The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Progress!

THERE can be few who have not some acquaintance with the poems of Tennyson. Among them, scientific men generally are attracted to the two poems on Locksley Hall—poems that express vividly the impatience and impetuosity of hot-blooded youth, with which is contrasted in the later poem the serenity and matured judgment of age, sixty years later. The voice of youth:

"Not in vain the distance beckons. Forward, Forward let us range,
Let the great world spin for ever down the ringing grooves of change."

is in sharp contrast to the disillusionment of age:

"Nay your pardon, cry your 'forward,'
yours are hope and youth, but I—
Eighty winters leave the dog too lame to follow with the cry."

We were led to re-read Locksley Hall by coming unexpectedly upon two passages from *The Times* written 100 years apart. Each of them was a summary of progress, but what a difference there was between progress when Tennyson was in his thirties and to-day, 50 years after his death! In 1845, we read: "We need scarcely allude to the change of the currency, the repeal of the Test and Corporation Acts, Roman Catholic Emancipation, the Reform Act, the New Poor Law, the Abolition of Slavery, the Ecclesiastical Commission, the Income-tax, or the Maynooth Grant. These will occur at once to every one. (Other changes cited are prohibition of women's labour in mines and the general abolition of capital punishment and of imprisonment for debt.) But these are scarcely more than a record of what the nation has already done for itself. From lucifer matches, which 20 years ago were sold at 3s. 6d. a box as philosophical toys, and have now driven away the tinder box even from the back woods of North America, to the electric telegraph, which has all but literally annihilated time and space—in all our doings, in every circumstance affecting us, we can trace the finger of change; and as regards our material condition, it is impossible to deny that on the whole the progress is one of improvement. A dozen years ago Dr. Dionysius Lardner proved upon oath, by mathematical calculations, that it was impossible that a steamer could ever cross the Atlantic; the impossibility is now a matter of weekly occurrence. Ten years ago we paid eighteenpence for the postage of a letter in an envelope

On Other Pages

carried 80 miles; it is now carried 400 miles for one penny. Fifteen years ago railway locomotives accomplished 20 miles an hour; they can now do 75. We can now go to China and back in less time than, 20 years since, it occupied to get to Calcutta. Who is now daring enough to assert that we are more than on the verge of our changes?"

But let us go forward a century to the world in which we live, this "violent and savage age" as Mr. Churchill has styled it. This is what we read in the report of the Commanding General of the U.S. Army Air Forces. General Arnold says that at the beginning of the war the United States possessed bombers with a speed of 200 miles an hour, a fighting range of 900 miles, a "ceiling" of 24,000 ft., and a bomb load of 6000 lb. To-day, there are available bombers capable of carrying 20,000 lb. of bombs to targets 1600 miles distant at speeds of 350 miles an hour and altitudes of over 35,000 ft. But within a few years there will be jet-propelled bombers flying at a speed of anything up to 600 miles an hour to targets 1500 miles away at altitudes of over 40,000 ft.; and even greater bombers, flying "at stratosphere altitudes and speeds faster than sound" with bomb loads of 100,000 lb., are among the certainties.

"Then fighters, which in 1941 were limited to speeds of 300 miles an hour, a range of 200 to 300 miles, and ceilings of 20,000 ft. To-day, conventional fighters have speeds of 500 miles an hour, combat-ranges of 1500 miles, and ceilings of 35,000 ft. Within five years jet-propelled fighters will be produced with the speed of sound and able to reach targets 2000 miles away at altitudes of 50,000 ft. Again, at the beginning of the war there were no rockets. Now American rockets could be directed to targets by electronic devices and new instruments which guide them accurately to sources of heat, light, and magnetism. Drawn by their own fuses, such rockets will streak unerringly to the heart of big factories, attracted by the heat of the furnaces." General Arnold adds that these target-seeking devices are "so sensitive that in the space of a large room they aim themselves towards a man who enters, in reaction to the heat of his body." As regards bombs, the United States started with the 2000-pounder, practically speaking, as the maximum. The new bombs developed during the war range from 4 lb. man-killing bomb to the gigantic 22,000 lb. deep-penetration bomb. And at the present moment there are in manufacture bombs weighing 45,000 lb. To this we may add poison gas and the atomic bomb!

It would be unfair to judge our generation by its warlike propensities. The aged and the disillusioned may be justified in taking a poor view of a civilisation that can produce the Belsens of Germany, the prison camps of Japan that reek of the worst features of the Middle Ages, the atomic bombs that can wipe out whole cities in the manner of Doomsday as conceived by the ancients of 2000 years ago. But there is far more to our credit than to our discredit. It is true that in this year of grace we chronicle the achievements of science in its application to warfare. But science has achieved within this last 100 years far more for the alleviation of human suffering than for the destruction of human life. The discovery of anaesthetics, made in 1846, opened the door to the vast surgical advances of the century. The work of Pasteur and many another in that field has proved of incalculable benefit. The application of science has enriched life beyond all recognition. The spread of education has enabled mankind to use the leisure that the machine has given him.

If we are not yet arrived at the millenium, we are at least travelling rapidly and hopefully. Science moves in little steps, providing us from time to time with little quanta of discovery, but from the whole there comes a steady and ever-quickening flow of advancement. We are not yet 80 years of age, and so we are not yet disillusioned! Perhaps in due course disillusionment will come; much depends upon the use that mankind makes of the powers that discovery is giving to it. The way is plain, however: science cannot rest. We go back even farther in our rough island history and re-echo the words spoken by Burke in 1780: "Applaud us when we run; console us when we fall; cheer us when we recover; but let us pass on—for God's sake, let us pass on!"

NOTES AND COMMENTS

The Coke Oven of To-morrow

EXPERIENCE gained during the war, and the possibilities of learning thereby, were the cardinal points of Mr. W. Neville Warwick's presidential address to the Coke Oven Managers' Association in London last week. In this first full-dress survey of the industry during the war, the president laid stress on the replacement of the pre-war demand for a few by-products by the war-time necessity for the production of pures, a development which might lead, he said, to the study of closer fractionation, and ultimately to the erection of ancillary plant for the production of organic chemicals vital to the synthetic chemical industry. The passing of the relatively inefficient batch still seems assured, and the installation of extensive continuous .fractionation plant is thereby warranted. The industry, at any rate, must see that new plant erected is not allowed to lapse into redundancy, as it did after the last war. Renewed attention is being focussed on chemical utilisation and production of organic compounds from coke-oven gas, and it will be for the coke-oven industry to decide (for example) whether to stop at ethylene recovery, or go a stage further to the partial separation of methane. The president had a few wise words to say on the production of oil from coal, with an eye on the valuable subsidiary industries based on the Fischer-Tropsch and similar processes. At all events, as he said, the expenditure involved in the large-scale production of oil from coal makes it likely that the coking plant would more probably be the adjunct to the oil plant than *vice versa.*

Problems Ahead

DIFFICULTIES there had been and would be. During the war these had been very largely overcome by the loyalty of certain categories of their workers, but the study of the problems of dwindling man-power in heavy industry was a necessity. Production specialists in the U.S., he noted, had paid insufficient attention to the protection of the operator, though a Russian research institute had been devoting much time to the problems of uncongenial employment on coke ovens. We agree that there is scope for ingenuity in design with improved working conditions in view; also that such study would increase plant efficiency. The escape of green gas during charging is another problem to which he referred; and he noted that the tonnage from the better coking coal seams was diminishing and the quality deteriorating. There is no doubt that problems of general design must loom largely in the future, if the industry is to keep up its standard of performance. It is gratifying to read the president's words on the war effort of the technical Press in support of industry, and his appreciation of the difficulties under which the Press kept going during hostilities; and his final remarks on the function of professional institutions seem to us the height of good sense. Mr. Warwick's address may have been controversial, as he himself suggests, but it was certainly constructive.

Consolidating the Controls

ON a cursory reading, the Prime Minister's statement about the regrouping of the supply and production ministries might have seemed no more than a shuffling of departmental responsibilities; but his superlatively non-committal response to Sir John Anderson's request for a debate on the statement, and the rather odd arrangements about atomic energy research (reported elsewhere in our columns) attracted special attention to the meaning behind the change. The ultimate disappearance of the Ministries of Production and of Aircraft Production is a good move: but just what is behind the separation of the various metals controls from the raw materials controls remains to be seen. It is to be hoped that some light on this may emerge in debate, if debate there is to be. At all events, engineering and its materials are to be the responsibility of the Ministry of Supply, while raw materials, including chemicals, are to come under the ægis of the Board of Trade. The responsibility for research into atomic energy is to be removed from the D.S.I.R., and is to be placed in charge

of the M.O.S., though officers of the D.S.I.R. are to be consulted from time to time. It certainly does not appear that there is going to be any hurry about the relaxation of controls, and the segregation of the three metals controls under a vastly more powerful Ministry of Supply gives the impression that the Government intends to keep a tight hand on the materials concerned. Finally, the co-ordination of military supply problems, formerly the task of the Ministry of Production, will be the subject of "other arrangements." The public has a right to know what these vague "other arrangements" are to be. Vagueness in such a contest is quite unwarrantable.

Imperial College Visited

ALTHOUGH London, unlike several Continental capitals, does not yet boast a special University quarter, the Imperial College of Science and Technology—the centenary of which was celebrated last week—has contrived to turn a part of South Kensington into a very fair substitute for one. The visitor who walked through the College's departments, laboratories, and workshops last week-end went away convinced of the compact contribution that is constantly being made there to a wide range of subjects. Some may have regretted the substitution of the unnaturally peaceful atmosphere of a special occasion for the workaday atmosphere which normally pervades the College's precincts. However, conducted by guides and enlightened by demonstrators recruited from among the students, a good many visitors will have recalled the welcome relief which such occasions in the past were capable of bringing to harassed students and demonstrators—and even to more august members of the institution. At all events the grateful visitor, whose invading steps no longer disturb the centenarian routine, records his hopes for more frequent contacts in future, and a sincere wish for fruitful activity in the years ahead. Many, we know will join with us in welcoming the addition of the bust of our old friend Professor Armstrong to the College's gallery of portraits of its past great men.

Streptomycin

Method of Preparation

SOME details concerning the production of the antibiotic streptomycin, are given by Mr. C. R. Addinall (assistant director, research and development, Merck & Co.) in a special chemical supplement of the *Journal of Commerce and Commercial* (New York, September 10, 1945). Since the isolation of the soil actinomycete, *Streptomyces griseus*, by Waksman *et al.* in 1944, and the growth therefrom of the anti-bacterial streptomycin, research has been proceeding vigorously towards perfecting this material.

