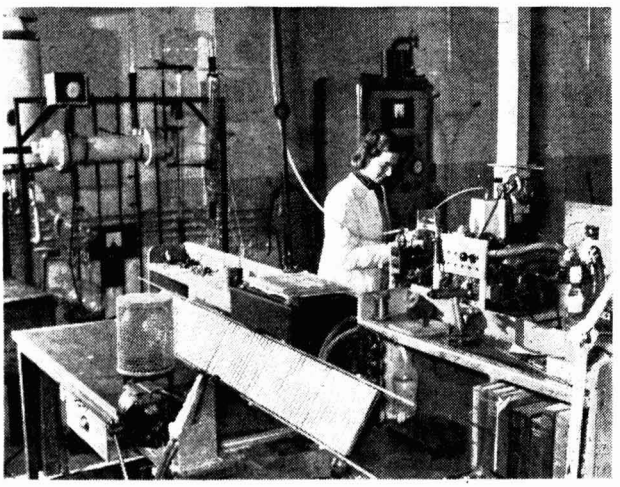
The company's present position is due in no small measure to the recognition of the vital rôle of research, since high vacuum technique is rapidly expanding and fresh applications are continually being found in science, medicine and industry.

Not only is exploratory work undertaken to perfect the firm's products, devise new and more efficient apparatus and keep the company abreast of the latest developments, but also a considerable amount of investigatory work is done to develop plant and techniques for customer applications—often work which at first sight may appear to have no connection with high vacuum, e.g., investigation into lacquers as an important complementary to the deposition of thin films in vacuum.

Laboratories Contiguous

Research investigations include pumps and pumping problems, instruments, vacuum coating, vacuum metallurgy, freeze drying, and many other subjects, both from the production and equipment angle and covering all the manifold applications of the technique. As far as possible, in laying out the new factory the laboratories have been kept contiguous to one another as in practice work in one section has often been found to influence profoundly the other three. Continuing expansion of the company's activities after the plans for the building had been made has necessitated some provisional modifications to this ideal, but it is planned to bring the freeze-drying and allied chemical work into the research area with the building extension now under consideration. The layout of the laboratories is standardised and no part of the floor area is more than 20 ft. from a grid carrying electricity, gas, cooling water and compressed air supplies, which greatly facilitates re-planning to suit the various research problems as they arise. Writing and discussion rooms are provided for each section of the laboratory, experience having shown that even for junior members the laboratory itself is not always the most suitable place for such purposes.

The company's reference library is of a very high standard. Part of the service given is the abstraction and circulation to the relevant personnel of details of papers and articles published throughout the world on high vacuum and allied subjects.



A research worker busy on a new freeze drying plant which is being developed by Edwards & Co.

High vacuum workers outside the firm some time ago realised that the company could be relied upon for elusive references and requests for copies of the abstracts became frequent. Thus the decision was taken four years ago to start an independent journal, *Vacuum*, offering a complete abstracting service together with articles and papers on vacuum work. *Vacuum* is an authoritative scientific journal devoted to the advancement of the technique generally and as such receives contributions and advertisements from vacuum equipment manufacturers and workers throughout the world. It has been widely accepted as an important and valuable scientific publication.

In order to ensure that a new project should be passed to production free from 'snags' the technical department was formed and provides the hub for the firm's technical co-ordination. This department is a separate entity possessing its own drawing office and means of production. It is thus well equipped, not only for taking the original idea from the research department and producing a practical piece of apparatus ready to be taken over by the production department for quantity production, but also for the design and building of 'custom-built' plant in 'one-off' quantities. Under erection at the moment in the technical department as pre-production units are a vacuum arc furnace, a continuous coating plant and a coating plant for aluminising 6 ft. diameter astronomical mirrors. A recent 'one-off' product of Edwards is a freeze-drying plant for the preservation of blood plasma capable of providing the requirements of a population of several million.

The company's workshops have been specially equipped for precision production of scientific apparatus and equipment.

Inspection, including leak detection, plays a dominating part in all stages of fabrication and assembly, so vital is vacuum tightness for the company's manufactures, and this aspect of the company's production makes a significant difference from that normally encountered in engineering work.

When proposing 'The Company and High Vacuum,' Sir Ben Lockspeiser, in part, said:—

The production of a vacuum first became of serious manufacturing concern when Edison and Swan invented the carbon lamp, which brought electric lighting. Since then, there has been a constant and stimulating interplay between the workshop and the laboratory, in both need and practice. Research on the discharge tube led to X-rays, and their value in the field of medicine stimulated a large industrial demand for vacuum equipment. The explanation of the blackening of the old carbon lamp led to the great invention of the thermionic valve and the demand for higher vacua. The story goes on to radio, radar and television, none of which would be possible without high vacuum equipment. Because of the massive quantity of production and the large sizes of certain vessels which require to be evacuated, the equipment has to fulfil the double requirement of high efficiency and speed of operation.

Another important application of vacuum

technique within recent years has been to the process of freeze-drying. Although the principle has long been known and has been applied on a limited scale from the early part of this century, it was the urgent demand at the outbreak of the last war for very large quantities of dried blood plasma which led to the development in the USA and also this country of modern industrial freeze-drying equipment. This most difficult problem has been solved by the development of the modern liquid diffusion pump and the highly efficient mechanical backing pump, and Edwards & Co. are in the forefront in their production.

The Big Battalion Favoured

Great industrial innovations usually demand in these days large sums both for development and capital investment, and for this reason modern technology favours the big battalion, but there is a vital and distinctive place for the specialist firm, which makes itself highly proficient in its own field and performs thereby an invaluable service for many industries, and often for research laboratories also. W. Edwards & Co. is an excellent example of such a specialist firm, occupying a unique position and serving both industry in the newest technology and science in its most advanced technique, in discharge tubes of all kinds, in the electron microscope, in the separation of isotopes, in accelerators for nuclear particles and in various branches of metallurgical research.

In industry, and particularly in its modern aspect, this company is pumping away for dear life in a literal sense for international trade in manufacture has swung markets towards those based on the newer technologies, and our living depends more and more on our skill in exploiting them. Your success is particularly gratifying, because we relied almost entirely on imported vacuum equipment before the war. The United States and Germany has made great headway in manufacturing this particular kind of equipment and provided 90 per cent of our needs in 1939. Now the much larger home requirements for vacuum equipment are completely met by British manufacture, and Edwards & Co. make not only a large contribution to the home market but export in addition between 30 and 35 per cent of their output.

An achievement of this magnitude in so short a time does not happen by itself. It is a striking contribution to good engineering, good design, good science, knit together by good management and good organisation.

In its great services to science, W. Edwards & Co. is handsomely repaying an old debt, for I believe I am right in saying that about 1924 Dr. Kaye, who was head of the Physics Division of the National Physical Laboratory at the time, invented a new type of vacuum pump and approached Mr. Edwards, your present managing director, with a view to getting it manufactured. The company began in this way by manufacturing Dr. Kaye's pump. The company turned to the research laboratory for a good start in life, and it now makes a valuable contribution to keeping research alive.

You have your own laboratory, of course. You could not get on without it. Its main job is to attend to your daily needs, but I trust nobody will ever consider that as sufficient. It is right and proper that most people in an industrial laboratory should keep their noses to the grindstone, but some (there never can be very many) should be not only free, but feel themselves free to assume a more detached attitude, to take long views and concern themselves with the fundamentals.

Mr. Edwards' Response

In the course of his response, Mr. Edwards said:—

'With taxation as applied today, it is virtually impossible for a young enterprise to grow without an influx of capital from outside the firm. Now our company, which passed through its early period of growth during the days of comparatively easy taxation, was able by 1946, to present to the Industrial & Commercial Finance Corporation a history inspiring confidence and thereby to attract the additional capital made necessary by the severe effects of 100 per cent Excess Profits Tax in the middle '40's. But today such small enterprises will have to rely upon private funds for expansion, and therefore it is my hope that financiers and industrialists will take courage in both hands and be prepared to risk financial support to small enterprises until they reach such size that they could properly be handled by the finance corporations. If some such action is not taken, many promising ideas will perish from lack of funds and possible world markets will be lost to Britain.'

Steel Tubes for the Chemical Industry

by W. E. SMITH (Accles and Pollock, Ltd.)

CHEMICAL engineering has become so complex over the past few decades that it is almost impossible for anyone to be an expert on every separate facet. There are, however, common problems that have to be faced in every field, difficulties that are common to all chemical engineers, in no matter which branch they have specialised. Pipelines are perhaps the best example of such a subject, for the chemical engineer always has to handle his products, whether they be fertilisers or pharmaceuticals, petroleum or paints. And that problem of handling comes back, in most cases, to the provision of pipelines.

A Growing Demand

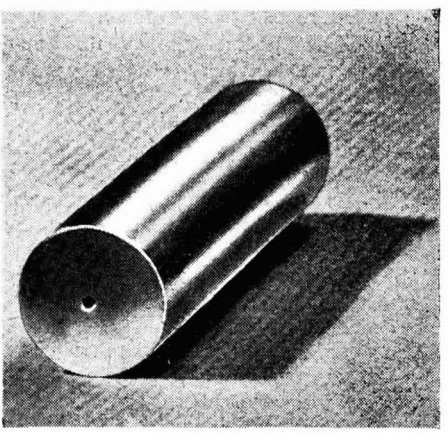
We who make tubes, therefore, have a direct interest in every branch of chemical engineering. Over the past thirty years we have been called upon to develop new skills in drawing and manipulating steels and other metals to provide the pipelines demanded by the growing chemical industry. Today, those demands continue, and we are being called upon to supply an even wider range, from the heavy-walled tubes needed in high pressure processes to those with paper-thin walls used in flexible joints.

When designing a new item of plant, the chemical engineer can choose from a wide variety of materials for his pipelines. Pipes are available in plastics, glass, lead, rubber, ceramics, non-ferrous metals, and a wide range of steels. We at Accles & Pollock Ltd. are concerned chiefly with steels, but these—including the wide range of stainless steels and stainless irons—are perhaps the most important single group of all.

In our experience, the chemical engineer is concerned with three main problems. First, the ability of the pipeline to stand up to the conditions of the process—which includes resistance to corrosion, suitability for the pressures and temperatures likely to be encountered, and so on. Second, the fact that the pipeline should not contaminate the product—particularly important in the case of fine chemicals. Third, ease of fabrication and maintenance.

There is, of course, a fourth consideration which can almost be left unsaid. That is the question of cost, but in the chemical industry, as in other industries, the initial cost is becoming increasingly less important compared with the question of a long and trouble-free life. The move towards larger units and continuous processes makes designers more anxious than ever to avoid plant stoppages—so they choose the material that can be relied upon to stand up to the conditions rather than risk possible breakdowns. The present-day high labour costs tend to emphasise this argument in an industry where the ratio of capital expenditure to employees is traditionally high.

Oddly enough, chemical engineers place little emphasis on the question of bore finish in pipelines. This seems unusual to the tube-maker, because the use of a tube as a pipeline inevitably implies a flow along the tube bore, whether of liquid, gas or finely-divided solid. The rate of flow of any substance in a pipeline is governed by a number of factors, including the pressure difference, the diameter and length of the pipe, and the density and viscosity of the substance, but also including the interior surface condition of the pipe, which should present as little resistance as possible to the desired move-



An actual size illustration of high-pressure tubing produced by Accles & Pollock Ltd. for research work with gases under pressure. A special process was developed to produce tubes of sufficiently high tensile strength—as great as 100 tons per sq. in.

ment. Refrigerator manufacturers, who are admittedly usually dealing with smaller sizes of tube, are most insistent on the high quality of bore finish in the tube supplied to them, and it would seem that the same considerations should apply to chemical pipelines. However, it may well be that chemical engineers get the quality they need without realising it, for they invariably specify solid-drawn tube in which the cold work inherent in the process necessarily produces a high surface quality. This question of bore quality is important from another aspect, for any irregularity in the tube bore must encourage preferential corrosive attack.

Standardisation Advisable

Close tolerances are rarely called for on normal pipelines, but the question of standards is raising more attention in the chemical industry. This is a problem where we, as tube makers, can do little more than advise. The chemical engineer is our customer—and we naturally try to supply whatever he asks for. The result, perhaps, has been a rather bewildering range of sizes and gauges, with tube of many different dimensions being used for the same purpose. This, however, is a question on which the customer, rather than the supplier, must take the initiative.

On every other problem connected with tube, we are, of course, delighted to offer all the help we can, and our specialised experience in weld problems, heat treatment and manipulation is always at the disposal of the chemical engineer.