A suitable growth medium has now been adopted, consisting of 1 per cent. glucose, 0.5 per cent. peptone, 0.3 per cent. meat extract or 1.2 per cent. corn steep, and 0.5 per cent. NaCl, and growth has been found to be much more rapid in agitated cultures than in stationary. After 5-10 days, streptomycin is isolated from the culture filtrate by adsorption on activated charcoal. The crude antibiotic is removed from the charcoal by elution with acidified alcohol, and the eluate neutralised with NaOH. The addition of 10 vols. of ether gives a highly concentrated aqueous solution of streptomycin, which is further concentrated by evaporation at reduced pressure.

The original unit of streptomycin was defined as "that amount of material which will inhibit the growth of a particular strain of *E. coli* in 1 c.c. of nutrient broth." The more recent availability of pure crystalline preparations, however, has provided a weight unit for standardisation; and to-day the official unit is 1 μg. of pure streptomycin base—approximately equivalent to 1 unit as determined by bacteriological assay.

Toxicity of the drug is stated to be "rather low"; the lethal dose for 50 per cent. of mice treated with the pure material has been shown to be about 750 mg./kg. body-weight when administered subcutaneously, and 3 g./kg. when given orally.

The probable utility of streptomycin lies in the broadening of the range of chemotherapeutic attack on diseases caused by bacteria, particularly in the direction of diseases caused by the gram-negative group, including *Salmonella* infections, tularemia, gram-negative wound infections, typhoid fever from strains of *E. typhi*, meningitis due to *H. influenzæ*, and also certain gram-positive urinary tract infections.

Metallurgists will welcome the appearance of R. T. Rolfe's *Dictionary of Metallography* (Chapman & Hall; 15s.) which has just been published. Mr. Rolfe, as chief metallurgist to W. H. Allen, Sons & Co., Ltd., Bedford, is a recognised authority on the subject; a full review of the work will be published in a later issue.

South Wales and the Future of the Chemical Industry—II

by D. D. HOWAT, B.Sc., Ph.D., F.R.I.C., A.M.I.Chem.E.

(*Continued from* The Chemical Age, *October* 27, 1945, *p.* 384)

GRANTED that the framework of a diversity of industry is now actually in being in South Wales, further efforts are urgently required to make this scheme a vital factor in the economic life of Britain. The necessary measures include the thorough reorganisation of the coal industry—a task which must be undertaken as rapidly as possible. Also high up on the list of urgent requirements is the provision of ample supplies of cheap electric power. Both factors are closely associated, as with the almost complete reliance on steam stations for power generation in Britain, coal and power costs have become involved in a vicious circle of rising prices and shortened supplies which threatens the whole fabric of our future industrial development. The salvation of industry in this country depends on the speed and completeness with which the coal industry may be reorganised and productivity per worker raised to the levels obtaining in similar conditions in the coalfields of Holland, the Ruhr, and Poland.

Hydro-electric Power

At the same time all other possibilities of power generation must be exploited to the utmost. In the field of hydro-electric power generation South Wales is most conveniently situated. The findings of a series of expert commissions have conclusively demonstrated that a Severn Barrage Scheme for electric power generation is a practicable proposition of real promise for the future. According to the latest report a total of 800,000 kW installed generating capacity will send out 2107 million units annually. Capital cost of the scheme, estimated at £47 million, will involve an average charge of 0.275d. per kWh at the reception points.

In passing, an appeal may be made for the granting of low-interest loans by the State to finance the rapid development of large capital schemes of this type. Civil engineering works involved in the construction of the dams and breakwaters have a very long life, while the efficiency of the water-turbines is about 94/95 per cent., with only negligible maintenance and replacement costs. In view of these facts and of the contribution to the capital assets of the country a very strong case may be made for the granting of such loans. Heavy burdens are imposed on such schemes if loans have to be raised on the prevailing interest rates, operating charges in this latest report being based on a 3 per cent. rate of interest. A reduction of interest rate to 2.1 per cent. would permit of a reduction in power costs to 0.225d. per kWh. Such savings in power costs, although apparently very minute, exert a tremendous influence on the production costs of aluminium, magnesium, calcium carbide and ferro-alloys, the figure saved amounting to almost £5 per ton in the case of aluminium and 14s. per ton in the case of calcium carbide. Amounts of this magnitude are extremely critical in determining the possibilities of trade in the export market. (*See* The Chemical Age, 1945, 52, 518).

Inter-related Industries

One fact is abundantly clear, the fate of the electro-chemical and electro-metallurgical industries now in being in South Wales depends upon the exploitation of the hydro-electric power from the Severn. Without this, any long-term plan for the development of these industries in this area is impossible. In Table 1 an attempt has been made to indicate the inter-related industries which might be developed in South Wales provided that cheap electric power was made available.

Taking the scientific utilisation of coal as a starting point, treatment of the coal in the coke ovens yields coke, light oils and tars, and gases. As indicated in the diagram, the coke finds employment in the aluminium, magnesium, calcium carbide, and ferro-alloy industries in the manufacture of electrodes for electric furnaces, particularly heavy consumption of carbon occurring in light metal reduction. Coke also forms a constituent of the charge in the production of the ferro-alloys and enters into the formation of the calcium carbide. Considering the production of carbide as an example, the total quantity of coal consumed in the production of one ton of the compound is probably about 4 tons, the quantity being made up as follows: coke in the charge 0.5 tons, coke for electrodes about ¼ cwt., coal for the calcination of the limestone 2 cwt., coal for the production of power in steam stations 2½ tons. Obviously, this total will be cut by more than half if hydro-electric power is available.

Coke is the basic raw material for the synthetic plant for the production of methanol and ammonia. Gasification of coke in a water-gas producer yields the mixture of carbon monoxide and hydrogen from which the two compounds are built up catalytically. At this stage mention may be made of the first of the projected new develop-

ments—underground gasification of thin uneconomic coal seams. By this process there is obtained a gaseous mixture approximating fairly closely in composition to water-gas, this mixture being capable of providing the raw materials required for methanol and ammonia synthesis and also eminently suited for employment in the Fischer-Tropsch synthesis—another innovation urgently required in the area.

Also dovetailing into the synthesis scheme is the possibility of using coke-oven gas as a source of raw materials. Fractional liquefaction of these gases yields a hydrogen/nitrogen fraction, a liquid methanol fraction, and a liquid olefine fraction, each being capable of utilisation for synthetic processes.

Oxidation of the methanol to formaldehyde yields one of the key raw materials for plastics production, while the ammonia may be absorbed partly in fertiliser manufacture and partly in plastics. By providing adequate capacity for plastic manufacture these raw materials will find an immediate outlet, together with the benzene and phenol from the coke-oven by-product recovery plants. Closely associated with plastics manufacture is the production of the synthetic fibre, nylon. A plant for the manufacture of nylon, to be absorbed mainly in the weaving of hosiery, is planned for establishment at Pontypool, Mon., this plant employing 1700 people when at full production. Such a plant will provide an immediate market for benzene and phenol.

Oil Refining

The case for the introduction of a large-scale general oil-refining industry into Britain has been argued frequently and ably, an obvious site for one of the refining plants being in South Wales. Considerable refining of the "primary product" from the Fischer-Tropsch synthetic process is required, and if this process were established in South Wales in association with the oil-refining plant very valuable work could be done. In addition the olefines produced from the Fischer-Tropsch synthesis and from the oil-refining plant would be absorbed for plastics production, the recent history of these processes in the U.S.A. proving how valuable such inter-related industries may be.

Carbide production should, undoubtedly, continue supplying acetylene for the plastics industry and for welding and cutting in the light engineering and chemical industries. At the present time the future of acetylene production cannot be assessed correctly until the results of data accumulated during the war are divulged in full. Pyrolysis of natural gas (85 per cent. methane) to acetylene by catalytic action has apparently been carried out on an extensive scale in the U.S.A. during the war. While this development is of far-reaching and perhaps crucial importance, it is not possible at present to assess how the price of the acetylene so produced compares with that obtained from carbide. The only safe assumption as a guide for future policy is that both sources will contribute to the provision of acetylene supplies and that plans should be made for the continuance of the carbide industry in South Wales.

Extraction of alumina from clays and shales to replace the present requirements of imported bauxite ores is another development urgently awaited. Here, again, progress in the U.S.A. has been much faster than in this country, one process having reached commercial operation. Two methods have been proposed, one involving sintering with additions of lime and soda and the other a sulphuric-acid extraction process. Either could be employed in South Wales, but probably the sintering process would be favoured in view of the supplies of coke-fines for the sintering operation.

Light Metals

Meantime the progress of the light metal industry in this district should be assured by vigorous action. So far as aluminium production is concerned, imports of bauxite ores will, no doubt, have to be continued for the present, the materials being purified in the Bayer plant. These supplies should be supplemented by the development of a process for the extraction of alumina from clays. Insufficient data exist in this country to enable an accurate analysis to be made of the relative costs of the Bayer process and that of one of the new clay extraction processes. Fundamentally, the Bayer process is costly and relatively difficult to operate, involving the consumption of 1½ to 2 tons of coal for each ton of purified alumina. Added to this is the expenditure of foreign currency in purchasing the ore, as well as the freight charges. Obviously, a strong case may be made for the immediate investigation on a pilot-plant scale of the new processes reported from the U.S.A. for the use of naturally-occurring clays and shales as sources of alumina.

As it is an important raw material in pharmacy, in the refractory industries, and as a source of magnesium metal, the recovery of magnesia from sea water should be stimulated. While the adverse findings of the Select Committee on National Expenditure have had repercussions on the process of magnesia recovery as established in South Wales, experience elsewhere has proved that the process is fundamentally sound and should be encouraged here. In the immediate future it is essential that imports of raw materials should be controlled and only those imperative for our economic well-being permitted. If magnesia may be recovered from the sea water around our coasts then no case exists for the importing of supplies from abroad. Although there are difficulties and dangers in the carbo-

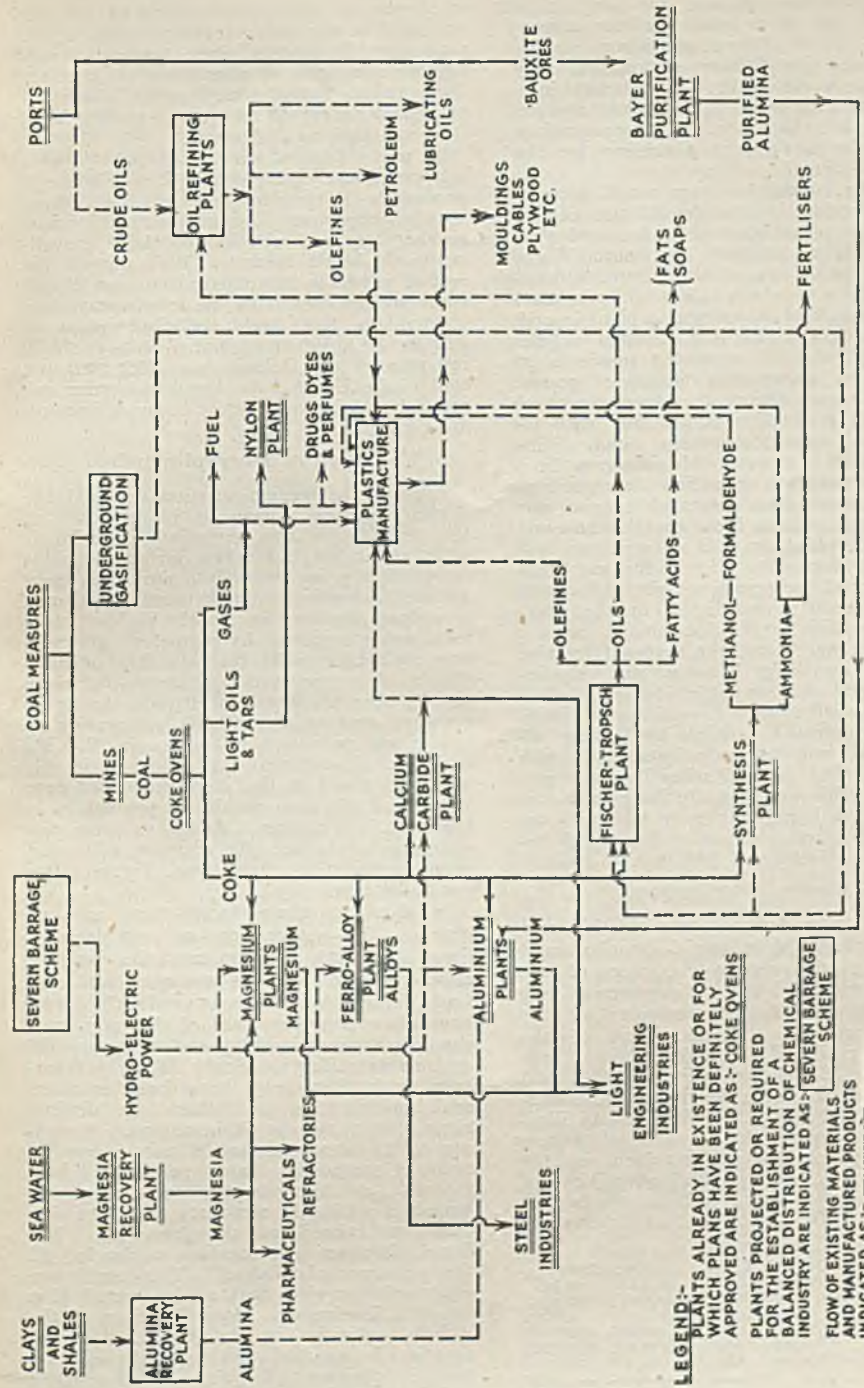
PORTS
CRUDE OILS
OIL REFINING PLANTS
OLEFINES
PETROLEUM
LUBRICATING OILS
BAUXITE ORES
BAYER PURIFICATION PLANT
PURIFIED ALUMINA
MOULDINGS CABLES PLYWOOD ETC.
FATS SOAPS
FERTILISERS
COAL MEASURES
UNDERGROUND GASIFICATION
FUEL
NYLON PLANT
DRUGS DYES & PERFUMES
PLASTICS MANUFACTURE
GASES
LIGHT OILS & TARS
COKE OVENS
MINES
COAL
OLEFINES
OILS
FATTY ACIDS
METHANOL—FORMALDEHYDE
AMMONIA
CALCIUM CARBIDE PLANT
FISCHER-TROPSCH PLANT
SYNTHESIS PLANT
COKE
SEVERN BARRAGE SCHEME
HYDRO-ELECTRIC POWER
MAGNESIUM PLANTS
MAGNESIUM
FERRO-ALLOY PLANT
ALLOYS
ALUMINIUM PLANTS
ALUMINIUM
LIGHT ENGINEERING INDUSTRIES
SEA WATER
MAGNESIA RECOVERY PLANT
MAGNESIA
PHARMACEUTICALS
REFRACTORIES
STEEL INDUSTRIES
CLAYS AND SHALES
ALUMINA RECOVERY PLANT
ALUMINA
LEGEND:-
PLANTS ALREADY IN EXISTENCE OR FOR WHICH PLANS HAVE BEEN DEFINITELY APPROVED ARE INDICATED AS:- COKE OVENS
PLANTS PROJECTED OR REQUIRED FOR THE ESTABLISHMENT OF A BALANCED DISTRIBUTION OF CHEMICAL INDUSTRY ARE INDICATED AS:- SEVERN BARRAGE SCHEME
FLOW OF EXISTING MATERIALS AND MANUFACTURED PRODUCTS INDICATED AS:-
FLOW OF MATERIALS AND MANUFACTURED PRODUCTS ASSOCIATED WITH PROJECTED SCHEMES INDICATED AS:-

TABLE 1.

thermic reduction process for magnesium production, it offers some definite advantages in the conditions obtaining in this country, and its further exploitation may prove well worth while. As already indicated from the plant at Swansea, now in operation, it is hoped to produce magnesium at the price at present obtaining for the electrolytic metal.

From the foregoing a very rough estimate may be formed of the possibilities of the development of an electro-chemical and electro-metallurgical industry in South Wales and of the diversity of inter-related secondary industries to which this would give rise. The framework of factories and plant is now in existence, but the full fruition of the scheme will depend upon the provision of supplies of cheap hydro-electric power. Granted this condition, the development of light metal production is possible, with its dependence upon the purely chemical industry for the recovery of magnesia from sea-water and the extraction and purification of alumina from imported bauxite ores and preferably from local supplies of clays and shales. Light metals so produced will have a great part to play in the expansion and growth of the precision light engineering industry recently established in the area. Calcium carbide production should proceed in the post-war years, the material forming a connecting link between the electro-chemical and the synthetic chemical industries. An admirable dovetailing of inter-related industries is possible by linking calcium carbide and coke-oven by-products with the oil-refining and Fischer-Tropsch processes. In this way a really integrated synthetic chemical industry may be built up, the projected nylon plant at Pontypool being only the first small link in the chain.

Power Distribution

Any real plan designed to weld this area into one integrated industrial complex must provide for the speedy execution of the Severn Barrage Scheme. Disagreement may be registered with the provisions of the scheme governing the allocations of the power so produced by which only one-quarter, or 527 million units, of the total output is scheduled for distribution to South-West England and South Wales. As illustrating the inadequacy of this allowance, the power consumption involved in the manufacture of reasonable quantities of aluminium, magnesium, and calcium carbide is shown in Table 2 which also shows the

Table 2

Product	Annual output (tons)	kWh. required (million units)	Power Costs at ¾d. per unit	Power Costs at ½d. per unit
Aluminium ...	15,000	330	£1,030,000	£343,000
Magnesium ...	5,000	100	£312,600	£104,200
Calcium carbide	100,000	330	£1,030,000	£343,000
Totals		760	£2,372,600	£790,200

total power costs on the basis of ½d. per unit and at the now prevailing price of ¾d. per unit. Even to produce these relatively modest quantities of aluminium, magnesium and calcium carbide involves an allocation of power nearly 50 per cent. greater than that indicated in the report.

As power from steam stations in this area is approximately ¾d. per unit, it is, obviously, impossible to produce any of these three vitally important commodities at prices bearing any real relation to those prevailing in the world markets. For example, the cost of power to manufacture one ton of calcium carbide even with the low consumption secured in this highly efficient plant is £10 6s. 3d. When compared with the selling price of $50 dollars (say, £12 10s.) per ton in the U.S.A., the hopeless burden imposed by high power costs becomes immediately obvious.

Threat of Unemployment

Even if the recommendation to build the Severn Barrage Scheme is implemented in the near future the immediate question is what action may be taken during the eight intervening years before the project is completed. Already unemployment constitutes a serious problem in South Wales, grave fears being expressed by competent observers and by responsible trade union officials. Totals of unemployed are increasing more rapidly than elsewhere in Britain, the figure standing now at over 23,000. According to one report reduction in orders in R.O.F's and other Government establishments in this area will result in the displacement of over 120,000 people from munitions production in the next few months. Added to these disquieting totals are the Service men and women returning from the Forces after demobilisation.

In face of these facts there are no grounds for satisfaction or complacency. Some immediate solution must be found if another period of mass unemployment and trade depression is to be avoided. Criticisms have often been expressed of the unprogressive character of industry and the provincial outlook prevailing in South Wales. Whatever truth there may have been in these criticisms in the past there are distinct signs that a new spirit is abroad. According to an announcement a private conference of economists and politicians, held recently at Aberystwyth, took steps to launch a national, non-party, non-sectarian movement aimed at the formation of a Welsh Economic Corporation to develop all the resources of Wales. This conference expressed the view, that an integrated plan for area development along the lines of the T.V.A. activities in the U.S.A. was imperative in view of the economic and industrial position of Wales. Progressive action along these lines is urgently required

and the fact that the realisation of the need and the formulation of plans to meet it arose in Wales helps to refute some of the criticism so freely expressed outside the Principality.

To cover the interim period before the supplies of hydro-electric power can be made available from the Severn Barrage Scheme special provisions might be made for this area under the Distribution of Industries Act. A Special Commission or Public Corporation might be established to co-ordinate and control the development of the projected new industries. Such a body might be empowered to subsidise the sale of electric power at reduced rates to stimulate light metal, calcium carbide and ferro-alloy production. As the subsidies involved would be fairly heavy, probably amounting to ½d. to ½d. per unit of power, strict controls would have to be observed by all consumers entering such a scheme. Probably a simple procedure would involve the setting of target figures for production, the governing public body undertaking to purchase the entire output at definite prices fixed in relation to the costs of raw material supplies and to world market prices. Special arrangements might also be made for the provision of pipe-lines for gas and oil transmission and for the grouping of associated new industries in relation to one another.

Subsidising the sale of electric power is not a procedure to be advocated lightly, but such a provision may serve as a temporary expedient until the hydro-electric scheme is thoroughly established. In view of the grim history of the pre-war years and the sombre prospects of to-day, a subsidy of £1 to £1.5 million may not prove ultimately to be excessive and may be expected to pay dividends in increased employment and in the stimulation of a diversity of inter-related secondary industries.