Welding still seems to be regarded with considerable suspicion by some chemical engineers—particularly when a material in the stainless range is concerned. These fears are quite unfounded, provided the proper technique is adhered to, and although the stainless steels vary considerably in their suitability for welding, satisfactory joints can be obtained provided the correct procedure is laid down and rigidly adhered to on site. Even the obvious precautions are sometimes forgotten, however, and trouble must be expected if, for instance, incorrect welding filler rods are used.

The manipulation problems raised on site during erection rarely go beyond fairly simple bends. Chemical installations do, however, call for most intricate examples of tubular coils and we have developed special techniques for producing these.

Pipelines are normally made from tubes of normal commercial sizes, but the increasing tendency towards continuous automatic, or semi-automatic, installations calls for greater use of instruments. Tube of the smaller sizes plays a big part in instrumentation and to meet these demands the tube-maker has had to produce, in the same range of corrosion-resisting steels, highly accurate tubes of small diameter for Bourdons, capillaries, thermometer bulbs and other purposes. This specialised range of high-precision tube for scientific instruments is a field on its own. Great advances have been made over the past few years and as an indication of the fine limits that can be achieved, we have successfully made a solid-drawn tube with an outside diameter of 0.0017 in.—about half the size of human hair.

The same field includes multi-bore tube, which, as its name implies, is tube with a number of separate bores—anything from two to fifty or more.

Composite tube has a bore of one material and an outside of another—the answer to problems where corrosive conditions differ externally and internally and one material cannot be found to suit both. Composite tube can also be used to save money when precious metals have to be employed on a particular process, for a thin-wall tube of precious metal can be given the required physical strength when combined with another tube in steel.

These, however, are all specialist applications developed to solve particular problems. I mention them here to show some of the latest achievements of the tube-maker, and also because it is as well for the chemical engineer to know the resources on which he may call if faced with an unusual problem.

Corrosion-resisting Metals

Perhaps the most immediately useful purpose would be achieved by listing the corrosion-resisting metals normally demanded by the chemical engineer, with some notes on their special properties.

Stainless steel, of course, is the most important range, and pipelines in this material have solved many problems in chemical engineering since we successfully drew the first stainless steel tubes at our works nearly thirty years ago.

Stainless steels are divided into two main classes, martensitic and austenitic, so called

from the difference in their crystal structure.

Martensitic steel—usually called ' stainless iron '—contains up to 0.2 per cent carbon and 12-14 per cent chromium. It is magnetic at ordinary temperatures, like plain carbon steel, passes through well-defined change points of heating and cooling, and therefore may be hardened by heat treatment (cooling from a high temperature) and subsequently tempered.

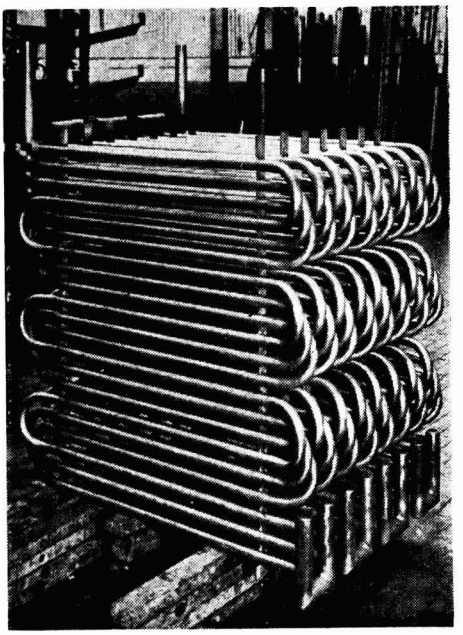
It may be used for a wide variety of mild corrosive conditions and resists scaling up to about 700°. Owing to the high chromium content, stainless iron has a far greater corrosion resistance than mild steel. This resistance is greatest in the hardened and polished condition, but even when softened the low carbon stainless irons resist ordinary atmospheric conditions to a remarkable degree.

Stainless iron should not be regarded as an acid-resisting steel. Its resistance is far in excess of that of mild steel, but many of the well-known acids will attack it. Some of the weaker mineral acids and some of the organic acids have little effect. It is, for instance, resistant to 10 per cent boric acid, phenol, cresol, fatty acids, pyrogallic acid and tannic acid.

The resistance to nitric acid varies considerably according to temperature and concentration. It is completely resistant to nitric acid of SG 1.2 up to fairly high temperature, whereas the attack of this acid on mild steel is violent. In general, nitric acid of dilute strength will attack stainless iron but the stronger solutions have practically no effect at room temperatures. Rise of temperature up to 80° has little effect in HNO_3 of intermediate concentrations. At boiling point the acid has a serious corrosive effect at all concentrations. It should, however, be noted that the resistance of stainless iron is far above that of mild steel.

Austenitic Steels

The austenitic steels are totally different from the martensitic stainless iron. They are non-magnetic and cannot be hardened by heat-treatment, although they work-harden rapidly when cold worked. Austenitic steels are the true ' stainless ' steels for they possess remarkable resistance to corrosion and acid attack under a wide variety of conditions. They owe this property to their high chromium and high nickel content, coupled with the fact that in the fully softened condition they are homogeneous solid solutions.



A complicated tubular coil fabrication in stainless heat-resisting steel by Accles & Pollock

The austenitic range includes a wide variety of steels, for by the addition of small percentages of other special elements, in addition to nickel and chromium, materials can be produced to withstand special conditions. The addition of molybdenum, for instance, gives greater resistance to sulphuric acid and to concentrated solutions of acetic acid. The inclusion of high silicon and manganese contents, with greater percentages of chromium and nickel, gives a useful range of heat resisting steels. The addition of titanium or columbium ensures freedom from intercrystalline corrosion or weld decay.

It is perhaps most convenient to list some of these steels in order to give an idea of the influence of their composition.

Steel containing:

Carbon	Chromium	Nickel
0.08% max.	17-20%	7-10%

Highly resistant to corrosion and acid attack. The most ductile of the austenitic steels we produce and therefore particularly suitable for work which is manipulated in the cold state.

Steel containing:

Carbon	Chromium	Nickel
0.08-0.15%	17-20%	7-10%

Only slightly less ductile and may be used for manipulated work with success. If welded, it must be softened afterwards.

Steel containing:

Carbon	Chromium	Nickel	Titanium
0.15% max.	17-20%	7.5-10.5%	5 × C percentage
or 0.15% max.	17-20%	10-14%	Columbium 10 × C percentage

Specially designed to resist inter-crystalline corrosion (weld decay). Has great acid-resisting properties. Can be used as a heat-resisting steel as it is free from inter-crystalline embrittlement and resists scaling up to 800°.

Steel containing:

Carbon	Chromium	Nickel	Molybdenum
0.10%	17-20%	8-12%	2.5-3.5%

Of particular interest to chemical engineers, particularly when used in connection with acetic acid at high temperatures and concentrations. Has good resistance to sulphuric acid at moderate concentrations and room temperature and is usually recommended when the steels previously noted are not sufficiently acid-resisting for the purpose required.

Steel containing:

Carbon	Chromium	Nickel	Molybdenum	Titanium
0.10%	17-20%	8-12%	2.5-3.0%	0.3-0.6%

Similar to the previously noted steel but the titanium content makes it suitable for welding.

Steel containing:

Carbon	Chromium	Nickel
0.1%	18.0%	18.0%

Titanium or Columbium	Molybdenum	Copper
0.6%	3.0%	2.0%

This steel is considerably more resistant to sulphuric acid than either of the previous two listed and is the latest development in this class.

High Acid Resistance

These steels are widely used in chemical plant owing to their high acid-resistance. They are practically unattacked by nitric acid at all temperatures and concentrations, particularly between the range of 30 to 70 per cent acid. Their development has been of particular importance in making the conversion of ammonia into nitric acid by an oxidation process commercially practicable.

Although not resistant to sulphuric acid, in general the austenitic stainless steels may be used in contact with nitric-sulphuric mixtures of various compositions and at various temperatures, and can be used in the mixed-acid nitration processes which are widely used in the nitro-cellulose industries. In some cases the presence of copper sulphate will prevent the attack of ordinary sulphuric acid. The presence of molybdenum in these steels also gives increased resistance to sulphuric acid.

They are resistant to sulphurous acid and sulphur dioxide. In cases where there is the possibility of oxidation and formation of traces of sulphuric acid a molybdenum-bearing steel should be specified for maximum service, although care should still be taken when H_2SO_4 is liable to be present.

These steels resist commercially pure phosphoric acid in the more dilute concentrations up to boiling point, but with higher concentrations the maximum temperature permissible is lower. They also resist acetic acid, but if high concentrations of this acid are used at high temperatures a steel containing approximately 3 per cent molybdenum should be used.

Uses Widespread

Austenitic steels are widely used in the dyeing, tanning, rubber, oil and soap industries, where their resistance to fatty acids and the protection they give against contamination of the product are both important qualities.

One of the chief objections of chemical engineers to the use of ordinary austenitic stainless steels in the past has been the fact that when these materials are heated within a temperature range of 500° to 900° and then subjected to the action of certain corrosive substances, they become liable to selective attack along the crystal boundaries. The metal corrodes rapidly at these points, becomes very brittle, and may even disintegrate into separate crystals and be reduced to a powder. It is obvious that the whole value of the corrosion and acid-resisting steels is destroyed if subjected to this low temperature treatment.

This effect has become known as weld decay, because during welding there is always a zone of the metal which has been heated within the dangerous range and which, if subsequently subjected to corrosive attack, will suffer from inter-crystalline corrosion.

There are two ways of overcoming the problem. The first is by re-heating at 1,100° to 1,150° and cooling quickly immediately after low temperature heat-treatment—or at

least before the material has been subjected to corrosive conditions. This method, however, is obviously impracticable in many cases of welded construction and the second method has to be employed. That consists simply of selecting a steel specially designed to resist weld decay. By keeping the carbon content low and adding titanium or columbium to the ordinary austenitic composition steel, steel-makers have produced materials not adversely affected by heat within the range of 500° to 900°, and these steels (listed above) should be specified for any pipeline forming part of a large welded piece of plant which could not possibly be heat-treated after welding.

Failure Can Be Fatal

This problem of weld decay cannot be too strongly emphasised and it is usually much safer to specify one of the weld-decay-proof steels listed above for any operation involving welding or any other heat treatment within the dangerous range of 500° to 900° Failure to do so, coupled with the omission of the high-temperature treatment, can prove fatal.

The nickel shortage gave some impetus to the development of straight chromium stainless steels, which, though not so universally useful as the austenitic steels, have specialist applications and are available in tube form. We concentrate on three types of chromium stainless steels: 17 per cent, 20 per cent and 27 per cent chromium, with carbon contents around 0.1 per cent or less. The 17 per cent and 20 per cent chromium steels are generally used where resistance to corrosion is the main factor, and the 27 per cent chromium steel for resistance to scaling at high temperatures and to sulphurous atmospheres. Like austenitic steels, high chromium stainless steels cannot be hardened by heat-treatment, but they are magnetic. The 17 per cent and 20 per cent chromium steels can be welded by oxy-acetylene, electric arc, argon arc and resistance methods, but the weld tends to become brittle and should be softened afterwards. The 27 per cent chromium steel is not recommended for welding.

One further point to be watched in all pipeline installations is contact corrosion. If two dissimilar metals are in contact in an electrolyte, galvanic action is liable to be set up with the result that one of the metals is liable to increased attack. Information dealing with this can usually be supplied if details are given.

In all cases where doubt exists the steel-maker is glad to supply information on which is the most suitable material for the proposed application. Full information should be given of the temperatures and pressures involved and also of the composition of the corrosive medium, with special mention of any impurities likely to be encountered. Small traces of acid, for example, may cause pitting with certain solutions that would otherwise be quite harmless. On the other hand some substances may have a protective effect; thus a mixture of sulphuric and nitric acids may be used in certain cases where the use of sulphuric acid alone would be inadmissible.

One last point is that delivery, for long a sore point owing to raw material shortages, is no longer a problem in the standard qualities of stainless steels. The chemical engineer is once more able to order the exact material he needs for the job, without worrying about accepting substitutes just because his first choice is not immediately available. This change gives as much satisfaction to the tube-maker as it does to the customer, for we feel that the contribution we can make to the chemical industry—great though it has been—is far from exhausted, and we look forward to still further developments to help in creating yet better plant and processes.

Oil & Colour Exhibition

THE sixth Technical Trade Exhibition of raw materials used in the paint, varnish and printing ink industries, which will be held under the auspices of the London Section of the Oil & Colour Chemists' Association at the Royal Horticultural Society's Old Hall, Vincent Square, London, S.W.1, on 21-23 April, will be larger than in previous years.

For the first time, all the stands will be in one hall. Times of opening are as follow: 21 April, 3-8.30 p.m.; 22 April, 2-8.30 p.m.; 23 April, 2-7.30 pm. Refreshments will be available in an annexe. Admission to the exhibition will be free and full information and brochures giving details of the stands may be obtained free from the general secretary of the Association, Memorial Hall, Farringdon Street, London, E.C.4. For the luncheon at the Criterion Restaurant, tickets are restricted to members.