One fact is certain, the industrial prosperity of South Wales will depend upon the establishment of diversified industries based essentially on a combination of coal-oil-power schemes as shown diagrammatically in Table 1. Electro-chemical and electro-metallurgical basic industries backed by supplies of cheap power will provide essential starting materials and will dovetail admirably into the light engineering industries, while in combination with the chemical by-products of the coke ovens they will provide an adequate basis for the plastics and synthetic fibre industries.

Aluminium in France

A Ten-Year Plan

BEFORE the war, the aluminium industry in France was one of the country's mainstays, occupying the fourth position among the world's producers of the metal with an output of 50,000 tons in 1939. During the war, production declined by about 50 per cent., in spite of the fact that France has extensive bauxite deposits and although the Germans made every effort to keep up production. After the liberation, the output came nearly to a standstill, totalling a mere 800 tons in September last However, production recovered to 2100 tons in February, and to 3600 tons in June. The total prospective output for the current year has been estimated at 45,000 tons, a figure which compares favourably with the pre-war level. Before the war, roughly one-third of the total was shipped abroad, but it appears that the increase in domestic requirements and the development of new applications will not allow any exports for some time to come.

In order to meet the increasing demand and also to recapture export markets, a ten-year plan has recently been formulated for the industry, envisaging an annual output of 200,000 tons, at a cost of nearly 10 milliard francs. In reply to criticisms which have been voiced regarding the high capital cost of this plan, its supporters point out that the French aluminium industry has to make up much leeway, as compared with the other chief producers, before it can expand its production capacity. Output in the United States rose during the war from 148,000 to some 800,000 tons, that of Canada increased from 75,000 to 450,000 tons, while United Kingdom production more than doubled to 57,000 tons. As Germany's aluminium output, which totalled 200,000 tons in 1939, as well as that of Italy with 34,000 tons, will largely remain eliminated, the French industry foresees a favourable export opportunity. It is hardly surprising that bauxite exports are to be reduced under this ten-year plan.

Light Alloy Plants

Tube Investments' Plans

THE Tube Investments group of engineering industries has acquired from the Ministry of Aircraft Production two light-alloy production plants originally erected by them for the Ministry near Redditch.

An immediate increase in the labour force at the works is scheduled for the production of materials for the Government-sponsored Aluminium House, with the development of which the subsidiary companies concerned, Reynolds Tube and Reynolds Rolling Mills, have been associated. Plans for reorganising and extending the Redditch plants are already under way, with a view to developing the home and export market for British light alloys, particularly in their applications to building, domestic appliances, and the transport industries.

Boron in Steel

A Useful Alloying Element

CONFIRMING the war-time experience of many steel plants in the United States, the Bureau of Mines has published a report on its own metallurgical experiments, showing that boron increases the hardness of steel and is an adequate substitute for some of the scarce alloying metals, such as chromium, nickel, and manganese. Boron can also be used to produce fine-grained steel of good forging characteristics.

One of the striking advantages of this newly-developed alloying element is that small quantities of boron will do the work of much larger amounts of some of the other common alloying materials. For instance, it requires about 260 times as much nickel as it does boron to get the same degree of hardness. A phenomenal rise in the use of boron for this purpose resulted, and the new alloying element is now generally accepted by the industry as a satisfactory and, in some cases, as a more desirable substitute.

In listing the various characteristics of boron and its use as a steel alloy, the Bureau advised that it should not be considered a "cure-all" for improper steel-making practice, but that it should be regarded like any other steel-hardening element. In addition, there is a limit to the increase in hardness due to the addition of boron, and properties apart from hardenability must be supplied by other elements. Complete details of the metallurgical tests, together with charts and graphs, are included in the Bureau's report.

Britain's Steel Production

War-Time Statistics

IN spite of the necessity to replace richer imported iron ores by home-produced ores of a lower content, United Kingdom steel output averaged 12,680,000 ingot tons in the five years 1940-44, as compared with a five-yearly average of 11,257,000 tons for the period 1935-38. A statistical summary of the war-time operations of the British steel industry, together with a pre-war comparison, appears in the appended table. Home production reached its peak in 1943 with 13,031,000 tons, but in the following years, transport and fuel supply difficulties and, most important of all, the manpower position, compelled a reduction to the 12,000,000 ton mark. Imports trebled to 3,658,000 tons, compared with the five-yearly pre-war average of 1,244,000 tons, mainly as a result of larger shipments from the United States. They declined to 1,668,000 tons last year, and shrunk to 190,000 tons for the first half of the current year, chiefly as a result of the cessation of Lend-Lease imports of steel early in the year. Deliveries aggregated 16,000,000 tons in 1942-43. During the last two years, a decline in certain contracts, together with other factors, lead to a fall in demand to 14,328,000 last year. Exports reached a low level of 122,000 tons in 1943 (compared with 2,438,000 tons before the war), since then, however, there has been a modest recovery to 240,000 tons in 1944.

Period	Home production	Imports	Total deliveries	Export	Home deliveries
	(000 tons: ingot equivalent)				
1935–38* ...	11,257	1,244	12,482	2,438	10,044
1940 ...	12,975	3,356	15,231	1,286	13,945
1941 ...	12,312	3,658	14,564	526	14,038
1942 ...	12,942	2,407	15,956	274	15,682
1943 ...	13,031	2,773	16,005	122	15,883
1944 ...	12,142	1,668	14,328	240	14,088
1945† ...	11,970	190	12,060	360	12,600
1940–44* ...	12,680	2,772	15,216	489	14,727

* Average. † First half.

Output for the current year is not expected to exceed 12,000,000 tons. As imports have been cut down, stocks are near the minimum level. New estimates of steel requirements after the end of the war against Japan have not been completed, but it appears that, notwithstanding a temporary interruption in demand owing to the cancellation of war contracts, British ingot production is not likely to meet requirements, especially as there is a large export demand. Increased imports of steel in a semi-finished form will, therefore, become necessary.

In this connection, the question may be asked whether the steel industry's recently published five-year plan, which is *de facto* a 11-year plan, because during the six years of war no re-equipment and modernisation has taken place, should not be speeded up, so as to make possible an earlier increase of the steel ingot productive capacity.

ALASKAN WOLFRAMITE

A possible new Alaskan supply of wolframite, a source of tungsten, has been discovered by the U.S. Geological Survey, during a reconnaissance of the central Kuskokwim region on the north-east side of the Taylor Mountains, about 10 miles south-east of the Holitna river. The specimen, a fragment of quartz containing crystals of wolframite about 2 in. long, was found in loose rock, and appears to have broken from a quartz vein in a contact metamorphic zone about 3 miles wide.

Lode wolframite has hitherto been found in Alaska only at Lost River on the Seward Peninsula and in a small vein on Deadwood Creek in the Circle district. Wolframite is found as float near Caribou Creek in the Bonnifield district, and in placers at two localities, Deadwood Creek in the Circle district and Pearl Creek in the Fairbanks district.

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Technique of Macrography

III.—Photographic Apparatus and Procedure

(*Continued from* THE CHEMICAL AGE, *October* 6, 1945, *p.* 318)

THERE are various ways of studying a macro-etched surface. The simplest and easiest is, of course, to look at it with the trained, unaided eye; or possibly the metallurgist may employ the ordinary magnifying glass. The amount of information derived will, of course, then depend largely on the experience of the observer. In most instances, however, it is better to use a small binocular microscope with a magnification range from ×5 to ×30. As earlier indicated, greater power is inadvisable because there will be loss of focal depth.

Assuming the specimen to have been given the necessary polishing and etching, and employing vertical illumination, it is essential to use a low-power micro-objective and ocular. In this respect, care must be exercised in choice of instrument, because not every microscope will sufficiently separate objective and specimen. No eyepiece is used for photography up to ×30 photographic-type objectives. The following table of proposed lenses has been drawn up by the A.S.T.M.

Linear Magnification	*Type*	*Focal Length (approx.)*
1 to 3	Photographic	6 in.
3 to 10	,,	72 mm.
10 to 20	,,	40 mm.
20 to 30	,,	32 mm.

Objectives of this type will be found to have considerable superiority to low-power micro-objectives. The advantages they offer include excellent covering power and a flatter field, combined with enough operating distance to permit of the insertion of a vertical illuminator between objective and specimen. The aperture must be controlled by means of iris diaphragms.

Types of Illumination

The illumination employed for the obtaining of a macrophotograph must be either oblique or vertical. For oblique illumination the operator requires a series of small filament lamps mounted in reflectors of the proper type. It will be found advantageous if these are provided with condensers so that concentration of the light may be effected when necessary. To allow of modification of the angle and direction of illumination, adjustable stands should be used to carry the lamps. These stands should be loose rather than fixed, so as to facilitate greater flexibility.

For vertical illumination, there are notable differences as compared with microphotography. For example, the objective may cover an area as great as or greater than the diameter of the objective lens. Consequently, a vertical illuminator located in the rear of the objective will not give the entire field the essential evenness of illumination. This means that the 45-degrees plane glass must be mounted in front of the objective; then the diameter of the lens will exercise no influence on the amount of light that reaches the specimen.

Suitable Condensers

If the entire field is to be uniformly illuminated, the vertical illuminator must receive a wide-angled cone of light from a suitable condenser. This enables the rays that strike the extremes of the field to return through the objective on to the screen. The use of longer-focus, lower-power objectives calls for a longer focus in a condenser of larger diameter so as to maintain the necessary angle of light and to light up the entire field it is desired to study. A somewhat short-focus condenser is advisable for the majority of work with objectives ranging from 32 to 72 mm. Illumination is usually provided by carbon arc, filament lamp, or concentrated filament lamp.

In one system, the light passing through a lens is focussed in such a way as to flood with light a condensing lens. The condensing lens is then focussed so as to give a sharp image of the field diaphragm on the specimen surface. Where the condenser is of extremely large diameter, there may be advantage in introducing a ground glass screen in front of the focal point of the condensing lens. This will also help to give a more even illumination, but it should not be used until the first focussing has been effected.

Another system, advocated by the A.S.T.M., is to employ a condensing lens of large diameter set as near to the stage as is feasible. This is focussed so as to produce an image of the light source in the aperture of the objective. This may then

be studied on a piece of card held against the front of the objective, or against the mount, the objective being for the time removed. The principle of this system is that a wide-angled cone of light is supplied to the vertical illuminator.