German Industry

Index to Reports on Chemicals

AN index has been prepared jointly by the Technical Information and Documents Unit of the Department of Scientific and Industrial Research, and the Association of British Chemical Manufacturers, listing references to chemicals reported upon in the BIOS, CIOS, FIAT, etc., series of reports on the German Chemical Industry and in the unpublished documents held by TIDU.

In the main, the chemicals are arranged alphabetically by chemical constitution, adopting the nomenclature of the British Chemical Society, although sometimes it has been found necessary to use German trade names. In other cases products are grouped together, e.g., adhesives, chemical plant, dyestuffs, synthetic fibres, synthetic rubber (mainly Buna).

All plastic materials such as Bakelite, Albertols, Plastopals, Luvitherms, etc., have been grouped together under the heading of 'Resins, synthetic,' but the actual methods of preparation in some cases are described under the name of the monomer, e.g., styrene and vinyl chloride.

The index is in two parts: Part I covers the published information and Part II refers to the unpublished German documents. Both parts of the index have now been microfilmed and copies are available as follows:

Part I. Index to published reports:—Approximately 1,000 reports were published on the German chemical industry. This part of the index consists of over 31,000 cards, most of which have multiple references. It is contained in two 35 mm. microfilm reels, totalling 1,718 frames, £10 15s.

Part II. Index to unpublished reports and documents:—This part of the index consists of over 72,000 cards, most of which have multiple references. It is contained in five 35 mm. microfilm reels, totalling 4,512 frames, £28 10s.

Orders for microfilm copies of either or both parts of this index should be addressed to the Technical Information and Documents Unit (TIDU).

The master index is held by the Technical Information and Documents Unit of DSIR and may be consulted during normal office hours in the reading room of TIDU at Cunard Building, 15 Regent Street, London, S.W.1.

Soaps & Detergents

SOME months ago the authorities of the Borough Polytechnic were invited by the Regional Advisory Council for Higher Technological Education to investigate the possibility of providing special courses in Soaps and Detergents.

Since it is the policy of the Polytechnic to co-operate with industry in offering courses for which there is likely to be a demand, it has been decided in the first instance to arrange a short course of four lectures on physico-chemical aspects of soaps and detergents. The authorities have been fortunate in securing the services of Dr. K. G. Pankhurst, F.R.I.C., well known as a lecturer in the subject and author of the pamphlet recently published by the Royal Institute of Chemistry. Dr. Pankhurst has further agreed to advise on further courses.

The course, which is of an introductory nature and is designed to be a forerunner of a series on different aspects of soaps and detergents to begin in the autumn, is designed primarily for those associated with the soap and detergent industries. A knowledge of chemistry and physics up to Inter.B.Sc. standard will be assumed.

The four lectures will be held on Mondays, 3, 10, 17 and 24 May, at 7 p.m., the fee for the course being 10s. 6d. Further details may be obtained from Dr. F. Aylward, Borough Polytechnic, London, S.E.1.

Ergonomics Research

THE fourth annual conference of the Ergonomics Research Society will be held at Ashorne Hill, Warwickshire, 5-8 April, when the subject to be discussed will be 'The Scientific Study of Human Work in Industry.' The provisional programme includes considerations of physiological methods of measuring work; physiological studies of underground work; industrial psychology; and organisation of repetitive work. The annual general meeting of the Society will take place at the same time.

Those who will be speaking at the conference include Sir George P. Barnett (HM Chief Inspector of Factories), Sir Frederic C. Bartlett, C.B.E., F.R.S. (Emeritus Professor of Experimental Psychology, University of Cambridge), and Dr. Leonard Carmichael (Secretary, The Smithsonian Institution, Washington).

Liquid-Liquid Extraction in Refineries

By PETER W. SHERWOOD

EVER since the introduction of the Edeleanu process some 40 years ago, liquid-liquid extraction has been a unit operation of growing importance to the refining of petroleum. The patent literature discloses hundreds of processes concerned with the solvent refining of petroleum products, and numerous of these operating methods are finding industrial application.

Among the more important of these processes, we find the use of sulphur dioxide extraction for the removal of aromatic compounds from light lubricating oils, diesel fuels, naphthas, and catalytic cracking recycle stocks. Similar objectives are achieved by extraction with phenol, furfural, chlorex (dichlorodiethyl ether), and other solvents.

Deasphalting processes involving propane extraction have attained a position of outstanding importance during the past decade. Unlike most other solvents used in the petroleum industry, propane serves as solvent for the desired paraffinic components, leaving the asphaltic matter in the residue.

Aqueous solvents play an important part in the desulphurisation of petroleum distillates. Mercaptan content of gasoline can be lowered effectively by extraction with a water solution of potassium hydroxide and potassium *iso*butylate ('solutiser' process), or by means of an aqueous solution of caustic soda and methanol ('Unisol' process).

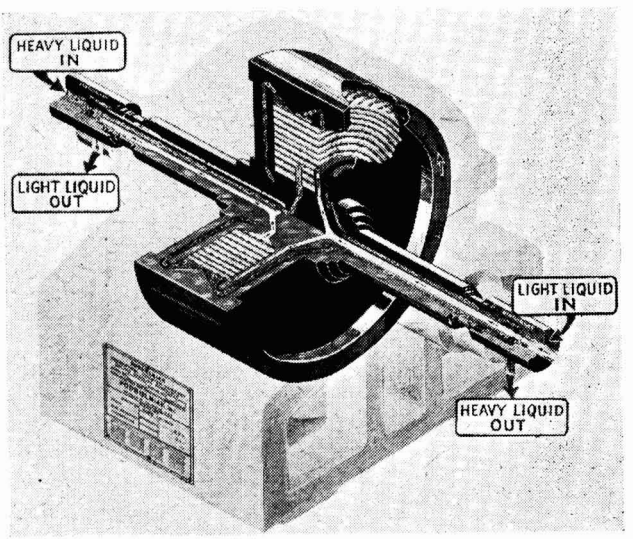
A new process, using water-diluted diethylene glycol as its solvent, has achieved commercial significance during the past few years for the recovery of nitration-grade benzene and toluene from catalytically reformed naphthas.

The growing concern with stream polution has been responsible for the installation of solvent extraction units for the removal of offensive chemicals (notably acids) from aqueous refinery waste streams before they are discharged.

These instances serve to illustrate the wide and growing scope of solvent extraction processes in the petroleum industry. With increasing demands on the degree of separation, development work has naturally taken two courses; methods of achieving greater selectivity, and means of promoting improved efficiency with any given solvent extraction system.

The former path has led to the selection of newer and more effective solvents and solvent mixtures (e.g. benzene and sulphur dioxide) and to fractional extraction. This latter concept is incorporated in the Duo-Sol process in which two mutually insoluble solvents (propane and a phenol-cresylic acid mixture) are employed. Here, propane serves to extract paraffinic and naphthenic components of the oil feedstock, while the tar acids

Courtesy Podbielniak Inc.



The flow of fluids through a Podbielniak centrifugal contactor. The lighter phase is admitted to the outside of the rotor, and the heavier to the centre. The heavier phase flows to the outside, displacing the lighter phase towards the centre, and mixing with it in the contacting elements of the rotor. Quiet zones at the centre and perimeter permit clarification of the streams as they leave the rotor

are an effective solvent for aromatic hydrocarbons. An outstanding feature of the Duo-Sol process is its ability to provide simultaneous refining and deasphalting action. By properly adjusting the ratio of the two solvents to each other and to the feedstock, it becomes possible to use this versatile process for the production of refined materials of widely differing properties.

Progress in Design Slow

Regardless of the system involved, the extraction process is almost universally carried out in continuous countercurrent operation in vertical towers. Reflux may be provided at one or both ends of the column. Until quite recently, surprisingly little progress has been made in improved tower design. For the more routine separations, traditional towers provided with internal packing, baffles or perforated plates have proved adequate.

Much work has been done toward the development of more efficient packing materials and certain improvements may be obtained by selecting the proper packing for a given system. Channelling tends to occur in packed columns and the packing is therefore often provided in several sections between which the liquid phases may redistribute themselves. This proneness toward channelling also limits the useful permissible tower diameter seriously.

However, all of these standard columns share one serious defect; contact between the two phases is quite inefficient and considerable height is therefore required to achieve one theoretical extraction stage. As a result, a single tower cannot be designed economically for more than a limited number of stages (in some systems as few as three) and holdup in each column is high.

Recently successful attempts to overcome this limitation involve the use of mechanically moving systems to effect rapid intimate contact between the two phases of the system. Promising results have been reported in America during the past year for three such systems; sectional vertical columns with mechanical agitation (illustrated by the York-Scheibel unit); centrifugal extractors (illustrated by the Podbielniak and the Luwesta units); and pulsating columns (a design under active investigation at Iowa State College, Cornell University, and in numerous industrial laboratories).

The York-Scheibel column has recently found commercial refinery application in the dephenolisation of aqueous effluent at Standard Oil Company of Ohio. It is a vertical cylindrical tower; paddle-type agitators, attached to a central vertical shaft, are provided at regular intervals of 1-2 ft. along the column. No packing is provided with each agitated section, but a special wire mesh packing separates successive sections.

While the agitator provides thorough and intimate mixing of the two liquid phases, the wire mesh packing serves the primary purpose of coalescing and separating the phases as they emerge from each contact stage. At the same time there continues to be some countercurrent contact within the packed section and extraction therefore continues to take place. Thus, it is possible for any one stage (consisting of one agitator plus one packed section) to exhibit an efficiency in excess of theoretical. More commonly, however, extraction efficiency per stage is of the order of 80 per cent. The York-Scheibel column can therefore achieve a theoretical extraction stage within a height of approximately two ft., and the system is ideally suited for systems involving a low partition cœfficient.

Performance results with a column of this type have recently become available for the systems acetone/*o*-xylene/water and acetic acid/*o*-xylene/water[1]. The investigation was based on a three-stage column of 12-in. diameter, and it was shown that the stage efficiency increases as the agitator speed is raised. The efficiency reaches a maximum at agitator speeds in the range of 200-300 rpm. Above this value, performance drops again due to inability of the calming section to separate the highly intermixed phases within the allotted space.

A Vast Improvement

Similarly, the stage efficiency increases to a maximum as total liquid throughput is raised. Depending on the properties of the solutions, the column had a capacity of 350 to 600 gal. per hour per sq. ft., before flooding interfered with satisfactory operation. Optimum extraction performance was just below flooding velocity. This limit is subject to adjustment by variation of the type and height of packing employed in the calming section and of the speed of agitation. The height required for a theoretical stage was found to be in the range of 9 to 16 in. at optimum conditions—certainly a vast improvement over the performance of standard packed extraction columns.

Much interest has been shown during the past few years in pulse extraction columns—a wholly new development in the field. In columns of this type, reciprocal motion is imparted to both liquids in the tower by means of an external power source—a reciprocating piston or diaphragm. Both packed and perforated plate extraction columns have been operated in this fashion and it has been shown that the column height required to effect a given extraction can be reduced by a factor of five by employment of this technique.

In the case of perforated plate columns, the plate opening is chosen of such small size that the density difference alone is not sufficient to cause counterflow of the two phases.

Density difference serves to provide countercurrent flow in the sections between the plates. On each downward impulse, supplied to the system by external mechanical means, the heavier phase is drawn through the plate perforations to be dispersed through the light phase in the next-lower section. Similarly, the light phase is dispersed through the heavy phase of the next-higher section on the up-stroke. By increasing the pulse rate, however, it becomes possible to maintain a state of dispersion throughout the column.

Four Primary Variables

Four primary variables determine the behaviour of such a column: flow rates, pulse amplitude, pulse frequency, and choice of continuous phase. The effect of these variables has recently been evaluated by Cohen and Beyer[2] for the system *iso*-amyl alcohol/boric acid/water. Flooding was found to occur at a holdup ratio of 0.30 when a pulse rate of 17 cycles per min. was employed, while an increase of pulse frequency permitted eventual deferment of flooding to a holdup ratio of 0.50 ('Holdup ratio' is defined to be the volume of discontinuous phase per volume of continuous phase in the column). The height equivalent to a theoretical stage ranged from 9.9 in. upward. As the flow rate of the dispersed phase was increased, the HETS first passed through a maximum and then through a minimum value before flooding velocity was reached.

Extraction efficiency is greatly increased as either amplitude or frequency of the pulse is raised. The two variables are interdependent and a good correlation could be obtained between the extraction efficiency and the product of pulse frequency and amplitude (i.e. the total volume pulsed per unit time.) For any given frequency, there is a definitely limited range of amplitudes within which operation is possible without excessive emulsification. As in other types of extraction columns, the selection of the proper continuous phase influences section efficiency significantly.