Adapting the Microscope

Two types of equipment exist, the ordinary metallographic microscope and the vertical macro-camera. Where the metallographic microscope is used, the first step is to take away the ordinary vertical illuminator unit for high magnifications. A simple objective holder is then inserted, and a vertical illuminator mounted between this and the stage. Usually, it is possible to take out the vertical illuminator and insert a side mirror to give oblique illumination. Usually, also, it is desirable to remove part of the normal microscope tube to avoid limitations upon the extent of field to be studied. The reason is that sharply divergent rays are produced from the back of the photographic type of objective.

These modifications render possible a magnification range of approximately ×5 to ×30. The particular benefit derived is permanent alignment and stability resulting from the mounting on an optical bench. If it is desired to obtain a lower magnification, *e.g.*, down to ×1, or a slight reduction, the metallographic microscope can be regulated to suit, but, on the whole, the results, where the specimens are large and of irregular form, will not be so satisfactory because of a lack of flexibility.

The vertical macro-camera comprises a camera mounted with great rigidity on a strong vertical stand, and having a wide range of vertical movement. This method is specially advantageous when the specimens are large and irregular, and where low magnification is needed, especially if it is desired to illuminate obliquely from more than one direction. Where the magnification desired exceeds ×3, especially if vertical illumination is desired, the source of light, condensing lens, etc., must be carried by a short optical bench placed beside or before the macro-camera. When the vertical illuminator is mounted on the camera front, a stage must be provided to enable focussing to be achieved without the necessity of moving the illuminator into a position where it is no longer in alignment with condenser and source of light.

Magnifications of the order of ×⅔ to ×2 sometimes create a problem. This arises from the difficulty of getting a lens big enough both to yield the wide-angled light cone and light up the desired area. Robinson and Ritchie recommend a large ground-glass screen set near to the vertical illuminator and replacing the condenser. The condenser on the source of light (about 12 in. from the ground-glass screen) is focussed in such a way that a large circle of light—approx. 5 in. in diameter—is thrown on the screen. A cleaned old photographic plate mounted at an angle of 45 degrees in a wooden frame constitutes a suitable vertical illuminator. This system will satisfactorily meet the needs of the metallurgist in regard to fractures, deeply-etched specimens, and magnifications within the range ×½ to ×2, where the details resolved are not enough to necessitate extremely accurate control of illumination. There is another method of "vertical illumination," elaborated by Greaves and Wrighton, which comprises setting the lens of the camera and a reflecting screen somewhat out of alignment, but this is not considered so satisfactory as the method previously described.

Details of the Process

It now becomes necessary to consider the actual procedure of macrophotography. The metallurgist needs to know and decide the extent of magnification and the kind of illumination to be used. If the surface to be dealt with is a fractured one, vertical illumination is unsuitable because the image obtained will be distorted, since not all broken surface will reflect light. A few fractures of flat type and having extremely fine grain can, however, be photographed macrographically by vertical illumination, using a ground glass set close to the illuminator.

For oblique illumination, the direction and angle of lighting must yield the required degree of contrast. This contrast usually decreases inversely within the angle of illumination. Lighting can be from one side or both sides. There is distinct advantage in obtaining a three-dimensional effect in the recording of fractures in actual parts. For this, the specimen should be so located that the features surrounding the fracture are shown as well as the fracture itself. Shadows may likewise be employed to give greater depth to photographs of solid objects. The specimen may be set in such a position that the shadow it throws helps to indicate its thickness. For this, a white ground with oblique light from one side may be employed, or, to tone down the shadow, a less intense light on the opposite side may help. A tilting movement in the camera column is also useful in this connection. A good ground for this type of work is provided by matte white paper or an old undeveloped photographic plate.

Where shadows are not desired with oblique light, a black felt or velvet background is possible, but may give results lacking in contrast. Robinson and Ritchie suggest supporting the specimen on a sheet of ground glass lit up from below by a couple of filament lamps in reflectors, with the use of ordinary oblique lighting.

Depth of focus is important. The objec-

tive must focus on the same screen images of objects both near to and remote from it (the objective). Focal depth diminishes quickly as magnification of the objective increases. With a single objective, stopping down the diaphragm causes an improvement. Where solid objects are in question, a longer-focus objective may be necessary to stop parts of the image from being thrown seriously out of focus. Where this occurs, the metallurgist will be well advised to employ the lowest-power objective and obtain the requisite magnification with the bellows draw, instead of using a high-power objective with a short length of bellows. A point to be borne in mind is that no more detail will be resolved in this way, nor will it be provided by enlargement, but for certain macrophotographs this expedient is the only way of obtaining a good result.

Where no other method proves successful, a photograph can be taken with a long-focus lens and afterwards enlarged. This may yield a better result than the direct photograph obtained with a shorter-focus objective. The reader should bear in mind, however, that the expedients above described relate solely to rough fractures and three-dimensional objects. Polished and etched specimens, in which deep etching has been adopted, usually need oblique lighting. It is sometimes essential that the angle of illumination should be kept constant and the orientation of the specimen arranged in accordance with the direction of lighting. This is particularly the case with macrophotography of the grain size of non-ferrous alloys, because very little modification of the direction of illumination makes dark grains look light, and light grains look dark.

If the specimen has been etched with the usual kind of reagent employed in microphotography, it is better to use vertical illumination because there are no marked relief effects to be stressed. With this type of illumination, the structures reproduced can be more readily correlated with those obtained with higher magnifications. The specimen may be focussed with the objective iris open. A clear glass screen with a small magnifier helps in photographing surfaces that have been polished and etched. The objective is then stopped down to the requisite extent, not limiting the aperture too much, in advance of exposure.

Orthochromatic plates are best for steel. Panchromatic plates are more suitable for highly-coloured alloys of copper base. Where contrast is difficult to obtain in the macrophotography of steels, a better result may be had if the specimen is photographed under water or with an alcohol film on the surface. Rubbing the surface with glycerol, a tiny smear being sufficient if thoroughly rubbed in with the finger, is recommended as simpler by Robinson and Ritchie. If a filter is required, it should be a yellow-green. Such filters are usually confined to orthochromatic plates in this class of work. Polarising screens will help if reflections cause difficulty.

The reader should note that stereoscopic macrophotographs can be taken by means of specially-constructed cameras. These are designed to take two photographs from somewhat different angles, and the two photographs are then studied through a stereoscope. This restores some of the depth lost when a single photograph is taken

Cast Iron in the Process Industries*

Some Points for the Chemical Engineer

by F. L. LaQUE†

IN view of the attention given to the relatively new corrosion-resisting alloys during the past few years, it may be surprising to many that cast iron has been referred to fairly recently as "the most important material of construction in chemical engineering."[1] Cast iron has been able to maintain this position largely as a result of the great improvement in grey iron foundry practice and the utilisation of alloying elements which have taken place within recent years. Moreover, it has been predicted[2] that the further application of cast iron in new processes "will depend only upon the recognition of properties it is possible to develop by the use of alloying elements."

The fact that cast iron has been used in large tonnages in chemical process equipment for a longer period than any other material of construction is traceable largely to the ready availability and low service cost of this engineering material. Grey iron foundries exist in practically every community; remote chemical and process plants, such as pulp and paper mills, may have their own foundries for production of replacement parts. In the latter cases, the original design of processing equipment to make use of grey iron castings is especially important.

Supplementary advantages of this material that account for its choice in many instances include the facility with which it

* From a paper published by the Gray Iron Founders' Society, Inc., 120 Branford Place, Newark, N.J.

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may be machined with ordinary tools in the field as well as in the shop, and its good anti-friction properties which enable it to run in rubbing contact with itself and other metals and alloys. Relative freedom from seizure and galling permits its use for bearings—lubricated or submerged—and the setting up of close clearances between moving parts, as in pumps and between agitator or scraper arms and kettle walls, with consequent improvements in operating efficiency. This freedom from galling is especially desirable in connection with the pfoper functioning of plug cocks.

Jacketed cast iron kettles have maintained their popularity for many reasons, *e.g.* :

1. The many cast-in studs between the jacket and the kettle contribute to high heat transfer rates.

2. Scrapers can rub on kettle walls without galling. This is an especially important advantage in the processing of viscous materials.

3. Cast iron kettles are rigid and retain their shape on heating and cooling so that scraping devices maintain close and uniform contact with all areas to be scraped, thus avoiding excessive wear of high spots or failure to wipe low ones.

Points in Design

For the many purposes for which iron or steel offers adequate resistance to chemical attack, the choice of grey iron castings may be based on one or more of the following factors :

1. A casting most readily provides the shape required with appropriate distribution of mass where mass is needed for strength, rigidity and durability, and with none of the complications of distortion, special heat treatment and the opportunity for undesired electrolytic effects and occasional awkward leaks that may be associated with various types of joint.

2. Grey iron is the least expensive casting material.

3. Cast iron may demonstrate an advantage over other forms of iron or steel with respect to rates of corrosion, either as uniform attack or pitting.

4. Grey alloyed iron may be made strong enough; and it maintains its strength, and particularly its rigidity or stiffness, at moderately high temperatures.[3]

5. By suitable choice of composition and casting practice—as by the use of chills—cast iron may be provided with exceptional resistance to erosion or abrasion. Chilled alloy iron, for example, showed outstanding performance in tests for die liners and muller tyres in the ceramic industry.[4]

The designer of chemical processing equipment of cast iron should take the following points into consideration :[5]

1. Large flat surfaces should be avoided and the thickness of metal kept as uniform as possible.

2. Where inequalities in section thickness are unavoidable, the change in section should be gradual.

3. Sharp corners, whether internal or external, are a source of fracture and should always be avoided.

4. All large flanges should be webbed, and slots should be provided rather than bolt holes, particularly with high silicon irons.

5. Long projecting pipes in large vessels should be avoided, and the design generally should be kept as simple as possible.

6. The advice of the foundryman should be sought and followed in the early stages.

The nature of chemical processes is such that resistance to corrosion is always an important factor in the choice of a material of construction. Cast iron differs from other ferrous materials in the way it resists corrosion. This difference is related directly to the physical structure of cast iron and, particularly, to the presence of graphite flakes in a ferritic, pearlitic, or austenitic matrix. The corrosion-resisting characteristics of grey iron may be altered by alloying and by foundry techniques since both affect the size, shape, and distribution of the graphite particles and, in addition, influence the corrodibility of the matrix. Consequently, as compared with steel, there is a greater facility and more scope for improvement in the corrosion resistance of cast iron by use of small amounts of alloying elements.

The presence of graphite is often a determining factor in the progress and distribution of corrosion. The graphite itself is insoluble in most corrosive media; and very often it is able to act as a binder, retaining other insoluble corrosion products in a coating which provides an effective barrier against further penetration of the corrosive medium to the underlying iron. By breaking up the structure of the iron the graphite particles may also serve to interrupt the progress of small pits and thus to prevent highly localised corrosion, which is not frequently encountered in cast iron.