The Podbielniak centrifugal extractor is a member of an entirely different type of liquid-liquid extraction unit. In units of this type the two phases are forced to move countercurrently through a perforated ribbon spiral which is rotated at 2,000 to 5,000 rpm. Units of this type are expensive in first cost and operation. However, they offer certain unique advantages. Thus, such centrifugal units can operate multiple (up to 20)—stage extraction with liquids which are in contact for only a fraction of a second. They are ideally suited for use with liquids which exhibit only low density difference or a tendency to emulsify. The ability to handle such systems effectively and practicably in a centrifugal field greatly widens the scope of solvents which may be applied for a given service.

Units of this design are available in capacities up to 20,000 gph. (up to five stages) and for throughputs of 5,000 gph. (up to 20 equilibrium stages). Space requirements are low. Commercial application of these units has, so far, been largely confined to special cases, notably in the pharmaceutical industry. However, recent exploration indicates that there is a field of usefulness for centrifugal extractors in the petroleum and petrochemical industries as well.

[1] E. G. Scheibel and A. E. Karr, *Ind. Eng. Chem.*, 1950, 49, 1048.

[2] R. M. Cohen and G. H. Beyer, *Chem. Eng. Prog.*, 1953, 42, (June), 279.

Canadian Cement Industry

A warning that the outlook for the Canadian cement industry 'does not appear as promising as in 1953,' was given recently by Mr. J. M. Breen, president of Canada Cement Co. The defence construction programme was nearly complete, he said, and hydro-electric development would require only half the 1953 volume of cement. Mr. Breen added: 'Undoubtedly we face foreign competition to an increasing extent.'

Zinc Alloy Die Castings

BSI Kite Mark Introduced

THE British Standards Institution and the Zinc Alloy Die Casters Association have together drawn up a certification mark scheme for zinc alloy die castings. Customers can now order castings guaranteed to be made under strictly controlled conditions subject to inspection by the BSI and complying with the exacting requirements of British Standard 1004, which was published in 1942 to safeguard the quality of ammunition components made from zinc alloy die castings.

Zinc alloy die casting is a quantity production process used in many industries to make parts, often complicated in design, which are strong and durable. To ensure that these qualities are realised to the full, it is absolutely essential to use only zinc alloys of carefully controlled composition. If certain impurities, notably lead, tin, and cadmium, are allowed to contaminate the alloy—even to the extent of a few parts in 100,000—the future behaviour of the castings becomes uncertain.

A Guarantee of Reliability

The purpose of the Certification Mark scheme just announced is to give the customer a guarantee that if he orders die castings from a firm licensed under the scheme, he will receive reliable castings complying with British Standard 1004. Wherever possible the castings will carry the Kite-mark, 'BS. 1004' and the die caster's name, trademark, or BSI licence number. Castings too small to be marked individually will be supplied in specially labelled boxes.

The new Certification Mark scheme will be widely publicised both by individual licensees and by the Zinc Alloy Die Casters' Association, which has sponsored it. Many firms have already had their works inspected by the British Standards Institution and have been granted licences to use the Kite-mark. The Association's own advertisements will include a list of members who are licensed and the list will be kept up-to-date as other members come into the scheme.

If the BSI finds that a licensee is supplying castings outside the specification, he will be warned and, in persistent default, will forfeit his licence. Participation in the scheme is open to any die caster, whether or not a member of ZADCA, who is willing and able to comply with the conditions. Full particulars are obtainable from The British Standards Institution, British Standards House, 2 Park Street, London, W.1.

Canadian Cobalt

RECENTLY appointed an official agent of the Government of Canada for the purchase of cobalt ores and concentrates. Cobalt Chemicals Ltd. has started full-scale operations at its new plant at Cobalt, Ont. A subsidiary of Ventures Ltd., the company, which is managed by Quebec Metallurgical Industries Ltd., has a contract with General Services Administration, an agency of the US Government, for the refining of concentrates acquired under the Government purchasing programme.

This contract came into effect recently when the first delivery of Government-allocated concentrates was made to the plant by the Silver Miller mine. Another of the larger producers in the area, Cobalt Consolidates, is shipping all its concentrates to the new refinery. Cobalt Chemicals has a present capacity of 15 tons per day of raw concentrates. Design of equipment and buildings is such that capacity could be increased to 35 tons daily with moderate additional capital outlay.

Gas Industry & Coal Prices

THE gas industry has been impelled to look for sources of supply other than coal—especially oil and natural gas—as a result of the high cost of coal, according to Col. Sir Harold Smith, chairman of the Gas Council. Speaking at a Coal Industry Society luncheon last week, he said that whereas coal prices to the domestic consumer had increased by 160 per cent since 1938, to the gas industry they had increased by 300 per cent.

'If,' Sir Harold continued, 'the prices of coal to the gas industry, as compared with the prices for other uses, were back on the 1938 competitive basis, and ample supplies were available, we should not be so tempted to look for processes which do not require coal. We know of no more efficient way of using coal than by carbonising it and recovering the by-products.'

Ultra-Violet Light in Industry

Many Uses Demonstrated in Exhibition

AN exhibition of ultra-violet apparatus for scientific and industrial uses was held from the 15-26 February, by Hanovia Ltd., in conjunction with the Midlands Electricity Board, at the Board's Industrial Showroom in Birmingham.

It should be borne in mind that the term 'ultra-violet' covers a very wide band of wavelengths, ranging from 4,000 to less than 1,000 angstrom units, and that not all the wavelengths are equally effective for the provocation of a given effect. The importance of choosing the right wavelength for the job in hand will become apparent in the discussion which follows, covering the various applications already in use.

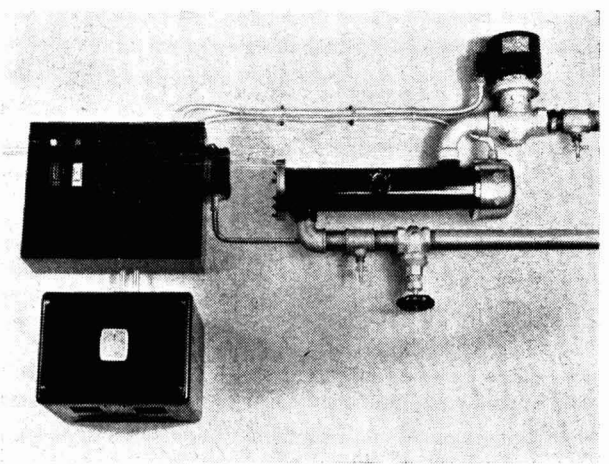
In certain cases the process of polymerisation can be initiated or accelerated by the action of suitable radiation. For example, in the manufacture of patent leather, a suitable liquid varnish is applied to the leather, which is then exposed to the radiation from mercury arc lamps, which causes the coating to polymerise to the flexible texture of patent leather. In the aircraft industry, similar use is made of the ultra-violet radiation from mercury vapour lamps in the 'cold welding' of perspex sections for the formation of aircraft turrets.

In many industries, particularly those concerned with the finishing of products, e.g. paint manufacturers, leather and leather-cloth makers, packaging printers, etc., manufacturers wish to know whether their products will stand up to continued exposure to strong sunlight. By means of a powerful ultra-violet lamp, such as the Hanovia U.V.S. 500, the effects of many months exposure to tropical sunshine can be simulated in a few hours.

In the processes mentioned above, the radiation employed is confined to the upper end of the ultra-violet band. It has been demonstrated, however, that radiations of a shorter wavelength with a peak in the neighbourhood of 2,600 angstrom units are highly bactericidal, and will destroy all known forms of bacteria, viruses and moulds. To utilise this effect, special mercury vapour discharge tubes are employed, which have an output almost entirely of radiation at 2,537 A.

Such tubes are widely employed in a variety of situations for the disinfection of air. They are particularly valuable for protecting foods and pharmaceutical products from airborne contamination during storage and during packaging.

The same principle is employed in the Hanovia water steriliser, which is capable of treating up to 2,000 gal. per hour of contaminated water without changing in any respect its taste or chemical properties. Such a process is of particular value in situations where the use of chlorination is forbidden or undesirable.



The Hanovia water and fluid steriliser, Model 5. In the horizontal barrel liquids exposed to a 1,100-watt AC arc tube are sterilised at over 1500 gal. (6820 l.) per hour

Probably one of the most widespread uses of ultra-violet rays in science and industry is the application of the phenomenon of fluorescence. The lamps fall into two main classes, those employing the high-pressure mercury vapour arc, with its rich output of radiation at a wavelength of 3,600, together with a black glass filter, known as 'Wood's glass'; and the low-pressure discharge tube in quartz with a maximum output at 2,537 A, again together with a suitable filter for removing the visible light.

The long-wave radiation can be used for chemical analysis, for distinguishing between various strains of barley, for the detection of minute traces of adulterants in food stuffs and other materials. In medicine it can be used for the diagnosis of certain skin diseases. The leather industry use the lamp to detect adulteration of natural tanning agents with synthetic tanning agents.

A further development of very widespread interest is the use of the fluorescence lamp in conjunction with suitable fluorescent inks for the detection of cracks and porosity in metal castings and plastic and ceramic mouldings. The article to be examined is immersed in a fluorescent fluid with high penetrating qualities. The ink is then washed from the surface of the object, but any cracks or flaws retain a residue which becomes immediately visible when examined with the fluorescence lamp.

Seaweed Processing

THERE has been a steady expansion of the seaweed processing industry in Scotland, demonstrated by the introduction of new products in which seaweed derivatives have been used as a basic ingredient. One of the latest in the field is a hand lotion from Moray Firth Seaweed Products Ltd., of Geddes, Nairn, and Orkney, who manufacture a wide range of seaweed products. Established some three and a half years ago, this firm concentrated first on the feeding stuff and fertilising applications of seaweed and have now reached the point where production is being very fully taken up. Work is now being done on the subsidiary aspects and on development of new lines.

A later development still is the production of seaweed tablets for human consumption. These tablets contain a blend of seaweed 'selected for their health-promoting properties.'

Microchemical Apparatus

Five New Parts of British Standard

THE British Standards Institution has now published five further parts to the British Standard for Microchemical Apparatus (BS. 1428:1954), publication of which was started in 1950.

Part B2, 'Ammonia Distillation Apparatus,' specifies a steam-jacketed ammonia distillation apparatus of the Markham type. A ground glass joint connection between the distillation vessel and condenser is permitted as alternative to the one-piece type. A detailed drawing is included, and dimensions are given for the guidance of manufacturers.

Part C1, 'Alkoxyl & Alkylimino Group Determination Apparatus,' specifies components for use in the micro-determination of alkoxyl groups by the Zeisel method and of alkylimino groups by the Friedrich method. Alternative types of Zeisel apparatus are described, with or without ground glass joints and with or without a spiral in the receiving vessel. Fully dimensioned drawings are included for all components.

Part C2, 'Acetyl Group Determination Apparatus,' specifies components for use in the micro-determination of acetyl and C-methyl groups by the Wiesenberger method. The flask, stillhead and condenser are connected by ground glass joints. A fully dimensioned drawing is included.

Part D4, 'Capillary Pipettes,' consists of a revised edition of BS. 797. To the six sizes (0.005 to 0.2 ml.) of one-mark pipettes in the 1938 edition have been added 0.1, 0.2 and 0.5 ml. graduated pipettes calibrated for delivery and the same three sizes calibrated for content. The construction, graduation, tolerances and inscriptions are specified, together with the essential dimensions, while other dimensions are included for the guidance of manufacturers.

Part E3, 'Micro-centrifugal Tubes,' specifies the construction and dimensions of two types and six sizes of glass micro-centrifuge tube and indicates certain essential and recommended features of centrifuge buckets for use with them.

Copies of these new parts of BS. 1428 may be obtained from the British Standards Institution, 2 Park Street, London, W.1. Parts B2, C2 and E3 are 2s. each and D4 and C1 2s. 6d. each.

Italians Tour UK

Journalists Guests of Foreign Office

A GROUP of six Italian journalists arrived in London on 4 March and are now in the middle of a two-week tour of Britain, arranged by the Tours and Facilities Section of the Central Office of Information on behalf of the Foreign Office. Before 18 March the party will have visited the National Institute for Medical Research; the Chemical Research Laboratory; Shirley Institute, the British Cotton Industry Research Association; Jodrell Bank Experimental Station; Metropolitan-Vickers Electrical Co. Ltd.; and the National Physical Laboratory. Visits will also be paid to a Welsh coal mine, various factories and the Steel Company of Wales.

The Italian journalists are Dr. Rinaldo de Benedetti, editor of *Illustrazione Scientifica;* Signor Domenico Beretta, special correspondent of *Sapere;* Professor Bruno Minoletti, editor of *La Marina Mercantile*; Dr. Andrea Rapisarda, *Civilita Delle Macchine*; Dr. Giuseppe Ratti, assistant editor of *Produttivita;* and Dr. Mario Tonelli, technical editor of *L'Informazione Industriale.*

Foreign Office Reception

On Tuesday evening, 8 March, the party were guests of honour at a Foreign Office reception in London at which Mr. J. W. Nicholls, C.M.G., O.B.E., Assistant Undersecretary of State, was host. Also present on this occasion were several members of Parliament, officials of the Foreign Office, members of the Italian Embassy, Italian correspondents in London, officials of the Department of Scientific and Industrial Research, representatives from the BBC and several national newspapers, and the editors of a dozen trade and scientific journals.

Among those present from the DSIR at the reception were:—Dr. Alexander King, European Scientific Co-operation; Mr. Winston Rodgers, Methods Engineering, Productivity; Mr. R. Ashton, Chemical Engineering Research; Mr. W. L. Francis and Mr. J. J. Beattie, Research Associations; Mr. R. C. Herbert, Press Officer; Col. W. G. Hingston, Chief Information Officer; Mr. J. Knox, OEEC; Mr. A. L. Thorogood, Application of Research by Industry; Mr. J. R. Gass, Human Relations Research; Dr. G. Mallock, Canadian Scientific Liaison Officer; Mr. E. D. T. Jourdain, Head of Scientific Secretariat; Mr. G. A. Dreyfus, Application of Research by Industry; Mr. D. Neville Jones, Research on Scarce and Waste Materials; Mr. C. S. Goodwin, Agricultural Research Council; Dr. D. M. C. MacEwan, Rothamsted Experimental Station; Dr. F. J. C. Herrald, Medical Research Council; Mr. W. A. Allen and Mr. R. W. B. Nurse, Building Research Station; Dr. L. A. Sayce, National Physical Laboratory; Mr. K. R. Butlin, Mr. J. R. Postgate and Mr. W. S. Greaves, Chemical Research Laboratory; Mr. J. E. C. Coventry, Central African Federation Scientific Liaison Officer; and Mr. J. P. De Wit, South African Scientific Liaison Officer.

Modern Production

THE Industrial Division of Philips Electrical Ltd., have prepared a new film 'A New Approach to Production Improvement,' with the co-operation and help of 17 widely differing industrial undertakings. This black and white sound film runs for approximately 50 minutes.

The film opens with an introduction to the Philips Industrial Application Centre. After a brief introduction to various systems of joining and heating metals, we are shown different types of resistance welding equipment. Next the film deals with the application of electronic measuring instruments in industry. This is followed by a quick survey of methods used for the removal of unwanted contamination from fluids.

After seeing how new production processes are originated, we are shown many ingenious applications of high frequency heating in industry, and the applications of dielectric loss heating to wood, plastics and other materials are also touched upon. The last part of the film consists of a survey of arc welding.

Copies of this film are available in 16 mm. and 35 mm. sound, black and white. They will be loaned free of charge to Film Societies, Engineering Societies, Technical Colleges, industrial undertakings, etc. Applicants are requested to write to the Industrial Application Centre, Philips Electrical Ltd., 122 Brixton Hill, London, S.W.

HOME

IChemE Associate Membership

Application forms (returnable 1 June) and particulars of the 1954 associate membership examination of the Institution of Chemical Engineers may be obtained from the secretary of the Institution, 56 Victoria Street, London, S.W.1.

Rayon Research

The British Rayon Research Association has started to move into its new laboratories at Wythenshawe, near Manchester. It is expected that the move will be completed by the end of the summer. All the fundamental research will be carried out in the new laboratories, but a small laboratory has been equipped at the London headquarters so that the staff can concentrate on the end uses of man-made fibres.

Fertilisers & Feeding Stuffs Act

Two papers on the Fertilisers & Feeding Stuffs Act are to be read at a meeting of the Fertiliser Society in the lecture hall of the Royal Society of Tropical Medicine & Hygiene, Manson House, 26 Portland Place, London, W.1, on 25 March at 2.30 p.m. They are: 'Some Legal Aspects of the Act,' by J. D. Westlake, and 'Some Effects of the Act on Fertiliser Manufacturers,' by Dr. J. Manning.

Private Trade in Vegetable Oils

The Ministry of Food announced this week that private imports of all oilseeds and vegetable oils, at present imported only by the Ministry, will be resumed on 1 June next, after a break of 15 years. From that date, states the Ministry, traders will be able to buy most types of oilseeds and vegetable oils freely from any source of supply.

Tungsten Sales Freed

The restoration of tungsten ores and concentrates to free dealing on 1 April was announced in the House of Commons last week by Mr. Heathcote-Amory, Minister of State, Board of Trade. He said private imports would be permitted from all sources except the dollar area, but during the early months of private trading consumers would be able to obtain a considerable part of their requirements from the Ministry's stocks. Arrangements to this end had been made with the co-operation of the trade.

Works Band Wins Prize

Clayton Aniline Works Band, Manchester, gained third prize in a north western area brass band contest organised by a national newspaper and held in the Queen's Hall, Preston, recently. Mr. E. C. Buttress conducted the 25 players in their test performance. Nine other leading bands competed.

Copper Supply

The Ministry of Materials has announced that, as from 31 May next, the Government Broker for copper will cease to operate. The Ministry consider that by the end of May consumers will have had adequate opportunities to make their own supply arrangements and there should no longer be any need for official support of the market.

Navy's New Submarine

An Admiralty announcement last week revealed that the submarine 'Explorer,' launched on 5 March at Barrow-in-Furness, will be powered by engines of a new type, using hydrogen peroxide as a fuel. These closed-cycle high-test peroxide engines are expected to give a maximum underwater speed of more than 20 knots.

Export of Drugs and Chemicals

In the House of Commons last week the President of the Board of Trade, Mr. Peter Thorneycroft, was asked what restrictions are still placed upon the export of antibiotics, pharmaceutical drugs and fine chemicals to Eastern European countries, and what steps he proposed to take to free such commodities from any embargo. He replied that there are no restrictions on the export of antibiotics and pharmaceutical drugs, or chemicals of primarily medicinal use, to Eastern European countries.

Harwell Extensions

A new wing which has just been added to the radiochemical laboratory at the Atomic Energy Research Establishment, Harwell, will extend the facilities for work on chemical and metallurgical problems involved in designing new types of reactors for power production. The chemists, metallurgists and engineers have begun studying several new schemes by which it is hoped that power may be released from fissile material more cheaply and more economically.

OVERSEAS

Not One Day Lost

Included in the 1953 annual report of the Mathieson Chemical Corporation, Baltimore, Maryland, USA, is the following: 'Relations with the corporation's employees continue at a high level of understanding and co-operation, and another year has passed without a single workday lost because of disagreements.'

Tin Conference

New uses and applications of tin were discussed by French and other metallurgists at a conference organised by the Tin Research Institute in Paris this week. The speakers included Dr. J. W. Cuthbertson, assistant director of research at the Tin Research Institute, and Dr. E. C. Ellwood, chief metallurgist at the Institute.

India's Largest Oil Refinery

The largest fractionating column ever to be shipped from the United Kingdom to India left the Port of London recently on a 6,000-mile voyage to the new Bombay oil refinery of Burmah-Shell Refineries Ltd. Burmah-Shell Refineries Ltd. (jointly owned by Shell and Burmah Oil Company) are now constructing a £20.000.000 oil refinery on Trombay Island, Bombay. On its completion in early 1955, it will have a crude distillation capacity of 2.000.000 tons a year, making it the largest refinery in India.

Urea from Eastern Europe

Urea for Britain's plastics industry will soon be coming from an additional source—from behind the Iron Curtain. Samples (46.3 per cent N) were flown recently from Bulgaria to London, where they were examined by many importers interested in obtaining additional supplies. The samples were found to be completely satisfactory, and negotiations have already commenced. The Bulgarians have stated that several hundred tons can be shipped immediately, and over the next four or five years some thousands of tons may be sent. Prices asked for by the Bulgarians were considered reasonable by the British firms interested in the deal, and it is unlikely that there will be any difficulty in obtaining licences or Bank of England sanction for currency to complete the transaction.

Punjab Steel Plant

Following a report by German experts, a steel plant with an annual capacity of 50,000 tons is to be set up in the Punjab, according to *Pakistan News*.

Chlorine Plant in Poland

A Castner-Kellner chlorine and sodium hydroxide plant has recently been opened in the Azot Chemical Works, Jaworzno (Cracow Voivodship), Poland. This will be of considerable importance in the production of plant protection chemicals.

Ore Plants in Greece

The firm of Fried. Krupp of Essen is to erect metallurgical and ore-dressing plants for nickel ore mined near Larymna, Greece. About 180,000 tons of ore will be processed yearly, and Krupps will buy part of the metal produced.

Sulphuric Plant for Peru

Sulphuric acid plant built in Baltimore has been shipped to Lima by the Pan American Consulting Co. to meet acid requirements for viscose rayon manufacture. Acid produced will also be supplied to other industrial users in Lima and nearby.

Uranium Contract for British Firm

The contract for the erection of a £2,000,000 uranium plant at the Dominion Reefs mine in South Africa has been awarded to the British firm of John Laing & Son, who built the atomic works at Windscale in Cumberland, and are at present engaged in the erection of the first British atomic power station.

Austria's Iron Ore Output

2,856,630 tons of iron ore were mined in Austria in 1953, as against 2,652,588 tons in 1952. The bulk of the output went to the Austrian iron and steel works at Donawitz, Styria, and Linz, Upper Austria; 195,378 tons were exported to Germany.

Research in Norway

Eleven new research institutes created since the war have booked laboratory and office space at the industrial research centre now being built at Blindern, Oslo. They include the Central Institute for Industrial Research, which is financed chiefly by a share of the State football pool profits.

PERSONAL

DR. R. BELCHER, senior lecturer in analytical chemistry at the University of Birmingham, has been invited by the Oesterreichische Gesellschaft für Mikrochemie to give lectures in Vienna, Graz, Innsbruck and Linz.

MR. A. W. HARRINGTON, director of Stanton Instruments Ltd., returned to this country on 11 March from a business tour of the USA and Canada. He visited the company's dealers in New York, Washington, Pittsburgh, Montreal, Toronto and other towns.

PROFESSOR OTTO HAHN who, in January, 1939, first obtained chemical evidence of the fission of uranium atoms by neutrons, celebrated his 75th birthday on 8 March. To mark the occasion, Professor Hahn was awarded the Grand Cross, Second Class, of the Order of Merit of the Federal German Republic. At the same time, he was invested with the Harnack medal of the Max Planck Society, of which he is president.

MR L. ANDERSON, F.R.I.C., M.I.Chem.E., a director of Boots Pure Drug Co. Ltd. and production manager of Fine Chemicals and Antibiotics, will be retiring on 31 March, and MR. S. HARKER-SMITH, T.D., M.A., has been appointed to the board as from 1 April. MR. E. A. HARVEY, M.Sc., F.R.I.C., has been appointed a director of Boots Cash Chemists (Eastern) Ltd.

Following Mr. Anderson's retirement, MR. H. S. HIBBINS, F.P.S., will now be the director of all production for Boots Pure Drug Co. Ltd., MR. K. H. HARPER, M.A., M.P.S., will become production manager of pharmaceuticals, and Mr. E. A. Harvey will be production manager for fine chemicals and antibiotics.

SIR ARTHUR SMOUT, a former director of Imperial Chemical Industries Ltd., has accepted the chairmanship of British Industries Fair Ltd., the new company which is to take over the BIF after this year's fair. For many years he was on the Fair Management Committee of Birmingham Chamber of Commerce. During the war he was Director of Ammunition Production at the Ministry of Supply.

MR. E. A. S. ALEXANDER, who is among new members of the Council of Industrial Design appointed by the President of the Board of Trade, is chairman of the Association of British Glass Manufacturers, managing director of United Glass Bottle Manufacturers Ltd. and a director of John Lumb & Co. Ltd. He is also on the board of management of the Pottery & Glass Trades Benevolent Institution.

MR. BERTRAM WHITE, a director of A. Boake, Roberts & Co. Ltd., has been appointed deputy managing director of the company.

MR. ERIC VERO, research manager of Fisons Research Laboratories at Loughborough, who for a number of years has been associated with Loughborough Glass Co., Ltd., as technical consultant, has been appointed to the board of the latter company, which is a member of the Fison group of companies. Mr. Vero graduated from Manchester University, where he acquired practical experience in glass-blowing, and later worked at Battersea Polytechnic and the Sir John Cass Institute. Loughborough Glass Co. manufactures laboratory and industrial glassware and also supplies a complete range of general laboratory apparatus.