Resistance to Acids

The effect of the graphite is not always beneficial, however. In some media, such as certain strong acids which form readily soluble iron corrosion products, the attack on the matrix actually may be accelerated by the galvanic cell set up between the graphite and the iron,[6] if the structure of the cast iron and the distribution of the particles of graphite are such as to permit infiltration of the corrosive constituents into the body of the casting. While, under such conditions, some improvement in performance can be achieved by alloying and foundry practice designed to secure a more favourable size, shape, and distribution of the

graphite particles and a "denser" iron, greater improvement may often be realised by the use of sufficient amounts of nickel, or nickel and copper, to develop an austenitic matrix more highly resistant to chemical attack and less active in its galvanic reaction with graphite.[2,6] Another method of increasing the resistance of cast iron to active acids is by alloying with large amounts of silicon.

Even when conditions of exposure are such as to lead to considerable "graphitic" corrosion, however, grey iron may still be able to function satisfactorily as a container for liquids, provided the stresses to be withstood are not too high, as, for example, in pipes carrying water or other liquids under relatively low pressure. In favourable circumstances, the nobility developed by the formation of an impervious coating high in graphite content reduces the galvanic effect between grey iron and non-ferrous alloys, such as bronzes.

In some cases, the nature of the chemical process or the corrosive media handled is such that, in spite of a fairly rapid rate of attack on cast iron, no other material can be expected to render long enough service to justify a higher initial cost. Or, again, the time required to show a profit on such investment would be so long as to introduce a serious danger of obsolescence. In such cases, either the thickness of the iron is increased to provide for the corrosion expected or the equipment is replaced as often as necessary. Such practice is confined, however, to processes where contamination of the product by iron compounds is not harmful or where any iron that may be dissolved may be removed to further processing.

Protective Coatings

The usefulness of grey iron may be extended considerably by the application of metallic and non-metallic protective coatings, as by electro-deposition, enamelling, spraying, and by lining with brick, graphite, and so forth.

Grey iron demonstrates good resistance to corrosion by alkaline solutions, by many organic compounds, and by neutral and slightly acid solutions. In certain strong acids, such as sulphuric, nitric, and crude phosphoric, iron acquires, as we have noted, protective corrosion products that permit its successful and economical use.

Sulphuric acid attack is resisted satisfactorily when the acid concentration exceeds about 70 per cent. by weight. Cast iron pots or pans have long been used for the concentration of sulphuric acid, *e.g.*, in the concentration of denitrated waste acids from 70 to 97 per cent. Corrosion of such pots may be fairly rapid in initial stages, but as the pots are used a protective coating is developed. The development of such coatings is favoured by operations under uniform conditions, particularly as to temperature. Aging, or normalising, of pots prior to use is desirable.[5]

In fuming sulphuric acid, cast iron may be embrittled, especially if there should be segregation of graphite.[7] In plants in which sulphuric acid is made by the contact process, all-cast-iron pumps or pumps with cast iron casings and complex chromium-nickel alloy impellors are in general use.

Cast iron vessels are employed in the manufacture of acetic, nitric and hydrochloric acids by action of concentrated sulphuric acid. The concentrated sulphuric acid itself is not too highly corrosive and, since the operating temperatures are above the boiling points of the other acids, there is no condensation to lead to corrosion by their vapours.[3]

Sulphonators, nitrators, and fatty-acid stills are frequently constructed of cast iron, which is also used successfully in the processing of coal-tar products, including crude tar acids and such refined products as phenols, benzene compounds, and toluene.

Grey cast iron is highly resistant to alkaline solutions and finds many and important applications in equipment employed in the production of caustic soda by both the ammonia-soda and the electrolytic processes. Improved life of equipment and reduced contamination of the caustic are achieved regularly by alloying the cast iron with nickel, and especially by the employment of regular and copper-free Ni-Resist. And cast iron has proved to be the most satisfactory material for fusion pots used in the production of anhydrous caustic soda.

Austenitic Alloys

Mention has been made of austenitic cast irons, the most common of which is Ni-Resist, *i.e.*, grey cast iron containing about 20 per cent. of nickel, or nickel plus copper in the ratio of about 2.5 to 1. Another austenitic cast iron, developed in England particularly to resist scaling and growth at elevated temperatures, is called Nicrosilal. It contains about 18 per cent. nickel, 6 per cent. silicon, and 2 per cent. chromium. These austenitic irons show a considerable improvement over an unalloyed iron or steel in resistance to corrosion by a variety of media, including mineral and organic acids, neutral and alkaline solutions, organic and inorganic sulphur compounds, petroleum products, etc. Austenitic irons are considered to be superior to ordinary cast iron in resisting oxidation and growth at elevated temperatures and are suitable for use at temperatures up to about 1500° F., where small permanent dimensional changes may be tolerated.

Advantage is taken of this property in many oil refinery applications[8] for such purposes as still tube supports, and in the gas

industry[9] for such applications as gas producer shells and return bends, butterfly valves, etc., between coke ovens and collecting mains.

For services where the castings may be subjected to abrupt and considerable changes in temperature, so as to lead to high thermal stresses, it is desirable to employ a more highly alloyed composition which contains about 30 per cent. nickel and has a much lower coefficient of thermal expansion. Minimum thermal expansion may be provided by an iron which contains about 35 per cent. nickel.

In the soap industry austenitic irons are used for fatty acid stills and for filter press plates. In the handling of caustic soda, they are employed principally for pumps and pump parts and valves. Similarly, these alloys are found to be serviceable materials for the piping, valves and filters handling the alkaline solutions used in the manufacture of viscose rayon, the copper-free variety being usually preferred.

In the salt industry, the austenitic irons have been found to be especially satisfactory materials for the bodies and grids of salt filters and for the pumps and valves which handle both hot and cold brines.

Silicon-Iron Alloys

By adding about 14.5 per cent. silicon to iron an alloy is produced which possesses remarkable resistance to a number of troublesome corrosive media. These include both hot and cold sulphuric solutions with or without oxidising compounds present, nitric acid, phosphoric acid, organic acids and acid salts. The ordinary silicon irons are not recommended[10] for use with bromine, fused alkalis, hydrofluoric acid, hydrofluosilicic acid when concentrated, and sulphurous acid. Strong, hot caustic solutions and some sulphates require special consideration. Resistance to hydrochloric acid, chlorine, and acid chlorides is provided by the addition of about 3 per cent. molybdenum which functions by developing insoluble surface films in hydrochloric acid and in other acid chloride solutions.

The principal limitations to the more extensive use of the silicon iron alloys are imposed by their hardness which, while advantageous in contacts with abrasive slurries, makes machining difficult and makes for their relatively low strength (tensile strength about 16,000 lb./sq. in.) and lack of toughness.

To the original article, tables are appended showing the results of many corrosion tests, a list of suitable chemical plant services for cast iron, and a list of corrosive chemicals which are satisfactorily resisted by high-silicon cast irons.

REFERENCES

[1] CUMMING and RUMFORD, "The Trend of Chemical Engineering," *Metallurgia*, 1938, *18*, No. 108.
[2] H. L. MAXWELL, "Cast Iron in Chemical Equipment," *Mechanical Eng.*, 1936, *58*, No. 12.
[3] W. H. ROTHER, "Utilising Cast Iron in Chemical Equipment," *Chem. Met. Eng.*, 1933, *40*, No. 7.
[4] J. O. EVERHART, "Some Special Wear-Resisting Materials for Clay Machinery Parts," *J. Amer. Ceram. Soc.*, 1938, *21*, No. 2.
[5] P. PARRISH, "Acid Resisting Cast Iron," *Foundry Trade J.*, 1941, *64*.
[6] WESLEY, COPSON, and LAQUE, "Some Consequences of Graphitic Corrosion of Cast Iron," *Metals and Alloys*, 1936, *7*, No. 12.
[7] H. C. LABOUR, "Centrifugal Pumps for the Process Industries," *Ind. Eng. Chem.*, 1938, *30*, No. 10.
[8] "The Petroleum Industry Applies Ni-Resist," Nickel Cast Iron Data, Section 1, No. 4, The International Nickel Company, Inc. O. B. J. FRASER, "Nickel and Nickel Alloys for Oil Refinery Equipment," *Refiner and Natural Gasoline Manufacturer*, 1933, *12*, No. 5.
[9] J. S. VANICK, "Nickel Alloy Cast Iron in Gas Manufacturing Equipment," New England Gas Assoc. (1936).
[10] *Bulletin No.* 11-*B*, The Duriron Company, Inc., Dayton, Ohio.

Electrolytic Tin Plating

U.S. Improvements

NEW advantages have been brought to electrolytic tin plating as a result of the discovery, made by the Metal & Thermit research laboratory, that potassium stannate in the electroplating bath is superior in many respects to the commonly used sodium stannate. Potassium stannate has four definite advantages over sodium stannate, which may be summarised by saying that the higher solubility of this new chemical permits the use of more concentrated plating baths, especially at higher temperatures; because of its greater conductivity, less voltage is required and anodes may be kept farther away from the work during plating; the added stability of potassium stannate solutions allows the continued use of more concentrated solutions without sludging trouble. Finally, the greater cathode efficiency shows an increase of 18 per cent. in deposition rate, at currents normally employed with sodium solutions. All of these factors combine to provide a plating solution which permits the continued use of plating speeds of from six to twelve mils per hour, representing a 100 to 400 per cent. increase over those possible with regular sodium stannate baths.

Imperial College Centenary

A Royal Occasion

AN impressive ceremony, well deserving of the occasion, was staged at the Albert Hall on Thursday last week, when Their Majesties the King and Queen attended the Imperial College Centenary Celebrations. The vast spaces of the hall were filled with students and ex-students, with the members of the staff in brightly coloured academic dress, and with industrial and other guests. Seats on the dais were reserved for the governing body of the College, and behind them was the Central Band of the Royal Air Force conducted by Wing Commander O'Donnell.

As the guests and the members of the College filed into their places they were entertained by strains of martial and other music, until shortly after 9 o'clock, when the Chancellor and Vice Chancellor of the University (the Earl of Athlone and Professor D. Hughes Parry) entered the hall, conducted by the Deans of the three constituent colleges, to the strains of *The March of the Men of Harlech*. At 9.25 Their Majesties, accompanied by H.R.H. The Princess Alice, and escorted by the Chairman and other members of the governing body, advanced to the dais.