In accordance with developments envisaged at the time of the formation of Telcon Telecommunications Ltd. (owned jointly by Mullard Ltd., and The Telegraph Construction & Maintenance Co. Ltd.), MR. J. INNES, a director of the latter company, has relinquished the managing directorship and his directorship of Telcon Telecommunications Ltd., but will continue to act as consultant to the board. MR. C. L. G. FAIRFIELD, Telcon's general sales manager, has been appointed a director as one of the three Telcon representatives on the board. MR. W. SAMPSON has been appointed executive director and will take over Mr. Innes' managerial duties.

Under the terms of the offer made by Fisons Ltd. for the ordinary shares of Pest Control Ltd., it is proposed that MR. F. G. C. FISON (chairman of Fisons) shall become chairman of Pest Control in place of MR. R. ADEANE, and that MR. D. J. BIRD and MR. A. WORMALD, who are also directors of Fisons, shall join the board. Subject to the stockholders' approval, it is proposed to pay Mr. Adeane £2,000 as compensation for loss of office. DR. W. E. RIPPER, founder of Pest Control and its present managing director, has agreed to continue as a director and it is proposed that he be appointed a vice-chairman. He will cease to be managing director and will surrender without compensation his existing agreement under which he is entitled to a fixed salary of £2,500 a year and a commission of 2½ per cent on the net consolidated profits. He will be appointed scientific adviser at a fixed salary of £5,000 a year. Under certain existing licence agreements, Dr. Ripper is entitled to receive royalties of £1,100 per annum plus 5 per cent of the net consolidated profits. If the offer becomes effective Dr. Ripper's rights under agreements will be commuted by payment to him of £50,000 and Dr. Ripper will have the option (subject to Treasury consent) to subscribe for not more than 129,032 ordinary shares of 5s. at 7s. 9d. per share. Any shares so subscribed will be acquired by Fisons on the same terms as those now offered. DR. E. PARRY JONES will continue as a director. MR. DAVID KINGSLEY will remain on the board until 30 June. MR. O'NEIL DUNNE will resign as director and general manager as soon as the offer becomes effective.

Obituary

The death has occurred of COL. SIR PAUL GUETERBOCK at the age of 67. He was managing director of Capper Pass & Son, the tin and lead smelters, and a past-president of the Institute of Metals.

The death occurred on the night of Sunday, 7 March, of PROFESSOR OTTO DIELS, Emeritus Professor of Chemistry in the University of Kiel, and joint winner of the Nobel Prize for chemistry in 1950. He was 78. The name of Professor Diels will survive for ever in organic chemistry: coupled with that of Alder, his fellow prizewinner, in the diene synthesis; and in 'Diels' hydrocarbon,' the fundamental hydrocarbon produced by hydrogenation of the sterols.

The Diels-Alder reaction is widely used in the synthesis of drugs, dyes and plastics, and has proved one of the most useful methods of organic chemistry.

We regret to record the death, which occurred at his home on 3 March, of DR. PERCY CLAUDE CAMERON ISHERWOOD, O.B.E., Ph.D., F.R.I.C., chairman and managing director of W. J. Bush & Co. Ltd. He was 76. Dr. Isherwood was first associated with the heavy chemical industry, serving in turn with the United Alkali Co. Ltd. and Brunner, Mond & Co. Ltd., but his subsequent career was synonymous with the growth of the fine chemical industry.

In 1901 he was appointed chemist-in-charge of the Ash Grove and Mitcham factories of W. J. Bush & Co. and became a director of the company in 1915. A notable contribution to the nation's chemical requirements during the first world war was made by Dr. Isherwood in 1916, when, in order to help remedy the shortage of pure zinc, he erected and operated a plant under his own patents at the Bush factory at West Bank, Widnes. In recognition of these services he received the O.B.E.

In the course of his duties with W. J. Bush & Co., Dr. Isherwood travelled extensively on the continent of Europe, in Canada and the USA. On the death of Mr. A. E. Bush in 1935 he was appointed joint managing director of the company and when Mr. J. M. Bush died in 1941 he became chairman.

From 1943 to 1945 Dr. Isherwood was chairman of the Association of British Chemical Manufacturers and president from 1947 to 1949. He was elected chairman of the British Essence Manufacturers' Association in 1941. He was also a Fellow of the American Chemical Society.

Publications & Announcements

MORE articles than usual have a chemical interest in *Science News 31*, published by Penguin Books Ltd. In 'Why Chemical Engineering?' J. F. Pearson, lecturer in the University of Manchester, describes the basic concepts and methods of the chemical engineer; R. F. Homer, who carries out research in chemotherapy for I.C.I., writes on 'Chemical Radiomimetic Agents and Cancer'; chemical control of weeds is described by R. N. Higinbotham; and there are a number of illustrations connected with the recent celebration of the 150th anniversary of the discovery of palladium.

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USES for peroxides as oxidisers and free radical sources for polymerisation catalysis are constantly increasing, and a number of new leaflets on their uses have recently been issued by Laporte Chemicals Ltd., Luton. Organic peroxides now manufactured by this company and described in the leaflets comprise benzoyl, di-*tert.*-butyl, and methyl ethyl ketone peroxides; *tert*-butyl hydroperoxide; peracetic acid; and *tert.*-butyl perbenzoate.

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VOL. III, No. 4, of *Colonial Plant and Animal Products* (Pp. 390, HMSO, 5s.) contains articles on stills for essential oils, an experiment on the curing of Sudanese sheepskins, and the production of cellulose pulp from Commonwealth raw materials; reports on investigations of sage leaves from Cyprus, sisal wax from Kenya, and hibiscus fibre from Tanganyika; book reviews and a bibliography; and the index to Volume III.

* * *

THE eighth Dalton lecture of the Royal Institute of Chemistry was delivered by Sir John Cockcroft on 'The Development of Radiation Chemistry and Radiochemistry' in Manchester on 27 November last. The lecture has now been published, and is obtainable from the Institute at 30 Russell Square, London, W.C.1.

* * *

FRESHWATER fish cultured in ponds provide an important source of food in countries where, for geographical or economic reasons, the supply of sea fish has presented difficulties. In these countries the science of fish farming, including pond manuring, has reached a high level. Fish culture occupies a most important place in the fishery development plans of the Colonial Office, who have just published 'Fertilisers in Fishponds,' a review and bibliography (HMSO, 25s.). This consists of a review, prepared by Dr. C. H. Mortimer in 1940, of abstracts on the effect on a pond of fertilisation with nitrogen, phosphorus, potash, lime, etc., and with sewage effluent. To this Dr. C. F. Hickling, Fisheries Adviser to the Colonial Office, has added important results published since 1940.

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AMONGST additions to the BDH catalogue during February were sodium sesquicarbonate and 2-(*o*-hydroxyphenyl)-benzoxazole. The latest monograph in the series of technical bulletins describes the properties and applications of dimethylglyoxime. Copies may be obtained free on request to BDH Laboratory Chemicals Group, Poole, Dorset.

* * *

LATEST Road Research Laboratory Technical Paper is No. 28, 'The Rheology of Non-aqueous Suspensions.' This paper summarises the more fundamental aspects of investigations carried out at the laboratory over a number of years into the properties of two-phase systems consisting of fine mineral powders dispersed in tars or bitumens. (HMSO, Pp. 50, 2s.)

* * *

A REVISED booklet on chemical and mining engineering and fuel technology has been issued by the Ministry of Labour and National Service as No. 19 in the 'Careers for Men & Women' series. All the sections give revised information not only about the scope, pre-entry qualifications and training arrangements, but also of the opportunities in the various branches of the engineering profession were discussed. It points out that for those who have obtained the appropriate professional qualifications there is a wide variety of opportunities in the chemical, plastics, petroleum, food processing and rayon industries, as well as with the engineering firms specialising in the construction of chemical plant. Copies of the booklet, price 1s. 6d., are obtainable from HM Stationery Office or any bookseller.

HOW combination processing (which means the integration of a number of different refining steps into a single, continuous, centrally-controlled operation without intermediate storage) can slash more than 20 per cent from investment costs in building today's new oil refineries is revealed in 'Kellogram No. 1' just published by the M. W. Kellogg Co., New York City, international contracting-engineering subsidiary of Pullman Incorporated. According to Kellogg, skillful integration of a refinery can cut the cost of processing equipment from five to 15 per cent, and the cost of off-site facilities (utility systems, tankage, etc.) by as much as 40 per cent. These savings add up to the possibility of erecting a complete new combination refinery for a total of from 20 to 25 per cent less than the cost of building a comparable unit-by-unit refinery. Equally impressive savings are to be had in direct operating costs of the combination refinery, including such items as labour, fuel, power, steam, water and maintenance.

* * *

LANKRO Chemicals Ltd., Salters Lane, Eccles, Lancs., are now manufacturing a comprehensive range of non-ionic surface active agents. This range comprises a series of products in the following groups: fatty alkylolamides, alkyl aryl polyglycol ethers, alkyl polyglycol ethers and alkyl polyglycol esters. These products have a very wide range of usage, but the company are particularly paying attention to their possible uses as emulsifying agents in industry.

* * *

AN up-to-date edition of their catalogue dealing with steel pipes for water, gas, sewage and air, has just been published by Stewarts & Lloyds Ltd., Brook House, Upper Brook Street, London, W.1. Consisting of 200 or so large pages, profusely illustrated, this new edition differs in the main from the previous one (published in 1938) in the alterations in standard outside diameters and thicknesses of the pipes and in the formulae for calculating the flow of water. It is pointed out that to obtain economy in steel, the minimum thickness of pipe suitable for the required working conditions should be used. The 'S. & L.' modern surface protections, it is claimed, make it perfectly safe to do this; they have been the subject of intensive research, are applied under strictly controlled conditions and provide the most effective means of resisting corrosive attack on the pipes either internally or externally.

* * *

FOR many years people have been using the normal incandescent tungsten lamp and, by usage, its rendering of the colours of many of the objects met in everyday life has become accepted as accurate. Because of this the colour rendering of other forms of lighting came to be compared, sometimes unfavourably, with that of the tungsten lamp. A new fluorescent lamp—the 'Deluxe Warm White'—has now been introduced, and it is claimed that this lamp not only blends very successfully with tungsten lighting but that it also gives a similar colour rendering. The manufacturers are Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2. Supplies are now available through electrical dealers.

* * *

BULLETIN No. 13 of the Tall Oil Association, 122 East 42nd Street, New York 17, includes an article on 'Tall Oil for Resins.' This points out that with tall oil at the top of the list of low-cost fatty and resin acid materials, resin chemists have had ample incentive for experimenting with tall oil, and claims that the growing consumption of this oil is clear proof that many have found the effort worth while.

* * *

ENTRY into the field of low tension control gear has been announced by G.W.G. Furnaces Ltd., of Dudley, Worcs., manufacturers of electric heating and melting furnaces, electrode boilers and steam raisers. They have acquired the sole licence to supply and manufacture, for the British Commonwealth, all control gear developed by Officine Meccaniche Riunite, Milan. This firm has achieved a high reputation on the continent with installations supplied to rubber firms, steelworks, chemical concerns and machine tool manufacturers, resulting in a phenomenal increase in production from 1947 to 1953. G.W.B. Furnaces Ltd. now supply complete panels ready wired and 'tailor made' to specification, also loose contactors, if required, for all purposes. Supplied in a standard range from 10-1,400 amp AC or DC, the contactors incorporate unique refinements, such as pivot bearings and sintered tungsten-silver contact faces giving a life up to 20 times that of conventional copper contacts.

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.)

BOWMANS CHEMICALS LTD., Widnes. 5 February, £25,000 debentures, to Branch Nominees Ltd.; general charge (ranking in priority to a Trust Deed dated 14 July, 1952). *£100,000. 12 June, 1953.

K. W. CHEMICALS LTD., London, W.C. 8 February, sub-mortgage, to Royal Bank of Scotland securing £5,000 and further advances not ex. in all £20,000; charged on land and factory at Dinting Glossop, with fixtures, benefit of contracts, etc.

LANCASHIRE CHEMICAL WORKS LTD., Manchester. 8 February, mortgage, to K. W. Chemicals Ltd. securing £5,000 and further advances not ex. therewith £20,000; charged on specified land and buildings at Dinting, Glossop, with fixtures, benefit of contracts, etc. (except etc.). *£3,996. 28 July, 1953.

SAMUEL BROS. (PLASTICS) LTD., Manchester. 9 February, debenture, to Barclays Bank Ltd. securing all moneys due or to become due to the bank; general charge. *£1,727. 5 November, 1952.

Satisfaction

BRITISH CELANESE LTD., London, W. Satisfaction, 10 February, of Trust Deed and supplemental deed respectively registered 2 October, 1943, and 8 November, 1944, to the extent of £6,038.