A Century of Achievement

In his speech of welcome, Lord Rayleigh, Chairman of the Governors of the Imperial College, spoke of the happy chance by which the centenary of the foundation of the Royal College of Chemistry in 1845 had fallen in this year of total victory. Looking back over the 100 years now ended, it was natural to take note of outstanding achievements. He was struck by the victories over the agencies of disease to which they had contributed. Beginning with Tyndall, their Professor of Physics, who established by investigations in this country running parallel with those of Pasteur in France that the microbes of infection are not generated spontaneously in putrefying matter, he referred to the stains used in the investigation of bacteria. The aniline dyes used for this purpose had their origin in the College in 1856, when W. H. Perkin discovered mauve. Perkin was not a professor, but a student under Hofmann, and was only 18 years old. Methyl violet and fuchsin were among the discoveries of Hofmann, who succeeded Playfair as professor of chemistry. Hofmann also took up the study of water-analysis from the standpoint of water supply and the disposal of sewage; and Frankland, who succeeded him, examined anew for himself the various methods of analysis which had been in use, and established an indirect method—a test to see how far the water contained ammonia and nitrates.

His Majesty signs the memorial record.

Under Professor Munro, their Zoology Department had, in recent years, built up a large body of knowledge about insect pests and how to combat them; and when the war came its staff and resources were used to the full in protecting stocks of grain, and in combating the insects which infect our troops with malaria, yellow fever, sleeping sickness, typhus and plague. Further light had come from the recent development of penicillin. Nearly all the penicillin in use to-day came from the progeny of the single small spot of mould originally observed by Fleming. The preparation of concentrated penicillin from it is a matter of no small technical difficulty, and with this and the question of its chemical nature their Organic Chemistry Department under Professor Heilbron was vigorously occupied. Penicillin might also be produced synthetically, and much more easily and cheaply than now, but they must first have an accurate knowledge of its ultimate composition. That step had now been achieved in the chemical department, but it was by no means enough in itself. They were now attempting to build up the same structure in the laboratory by the methods of synthetic chemistry, and it was quite likely that this would result in making the drug available to all.

The King's Speech

The King in his reply, which was broadcast, referred to the interest with which he and the Queen had listened to Lord Rayleigh's speech. Speaking as Visitor to

the College, the King recalled the interest taken by his family not only in the Imperial College since its foundation in the reign of Edward VII, but in its three constituent colleges since their beginnings. The first

On the left, Dr. R. V. Southwell, F.R.S., Rector of Imperial College. On the right, Lord Rayleigh, F.R.S., chairman of the Board of Governors.

president of the Royal College of Chemistry at its inception in 1845 was his great-grandfather, Prince Albert, later Prince Consort. Prince Albert showed the same concern for the well-being of the School of Mines, and as President of the Royal Commissioners for the exhibition of 1851 he gained for science and the arts that great site on which, with other institutions, the Imperial College now stands. The King then referred to the personal efforts which the Prince Consort made in supporting the exhibition despite the serious opposition he had to face in the Press and the reluctance of industrialists to give it the necessary support. Speaking of Dr. Lyon Playfair, who became a "special commissioner" for the exhibition, His Majesty mentioned the Queen's wish to remind them that Playfair bore the name of her family, with which he was connected through his mother.

Coming to the Imperial College of to day, the King said he was well aware that Lord Rayleigh could, had time allowed, have pointed out the many impressive victories won by the departments of the College in other fields. He knew the success of the D-Day invasion was, in fact, partly due to the engineers trained in the City and Guilds College and that the Imperial College had contributed to victory not only by research but by its training of men for the Empire. The achievements of British science and technology during the war had been outstanding and, with relatively limited resources, we could claim to have outmatched our enemies in every vital respect. Our hearts were filled with justifiable pride, and the same vigour, ingenuity, and skill that brought us to victory must be engaged in ever-increasing measure in the work of reconstruction.

At the same time, the King continued, our ardour must be tinged with apprehension when we reflected on the potency of the weapons which new developments in the realm of science were placing in the hands of mankind. He concluded with a message to the students, who would soon be going out from the College to their work in the world, to regard their knowledge and their skill always in the light of a trust for the benefit of humanity.

The Rectors' Thanks

The Rector of the College, Dr. R. V. Southwell, returned thanks to Their Majesties, speaking both for staff and students. Thrice within living memory they had had proof of royal interest in the growth of their constituent colleges: never before had they been favoured with the presence of both the King and Queen.

In 1846, the Prince Consort laid the first stone of the College of Chemistry in Oxford Street. The stone lay there—on the platform—to-night, waiting to be again embodied in their chemistry buildings. Had the Prince Consort's wide views been general, their problems now would be less hard; for then on his splendid ground-site buildings would have risen in ordered sequence, and Imperial College, chartered in 1907, would have been a federation of colleges that not only were adjacent in the fields of science, but lay within the same London borough. As has turned out, though two have buildings that adjoin to form a well-placed whole, the third—the Royal College of Science—has its departments widely scattered. As yet they had no place where they might beg His Majesty to lay

(*Continued opposite*)

MR. A. G. STEWART and MR. W. S. MORRISON, M.P., have joined the board of the United Steel Companies.

MR. R. S. GUINNESS has resigned from the board of the Imperial Smelting Corporation.

MR. ALBERT M. POXON, chairman of Newball & Mason, Ltd., manufacturing chemists, Basford, Nottingham, has retired after 55 years' service with the company.

MR. I. D. ORR, formerly vice-chairman, succeeds COL. J. V. RAMSDEN as chairman of the British Barytes Producers' Association. Col. Ramsden becomes vice-president.

MR. W. TAYLOR has been appointed Scottish manager of the British Bitumen Emulsions, Ltd., and of the Graphite Oils Co., Ltd., in succession to the late Mr. T. S. Johnson.

MR. ARTHUR MORTIMER, after 15 years as secretary of the Wholesale Drug Trade Association, has resigned that office. His successor, MR. CHARLES W. ROBINSON, M.P., took over his duties on November 1.

MR. THOMAS COCKBURN, F.R.I.C., City Analyst to the Glasgow Corporation, has retired after a long period of office. Friends and colleagues entertained the retiring principal at a dinner in the North British Hotel last week, when MR. A. R. JAMIESON, B.Sc., F.R.I.C., his successor, handed over parting gifts.

The Nobel Prize for Medicine for 1945 has been awarded jointly to SIR ALEXANDER FLEMING, Professor of Bacteriology at St. Mary's Hospital Medical School, London, to SIR HOWARD FLOREY, Professor of Pathology at Oxford University, and to DR. ERNST BORIS CHAIN, Oxford University Lecturer and Demonstrator in Chemical Pathology, for the discovery of penicillin and its healing effects.

MR. D. A. PRITCHARD, technical manager of the Chemical Group of Canadian Industries, Ltd., for the past ten years, and one of the pioneers of the Canadian alkali industry, has left Canada for Britain to carry out special work for the company until next autumn, when he proposes to retire and live in the United Kingdom. Born at Rhymney, S. Wales, in 1886, Mr. Pritchard went to the United States in 1910, where he was associated with the Pennsylvania Salt Manufacturing Co. In 1915, he returned to the United Kingdom and joined the Alkali Company, now part of I.C.I. He crossed to Canada in 1922 and joined the Canadian Salt Company (later a part of C.I.L.), where he was instrumental in installing a chlorine liquefaction plant which enabled the pulp and paper industry and other users to obtain chlorine for bleaching in a pure form. He also invented and worked out the "triple salt process."

GROUP CAPTAIN A. C. MENZIES, M.A., D.Sc., F.Inst.P., has been appointed controller of research and development to Adam Hilger, Ltd., and starts his duties on November 14, succeeding MR. F. TWYMAN, F.R.S., in this capacity. Mr. Twyman continues with the firm as managing director and technical adviser.

Dr. Menzies saw active service in the war of 1914-18 as a seaplane pilot in the Royal Naval Air Service, and after graduating

Dr. A. C. Menzies.

from Cambridge University, had university appointments in physics at Leeds, Leicester, and Southampton. At Leicester he inaugurated the physics department in the newly-formed University College, and at Southampton he held the Chair. In December, 1944, he was appointed to the Chair at University College, Swansea, the appointment to take effect after demobilisation, but by the courtesy of the College was released from this and enabled to join Adam Hilger, Ltd., where his specialised knowledge and administrative experience will be of value.

In this war he was in charge of operational research at the Air Ministry and was Deputy Director of Science and Deputy Scientific Adviser. Since last December, when Sir George Thomson retired from the post, he has been acting as Scientific Adviser. He has specialised in spectroscopy, first in atomic spectra, later in the Raman effect.

(*Continued from p.* 418)

this stone, that it might rest from its wanderings.

In accordance with Dr. Southwell's request, His Majesty then signed the memorial record, and the formal proceedings ended with the singing of the National Anthem: but Their Majesties were awarded a tremendous ovation when, after receiving the staff of the College, they returned to the hall and took part in the students' dance.

Parliamentary Topics

German Fertilisers

N the House of Commons last week, Major Peter Roberts asked the Minister of Supply and of Aircraft Production whether, in view of the shortage of potash fertilisers for British agriculture, he would make immediate arrangements for large shipments from Germany of such fertilisers, especially Kainit, as part of her reparations to this country.

Mr. Wilmot: Owing to shortage of coal, production of potash in Germany is at a very low level at present. My department is keeping in close touch with the situation with a view to obtaining supplies from this source as soon as output and internal transport conditions permit.

Patents

Sir A. Gridley asked the President of the Board of Trade whether he would now implement the recommendations contained in the first interim report of the Departmental Committee on the Patents and Designs Acts, dated March 12, 1945, as to the procedure to be adopted in connection with an extension of the term of patents where the patentee has suffered loss through the war; and when he proposed to introduce the necessary legislation.

Sir S. Cripps: I am now considering whether it will be possible to introduce early legislation.

Aluminium Houses

Major Lloyd asked the Minister of Works what was the approximate cost of the aluminium bungalow and the number on order.

Mr. Tomlinson: The cost for the aluminium temporary house is £1,365. The number on order is 50,000, but this figure is subject to negotiation.

Synthetic Fibres

Mr. Peter Freeman asked the President of the Board of Trade whether he would publish a White Paper on the war-time use of synthetic fibres for warm wear and other purposes in the Armed Forces during war.

Mr. Wilmot, who replied, said that synthetic fibres made a valuable contribution to war production, but the extent of their use does not justify the publication of a White Paper.

Malayan Tin Industry

Dr. Jeger asked the Secretary of State for the Colonies whether he was aware that the Malayan Chamber of Mines, while pressing for the cost of rehabilitating the tin industry to be defrayed from public funds, was urging that primary responsibility for this disbursement should rest with the private interests concerned and whether, in view of its past exploitation of labour and the consumer, he would take steps to nationalise this industry for the benefit of the Malayan peoples.