Increase of Capital

The following increase of capital has been announced:—EDWARD TAYLOR LTD., from £25,000 to £200,000.

Changes of Name

The following changes of name have been announced:—RIDINGS CHEMICAL PRODUCTS LTD. to PARKER CHEMICALS (SHIPLEY) LTD., on 1 February; G. W. SHERWIN LTD. to GEORGE STAPLES LTD., on 19 January.

New Registrations

H. A. Golding & Sons Ltd.

Private company. (529,333.) Capital £5,000. Importers, exporters, merchants, manufacturers, dealers in and commission agents for plant, machinery, metals, oils and chemicals. Directors A. Golding, M. D. Smith, G. Ingram, and F. W. Jones. Reg. office: 48 Moorgate Street, London, E.C.2.

Savant Chemical Laboratories Co. Ltd.

Private company. (529,398.) Capital £100. Manufacturers of and dealers in fire extinguishers, chemicals and chemical products and plastics, etc. First directors not named. Solicitors: Amphlett & Co., 6 Wine Office Court, London, E.C.4.

Sinclair Lindwall & Co. Ltd.

Private company. (529,410.) Capital £5,000. Analytical and manufacturing chemists, metallurgists, bullion dealers, etc. Directors: Gerald Sinclair, Stanley V. G. Lindwall and John A. Hulcoop. Solicitors: Carleton-Holmes & Co., 12 Bedford Row, London, W.C.1.

Sterilisation of Soils Ltd.

Private company. (529,890). Capital £5,000. Builders, timber merchants, general engineers, etc. Power is taken to carry on the business of industrial, analytical and consulting chemists and physicists, etc. Directors: David S. Grant, Leslie W. Lyon and Frank Foulger. Reg. office: 80a Scotter Road, Scunthorpe.

Company News

African Explosives & Chemical Industries Ltd.

Several adverse factors operated simultaneously to reduce the sales and profits of African Explosives & Chemical Industries Ltd. during the year ended 30 September last. This cannot be regarded as other than disappointing states the chairman, Sir Ernest Oppenheimer, in his annual review. He goes on to refer to the sharp drop in fertiliser sales because of severe drought; demand for explosives, etc., not reaching the levels estimated owing to the gold-mining industry not operating at full capacity due to shortage of native labour;

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and profits in the leather-cloth department declining owing to competitive market conditions, etc. Group manufacturing and trading profits declined by £302,386 to £1,769,262. An unchanged final dividend is recommended, making a total of 8 per cent for the year, against 10 per cent for the previous year.

Bakelite Ltd.

The board of Bakelite Ltd.—in which both Union Carbide & Carbon Corporation (USA) and Pinchin Johnson & Associates have a considerable interest, are recommending a final dividend of 9½ per cent for the past financial year. This is the same as for the previous year and makes a total of 12½ per cent. Group profit declined from £562,660 to £332,367. This was after all charges, including £87,986 special expenditure on the new factory.

Borax Consolidated Ltd.

The report of the directors of Borax Consolidated Ltd. for the year ended 30 September last shows group earnings of £1,290,495 before taxation, which compares with £1,267,610 for the previous year; after taxation, the figures are £617,192 (£510,521). Profits before UK taxation amount to £1,232,448 for the parent company, against £1,193,866 in 1952; net profit after taxation is £556,448 (£445,866). As a result of Inland Revenue decisions regarding the treatment for taxation purposes of exchange profits and of the profits of the company's foreign subsidiaries, reserves for taxation set up in previous years, totalling £371,763, have been released and of this sum £285,000 has been transferred to the exchange reserve. Having paid the dividends for the year on the 5½ per cent cumulative preference stock and the 6 per cent preferred ordinary stock, also an interim dividend at the rate of 2 per cent on the deferred ordinary stock, the directors now recommend payment of a final dividend on the deferred ordinary stock at the rate of 9 per cent.

General Refractories Ltd.

A preliminary statement of 1953 results of General Refractories Ltd. shows that group trading profits rose by £71,131 to £704,269 and the net taxed balance attributable to the group went up by £67,298 to £254,752. Unrequired taxation of £27,300 has been credited for 1953. The dividend for the year is 17½ per cent, an increase of 2½ per cent over the previous year.

Monsanto Chemicals Ltd.

In a letter to stockholders of Monsanto Chemicals Ltd., the chairman, Mr. Edw. A. O'Neal, Jr., states that the board has declared a second interim dividend on the ordinary stock of 13⅛ per cent (8d. per 5s. unit), less tax. The decision to pay a second interim dividend at the end of March has been made instead of recommending payment of a final dividend after the annual meeting. Group results (subject to completion of audit) show consolidated net profit of £750,059 for the year ended 31 December last, compared with £275,108 for the previous year. Turnover increased by 9 per cent, reaching the record level of £10,852,854. This was achieved despite reductions in selling prices of certain major product groups. In spite of keen European and American competition, exports again increased both in volume and in proportion of total turnover, the latter being approximately 40 per cent in 1953. The improvement in profit was largely due to increased sales volume, higher operating efficiency, and lower manufacturing and raw material costs on certain products. New construction has continued in line with the increasing demand for the company's products.

Revertex Ltd.

A preliminary announcement by Revertex Ltd. in respect of the year ended 30 September last, shows profit (after all charges, including taxation) amounting to £101,993, compared with £43,407 for the previous year. A final dividend of 15 per cent is recommended, this making 25 per cent for the year (same). At the annual meeting on 19 March a resolution will be proposed to enable the sum of £25,000 (part of the balance standing to the credit of the profit and loss account) to be capitalised and applied by issuing 100,000 new ordinary shares of 5s. each, credited as fully paid up, to the holders of existing ordinary shares in the proportion of one new share for every ten ordinary shares held.

Staveley Coal & Iron Co. Ltd.

An interim dividend of 4½ per cent, less tax, is being paid by the Staveley Coal & Iron Co. Ltd. on account of the year ending 30 June next This will be paid on the £6,770,712 ordinary stock as increased by a 100 per cent scrip issue and compares with an interim dividend last year of 8½ per cent on £3,385,356 capital.

Next Week's Events

MONDAY 15 MARCH

Chemical Society

Leeds: The University (Chemistry Lecture Theatre), 6.30 p.m. RIC lecture by Dr. G. J. Popjack: 'Chemistry, Biochemistry & Isotopic Tracer Technique.'

Society of Chemical Industry

London: Chemical Society's rooms, Burlington House, Piccadilly, 5.30 p.m. Crop Protection Panel meeting. R. L. Wain: 'Some Recent Developments in the Field of Plant Growth Substances.'

Institute of Metal Finishing

London: Northampton Polytechnic, St. John Street, E.C.1, 6.30 p.m. P. Spiro: 'Recent Developments Concerning Electroforming of Moulds.'

TUESDAY 16 MARCH

Royal Institute of Chemistry

Hatfield: Technical College, Roe Green, 7.30 p.m. Joint meeting with SCI (London Section). Professor H. W. Melville: 'New Kinds of Macromolecules.'

Society of Chemical Industry

London: Royal College of Science, South Kensington, S.W.7, 2.30 p.m. Agriculture Group meeting. Dr. G. W. Cooke and Dr. J. W. S. Reith: 'Recent Advances in Fertiliser Replacement.'

Incorporated Plant Engineers

Manchester: Engineers' Club, Albert Square, 7.15 p.m. Manchester branch annual meeting.

Cardiff: South Wales Institution of Engineers, Park Place, 7.15 p.m. Paper on 'Modern Hand Tools & Mechanical Aids.'

WEDNESDAY 17 MARCH

Society of Chemical Industry

Darlington: Technical College, 7.30 p.m. Joint meeting of Newcastle Section and Microbiological Group with RIC (Tees-side Section). P. W. Brian: 'Some Biological Aspects of the Production of Antibiotics by Micro-organisms.'

Incorporated Plant Engineers

Rochester: Bull Hotel, 7 p.m. Paper on 'Metal Spraying.'

Bristol: Grand Hotel, 7.15 p.m. Western Branch annual meeting and paper by W. A. Barber: 'Steam Flow Measurement.'

THURSDAY 18 MARCH

Chemical Society

Bristol: The University (Department of Chemistry), 7 p.m. Joint meeting with RIC and SCI. Dr. A. W. Sylvester: 'Patent Specifications Regarded as Chemical Literature.'

Edinburgh: North British Station Hotel, 7.30 p.m. Joint meeting with RIC and SCI for reading of papers.

Bangor: University College (Department of Chemistry), 5.45 p.m. Joint meeting with University Chemical Society. Professor H. N. Rydon: 'Some Problems in the Chemistry of Polypeptides.'

Society of Chemical Industry

London: Wellcome Research Institution, 183 Euston Road, N.W.1, 10 a.m. and 2.15 p.m. Chemical Engineering and Food Groups' conference on 'Chemical Engineering in the Food Industries' (continued next day).

London: Institution of Structural Engineers, 11 Upper Belgrave Street, S.W.1, 6 p.m. Road & Building Materials Group meeting. C. van der Poel: 'A General System Describing the Visco-elastic Properties of Bitumens & Their Relation to Routine Test Data.'

Teddington: Chemical Research Laboratory, Coleshill Road, 2.30 p.m. Microbiology Group visit, with presentation of papers and demonstrations.

Edinburgh: North British Station Hotel, 7.30 p.m. Meeting for reading short papers.

Institute of Welding

Chatham: Sun Hotel, 7.15 p.m. Medway Section meeting. Dr. C. L. M. Cottrell: 'Hydrogen versus Welding.'

Incorporated Plant Engineers

Peterborough: Gas Demonstration Theatre, Church Street, 7.30 p.m. Peterborough Branch annual general meeting and 'Any Questions?'

Liverpool Metallurgical Society

Liverpool: The Temple, Dale Street, 7 p.m. Conversazione.

FRIDAY 19 MARCH

Institution of Chemical Engineers

London: Caxton Hall, Westminster, 6.30 p.m. Graduates' & Students' Section meeting. J. Holmes: 'Mineral Dressing.'

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Newcastle-on-Tyne: Stephenson Building (Chemical Engineering Department), Claremount Road, 6.15 p.m. Graduates' & Students' Section (North East Centre) meeting. Display of technical films.

Chemical Society

Dublin: Trinity College (Chemistry Department), 7.45 p.m. Joint meeting with Werner Society. Sir Robert Robinson: 'Structural Relations of Natural Products.'

Dundee: University College (Chemistry Department), 7 p.m. Professor H. B. Nisbet: 'Technical Education.'

Society of Chemical Industry

London: Wellcome Research Institution, 183 Euston Road, N.W.1, 10 a.m. and 2 p.m. Continuation of the conference on 'Chemical Engineering & the Food Industry,' followed by informal dinner, Trocadero, Piccadilly Circus, 6.30 p.m.

Liverpool: The University (Chemistry Lecture Theatre), 6.30 p.m. Liverpool Section annual general meeting, followed by paper, 'The Surface Activity of Silicone Films' by T. W. Watson.

Plymouth: Technical College, 4.30 p.m. South Western Section annual general meeting; paper by A. C. Monkhouse: 'Recent Developments in Fuel Research.'

SATURDAY 20 MARCH

Institution of Chemical Engineers

Leeds: The University (Fuel Department), 3 p.m. Graduates' & Students' Section (Yorkshire Centre) meeting. Symposium on 'Statistical Methods in the Chemical Industry.'

Market Reports

LONDON.—A steady home demand has been reported from most sections of the industrial chemicals market, with contract deliveries well up to schedule. Export activity is also fairly good despite keen competition. The lead oxides and white lead have advanced in price. As from March 9 the revised basis prices are red lead £114 per ton, white lead £121 10s. per ton, with litharge quoted at £116. Titanium pigments are dearer. The coal tar products continue on a firm basis, with creosote oil and carbolic acid in good request, but cresylic acid remains slow. There is a persistent demand for toluol and xylol.

MANCHESTER.—Manchester traders during the past week have experienced a continued steady demand against contracts for a wide range of heavy chemicals for the textile and allied trades in the cotton, woollen and rayon branches, and fresh enquiries from these and other leading users have been circulating fairly freely. Prices generally are on a steady to firm basis. A further improvement in the demand for superphosphates and other fertiliser materials has been experienced and the seasonal pressure is expected to increase steadily. Creosote oil and phenol, as well as benzol and most other light tar products, are in good request.

GLASGOW.—The past week has shown a heavy demand on stocks of practically all classes of chemicals due mainly to a certain amount of dislocation in transport as a result of adverse weather conditions, and the recent railway freight increases have caused a certain amount of upset. On the whole, however, it has been an extremely busy week in all branches of the trade.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

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

ANALYTICAL CHEMISTS of Inter. B.Sc. or equivalent standard are required for the Works Laboratory and Process Control Laboratories at Thomas Tyrer's Works at Stratford. Some experience of industrial Inorganic Chemistry is preferred. Annual salary will depend upon qualifications, age and experience. Applications should be addressed to **THOMAS TYRER & CO., LTD., CANNING ROAD, STRATFORD, E.15.**

BRITISH GEON LTD. have vacancies in their factory for **CHEMISTS** to undertake supervision of plants producing vinyl polymers. The processes are continuous so shift work is involved. Age 23/30 years. Applicants should have a degree in Chemistry or equivalent qualification. Salary will depend on qualifications and experience and an allowance is made for shift work. Apply **STAFF DEPT., DISTILLERS CO. LTD., 21, ST. JAMES'S SQUARE, LONDON, S.W.1.** Please quote BG.254.

CHEMIST and **BACTERIOLOGIST** required for factory situated in the London area to undertake research and development work on a food product. Familiarity with the behaviour and properties of Vegetable Fats essential and a knowledge of Dairy Chemistry is desirable. Young man with ambition not objected to. Salary in accordance with experience and qualifications. Apply, in confidence, to: **KREMA, LIMITED, SARSFIELD ROAD, PERIVALE, GREENFORD, MIDDLESEX.**

CHEMISTS (qualified) required for Process Development Department concerned with a wide variety of Organic Chemical projects.

(1) **SENIOR CHEMISTS**—experience of Organic Chemical manufacture essential, together with drive and ability to lead a small team.

(2) **ASSISTANT CHEMISTS**—industrial experience desirable but not essential.

Salary for Senior Chemists, £800 per year upwards. Salary for Assistant Chemists, £550 a year upwards, according to qualifications and experience.

Apply, giving sufficient detail to establish a bakground, to **PERSONNEL MANAGER, A. BOAKE, ROBERTS & CO., LTD., CARPENTERS ROAD, LONDON, E.15.**

FISONS LIMITED require two **SECTION LEADERS** in the **DRAWING OFFICE** of their **DEVELOPMENT DEPARTMENT** at Felixstowe, to work on Chemical Plant design. Previous experience with this type of work essential. Higher N.S. desirable. Pension and Widows' Pension Funds, good salary and prospects. Apply to the **PERSONNEL OFFICER, FISONS LIMITED, HARVEST HOUSE, FELIXSTOWE, SUFFOLK.**

FOR SALE

FOR SALE
3,000 ft. 2 in. **Bore**
ALUMINIUM FLANGED PIPING
Immediate Delivery.
MADEN & McKEE, LTD.,
317, PRESCOT ROAD,
LIVERPOOL, 13.

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

DANKS' VERTICAL WATER-TUBE BOILER, 14 ft. by 6 ft. diam. New 1942. 120 lb. working pressure, 2,500 lb. evaporation per hour at 212° F. Complete with steel chimney. Excellent condition.
WILLIAM R. SELWOOD, LTD., CHANDLER'S FORD.
'Phone 2275.

FOR SALE — OERTLING MICROCHEMICAL BALANCE, Model No. 63/BP, in excellent condition. For further details, please apply to **WESTINGHOUSE BRAKE & SIGNAL CO., LTD., CHIPPENHAM WILTS.**

FOR SALE—8 tons of **AMMONIUM BICARBONATE,** packed in 2-cwt. free drums. Samples available on request. Apply **BOX No. C.A. 3299, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

7 BRAND NEW Jacketed **STERILIZING VESSELS**—7 ft. long by 3 ft. diam., complete with fittings.
2—18 in. **KEK PLATE MILLS,** complete with feeders, delivery bins, motors and entablature.
9—Worssam **ROTARY PRESSES.**
POWDER DRESSING OR SIFTING MACHINES.
1—Johnson **FILTER PRESS**—36 in. sq. plate and frame
1—Johnson **FILTER PRESS**—47 plates, 32 in. sq.
1—Johnson **FILTER PRESS**—30 plates, 25 in. sq.
Wood **FILTER PRESS**—69 plates, 2 ft. 8 in. sq.
24 in., 30 in. and 36 in. **HYDRO EXTRACTORS.**
Heavy Cake **CRUSHING MILL**—2-pair high, by Nicholson.
Bennett Copper-built **EVAPORATING UNIT.**
"U"-shaped Horizontal Jacketed **MIXER**—7 ft. long, 3 ft. wide, 3 ft. 3 in. deep, belt and gear driven.
3—5-roll **REFINERS** by Baker Perkins.
1—No. 1A Water-cooled **CIRCULATOR MILL.**
2—Excellent Nickel-lined Jacketed **TILTING PANS.** 60 gal. capacity and for 40 lb. working pressure.
2—Brand New Enclosed Aluminium **TANKS,** approx. 11 ft. long by 4 ft. 9 in. wide by 7 ft. 3 in.
5—Excellent Porcelain **DISC MILLS.**
1—Aluminium **STILL,** steam jacketed, dished top and bottom; 4 ft. 8 in. diam. by 6 ft. deep.
1—Very Fine **GARDNER SIFTER** and **MIXER,** trough 5 ft. 9 in. by 24 in. by 28 in. deep, with wood-built hopper, elevator, A.C. motor and starter.
RICHARD SIZER, LIMITED, ENGINEERS, HULL.
Telephone: 31743.

FOR SALE

C. BARBER, LTD.

500-gal. Over-driven M.S. **MIXING VESSEL.** M.S. pressure filter, 4 ft. 3 in. diam. by 5 ft. 3 in. overall height.

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

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

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

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

C. BARBER LTD.
SILVERDALE GARDENS
HAYES MIDDLESEX
Telephone—Hayes 2735/6

GARDNER MIXER AND SIFTER. 10 cwt. capacity, specially strong to deal with 80 lb. cu. ft. material, nearly new and little used, complete with agitating gear, and 12 cwt. Delivery Hopper, all complete with Higgs motors and reduction gears and starters. To-day's price, £1,300, will clear at £550. Apply, **BOX No. C.A. 3298, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

ONE TORRANCE MICRO TWIN-ROLLER MILL. Cast rolls, 14 in. by 8 in. Water cooled. Fast and loose pulley-drive.

TWO DE LAVAL SEPARATORS, VEE-BELT DRIVE. Good condition.

THOMPSON & SON (MILLWALL), LIMITED, CUBA STREET, LONDON, E.14. TEL. EAST 1844.

600

MIXERS

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

TROUGH MIXER—49 in. by 41 in. by 31 in., with twin "Z" mixing blades, fitted counter-balance lid. Motorised 50 h.p. 415/3/50 through reduction gear Quadrant power tilting gear driven by 5 h.p. motor.

Horizontal Trough **PUG MIXER**—3 ft. 10 in. by 2 ft. 6 in. by 2 ft. 6 in. deep. M.S. construction. Spiral scraper-type agitator. 6 in. outlet worm operated. Hinged steel cover. Fast and loose pulley drive through spur gearing.

Horizontal **DOUBLE TROUGH MIXER** with M.S. welded trough 40 in. sq. by 36 in. deep. "Z"-type agitators, double geared, motorised 400/3/50. Power-operated tilting.

Double Trough-type **TILTING MIXER.** Trough 32 in. by 32 in. by 24 in. deep. Fitted double "Z"-type agitator. Pulley drive.

SIFTER MIXER, size G. Mixing chamber 60½ in. by 17 in. by 21 in. deep with brush sifter mounted over. Spiral-type agitator. Mixer and sifter motorised 400/3/50. Timber feed hopper to sifter 20 in. by 18 in. by 12 in. deep.

Powder **SIFTER MIXER** by Geo. Porteous, size 6. Capacity 560 lb. M.S. trough 60 in. by 27 in. by 31 in. deep, 4 in. sq. centre outlet. Timber hopper feeding sifter with 20-mesh screen. Reject chute for oversize material. Broken scroll agitator driven through spur gearing by motor 415/3/50.

GEORGE COHEN SONS & CO., LTD.,
WOOD LANE, LONDON, W.12.
Tel.: Shepherds Bush 2070 and
STANNINGLEY, NR. LEEDS.
Tel.: Pudsey 2241.

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STORAGE

20—ALL WELDED MILD STEEL VESSELS, each 30 ft. by 8 ft. diam., ½ in. Plate. Dish Ended.

PROMPT DELIVERY.

Inspection by arrangement.

MADEN & McKEE, LTD.,
317, PRESCOT ROAD,
LIVERPOOL, 13.

PHONE 98 STAINES

STAINLESS STEEL 100-gallon **WATER-JACKETED ENCLOSED CYLINDRICAL MIXER.**

DITTO, 50 gallon. 220/1/50.

RUBBER-LINED CYLINDRICAL ENCLOSED TANKS, 850 gallons each.

Unused **PORTABLE ELECTRIC STIRRING ARMS** 400/3/50. 24 in. shrouded shaft fitted with simple propeller.

7,000 gallon **GLASS-LINED TANKS,** 18 ft. by 9 ft. diam.

CYLINDRICAL JACKETED VACUUM OVENS, 8 ft. by 5 ft., 7 ft. by 4 ft., 7 ft. by 3 ft. and 43 in. by 17 in.

WELDED STEEL JACKETED MIXING PANS—3 ft. by 2 ft. 6 in. and 2 ft. by 2 ft.

STEEL TUBE CONDENSER—6 ft. by 1 ft. 6 in. 60 sq. ft. tube area.

PUMPS, BOILERS, CONVEYORS, ELEVATORS, STILLS, CONDENSERS, etc.

HARRY H. GARDAM & CO. LTD.,
STAINES.

MORTON, SON AND WARD, LIMITED
offer
MIXERS

"MORWARD" "U"-TROUGH Mixers and Drying units in sizes up to 3 tons.

MIXERS, Horizontal or Vertical, Jacketed or Unjacketed, made to requirements. Several in stock.

3-cwt. Trough **MIXERS** by **CHALMERS** and **GARDNER.** Stainless steel lined troughs.

JACKETED PANS

ONE New 250g. in stainless steel. Others made to requirements in stainless steel or mild steel, with or without mixing gear.

500g. Jacketed **AUTOCLAVE** with detachable cover. 150 lb. in jacket.

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

CENTRIFUGE by **SHARPLES,** motorised, bowl speed 15,000 r.p.m. 300 g.p.h. As new.

TANKS

Lead-lined, cylindrical and totally enclosed in 75g. and 100g. sizes.

PUMPS

A large selection of **MONO** and other Pumps in stock, 2 in. to 6 in. New and second-hand.

INQUIRIES INVITED.
MORTON, SON AND WARD, LIMITED,
WALK MILL,
DOBCROSS, NR. OLDHAM,
LANCS.
'Phone: Saddleworth 437.

HEILBRON.—Offers are invited for 'Dictionary of Organic Compounds,' edited by Heilbron and Bunbury, 1943 edition, in three volumes, published by Eyre & Spottiswoode. Vol. I, new revised edition; Vols. II and III, reprinted with 1943 supplement. The volumes are unmarked, practically unused, and are of considerable value for reference purposes. **BOX No. C.A. 3292, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

FOR SALE

FOR SALE
HIGH PRESSURE AIR RECEIVERS

2—12 ft. by 6 ft. diam. 260 lb. working pressure.

1—20 ft. by 6 ft. diam. 350 lb. working pressure.

2—12 ft. by 3 ft. 8 in. diam. 350 lb. working pressure.

Inspection by arrangement.

MADEN & McKEE, LTD.
317, PRESCOT ROAD,
LIVERPOOL, 13.

GILLED STEEL STEAM PIPE, 3 in. bore, 5,000 ft. available.
GRAVITY CONVEYOR. Rollers 14 in. wide on 6 in. centres, with bends.
C.I. JACKETED STEAM PANS, 30- and 80-gal.
PAXMAN LOCO STEAM BOILER, 1,800 lb. evaporation 100 lb. w.p.
KIMMINS & SONS, LTD., LYNDHURST ROAD WORTHING.

IRON POWDERS for sale: **5 TONS ELECTROLYTIC, 10 TONS SWEDISH SPONGE, 1½ TONS MIXED,** Apply, **THE PLESSEY CO., WOOD BURCOTE WAY. TOWCESTER, NORTHANTS.**

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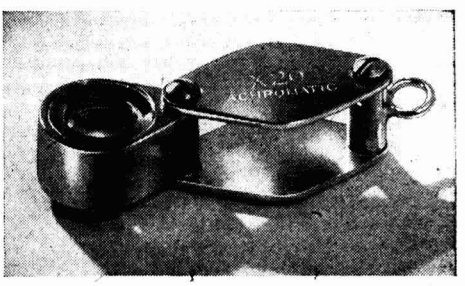

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