Mr. George Hall: The Malayan Chamber of Mines has asked for financial assistance to enable the companies to repair and replace equipment destroyed or damaged as the result of military operations. This request is at present under consideration. Whether or not such assistance is granted, it is my intention to take all possible steps to ensure the restoration of fair conditions of labour, and the fair contribution from the industry to revenue which will be required to provide, among other things, for improved social and welfare services.

Uranium Deposits

Replying to Mr. Studholme, the Prime Minister stated that all the necessary steps had been taken to open and explore existing known deposits of uranium ore in this country and to search for additional deposits in order to save purchases of this metal from overseas.

Oil-Heating Plant

Sir G. Fox asked the Minister of Fuel and Power whether, in view of the shortage of coal supplies, arrangements could now be made to facilitate supplies of crude oil for oil-burning heating plant; and whether he could give any indication of the stocks of oil in this country and the position with regard to imports.

Mr. Shinwell: I regret that until the future supply position of fuel oil is clearer, it will not be possible to consider a release of fuel oil in place of other fuels. Fuel oil stocks in this country were about 515,000 tons at October 11, and are falling. Reliable estimates of imports cannot be made in present circumstances, but every effort is being made to improve the position.

Tax on Firebricks

Commander Maitland asked the Chancellor of the Exchequer whether he would consider to remove the Purchase Tax on firebricks, which were valuable aids to fuel economy.

Mr. Dalton: In my Budget statement, I have proposed to exempt from Purchase Tax parts of domestic stoves, grates, ranges and fireplaces. This will free from tax those firebricks which are designed to be built into such stoves, etc., but not loose firebricks sold as accessories for domestic fire grates.

According to statistics published in *The Board of Trade Journal*, Switzerland imported from Germany chemicals worth 38,039,000 francs in 1943, compared with 32,467,000 francs and 23,202,000 francs in 1939 and 1938 respectively. Dyestuff imports rose to 15,505,000 francs in 1939 from 10,636,000 in the previous year; however, imports in 1943 totalled only 10,004,000 francs. Coal imports rose from 25,738,000 francs before the war to 90,365,000 francs in 1943.

General News——From Week to Week

The Sample Post (limit of weight 1 lb.) to Poland has been restored.

Mepacrine is now being produced by Aspro, Ltd., output aggregating 2,000,000 tablets daily.

Specification DTD 904—Cadmium Plating—has been reprinted, incorporating Amendment Lists Nos. 1 and 2.

R. W. Greeff & Co., Ltd., have returned, since October 29, from Bishop's Stortford, to their city office, Thames House, Queen Street Place, London, E.C.4. (Central 6550.)

A new depôt, costing £15,000, which is to be erected at Wick for the North of Scotland Milk Marketing Board, will incorporate a milk-processing and milk-products plant.

B.E.T.R.O. can now offer an intelligence service and, in the beginning of 1946, will be able to carry out specific research on instructions from members.

A new leaflet is now obtainable at the principal post offices giving particulars of the air mail services which are available for communication with civilians in countries overseas.

A bronze bust of the late Professor H. E. Armstrong has been presented to the Imperial College, South Kensington, by the Armstrong Trust, and will be placed in the central hall of the College.

Nine men, charged with offences relating to the sale of linseed oil without a Ministry of Supply licence, were found guilty of certain of the charges preferred, at the Central Criminal Court on Monday this week.

Members of the B.A.C. are reminded that nominations for officers or for general councillors must reach the offices of the Association not later than November 17, *i.e.*, 28 days before the annual general meeting on December 15.

Prospecting licences have been granted by the Ministry of Fuel and Power to the Anglo-American Oil Company in respect of four areas covering 670 sq. miles in the Scarborough, Whitby, and Bridlington regions of Yorkshire.

The Ministry of Supply announces that the joint United Kingdom/United States ceiling price arrangements in respect of waxes (carnauba, ouricuri, candelilla, beeswax) ceased to apply to purchases made at origin on or after October 22, 1945.

The Sir Henry Fildes Medal of the Institution of Factory Managers was won by Mr. T. B. Boothman of Bolton, for his essay on "Training of Factory Managers, practical and administrative, which should be first and why."

The rate of Purchase Tax chargeable on household goods of plastic material derived from cellulose, casein, papier maché or synthetic resin, used in the preparation or serving of food or drink, is reduced to 16⅔ per cent. of the wholesale value on and after November 3.

The General Account of the Development of Methods of Using Atomic Energy for Military Purposes, issued under the auspices of the U.S. Government, has now been published by H.M. Stationery Office, under the title *Atomic Energy*, price 2s. 6d. An extensive summary of its contents was published in THE CHEMICAL AGE, in the issues of October 20 and 27.

The Tube Investments Group's two-year programme includes new plant at the Sheffield works; additional welding mills at Oldbury; and wide reconstruction at the Chesterfield works, which, even before the war, operated one of the biggest heavy steel tube plants in Europe. New production layouts are projected for the works at Birmingham, Walsall, Wednesbury, and Jarrow.

The Fuel Luncheon Club, in commemoration of its tenth year of existence, has issued a pamphlet containing the club's rules, a chronology of the addresses presented to it, and a complete list of members. The club has indeed fulfilled its purpose to a greater extent than its founders anticipated (to quote the foreword) and sincere flattery is now being shown by the formation of similar clubs in provincial centres.

A simplified form of application for export licence will be brought into use, as soon as supplies can be printed, which will call for considerably less information than heretofore. Pending the introduction of the new form, exporters completing the present application form need no longer answer questions 6, 7, 8, 9, 10, 12, 13, 14, 15. Further, on page 3, the country of destination only need be given.

In his address to the British Barytes Producers' Association on election to its chairmanship, Mr. Ian D. Orr said that while there might be a shortage of white barytes in this country, there was plenty of good off-colour material, and he suggested that the support of the architectural and decorative professions might be enlisted to recommend the use of as much coloured paint as possible for the time being. Given the labour and a fair chance to carry out development and exploratory work, he felt that after a short time they might easily be in a position to supply the country for some time to come with most of its requirements of white material.

A research and experimental establishment covering all aspects of the use of atomic energy is to be set up at Harwell airfield, near Didcot, Berks, according to a statement of the Prime Minister in the House on Monday. Responsibility for the work is to be transferred from the D.S.I.R. to the Ministry of Supply, of which the "Tube Alloys Directorate" will now become a department.

The Association of Scientific Workers held a meeting on October 20, to examine the need for closer relations between social scientists and natural scientists in applying their knowledge towards the solution of current problems. Sir Robert Watson Watt, C.B., F.R.S., took the chair, and the speakers were Professor J. D. Bernal, F.R.S., Mrs. Joan B. Robinson, M.A., the economist, and Mr. D. Chapman, B.Sc. (Econ.) of Wartime Social Survey. The meeting resolved to set up a Joint Sciences Committee, consisting of scientists from various fields, to suggest the best ways in which scientists could be brought together to deal with social problems, and to consider certain fields in which such work is of particular importance.

Foreign News

"**Mercury Fulminate,** its Autocatalytic Reactions and their Relation to Detonation," is the subject of an interesting article by Leroy R. Carl in the current *Journal of the Franklin Institute* (1945, *240*, 3).

Between 1939 and 1945, British Guiana produced $40 million worth of high-grade bauxite for war purposes, representing a total production of 6½ million tons. In 1933 the production figure was 36,000 tons and, in 1936, 170,150 tons.

The increase in the coal distribution in France during October has enabled certain sectors of the chemical industry to increase their activity. It is now possible that there may be an increase in the production of sodium carbonate, as well as the starting up of new nitrogen manure factories. Production of tar in August amounted to 15,435 tons; crude benzol production totalled 1642 tons, compared with 1325 tons a year ago.

Forthcoming Events

November 3. Institution of Chemical Engineers (N.W. Branch) and **Society of Chemical Industry** (Liverpool Section). Inaugural joint meeting. Large Chemical Theatre, Liverpool University, 3 p.m. Mr. T. Wallace: "Starting up a New Chemical Factory."

November 3. Association of Austrian Engineers, Chemists and Scientific Workers in Great Britain. Rooms of The Chemical Society, Burlington House, Piccadilly, London, W.1, 3 p.m. Meeting of British and Austrian Scientists to discuss the restoration of science in Austria.

November 5. Royal Institute of Chemistry (Leeds Area Section). Chemistry Lecture Theatre, Leeds University, 6.30 p.m. Annual general meeting. Visit of the President, Professor Alexander Findlay.

November 7. Scottish Engineering Students' Association. 39 Elmbank Crescent, Glasgow, 7.15 p.m. Mr. A. A. Wells: "Photo-Elasticity."

November 7. Chemical Society (S. Wales Section), **Royal Institute of Chemistry,** and **S.C.I.** Newport Technical College, Newport, 6.30 p.m. Dr. E. H. Coulson: "Research on Coal Tar."

November 7. North-Western Fuel Luncheon Club. Engineers' Club, Albert Square, Manchester, 12.30 for 12.45 p.m. Professor P. M. S. Blackett, F.R.S.: "Atomic Energy."

November 7. Royal Society of Arts. John Adam Street, Adelphi, London, W.C.2, 1.45 p.m. (Inaugural meeting of the 192nd session.) Dr. E. F. Armstrong: "The Influence of the Prince Consort on Science."

November 7. Society of Public Analysts and other Analytical Chemists. Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1, 6 p.m. Mr. T. W. Goodwin and Professor R. A. Morton: "The Determination of Carotene and Vitamin A in Butter and Margarine," and Mr. J. L. Bowen, Mr. N. T. Gridgeman, and Mr. G. F. Longman: "A Photoelectric Method of Assaying Vitamin A in Margarine."

November 8. Society of Instrument Technology. London School of Tropical Medicine, Keppel Street, London, W.C.1, 6 p.m. Discussion: "Education in Instrument Technology."

November 8. Institute of Fuel. Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, 6 p.m. Industrial Waste Heat Recovery Series (first paper). Dr. P. O. Rosin: "Total and Recoverable Heat in Waste Gases."

November 9. British Association of Chemists (St. Helen's Section). Y.M.C.A. Buildings, 7.30 p.m. Mr. S. W. Norman: "Fractional Distillation, the Theory and its Applications."

November 9-10. The Discovery of X-rays: 50th Anniversary Celebrations. November 9. Royal Institution, 10 a.m.-1 p.m.: "Application of X-rays to Physics," including Amorphous Substances (Prof. J. T. Randall), and Fibrous Substances (Dr. W. T. Astbury). 4 p.m. Joint Meeting, Phœnix Theatre, London, W.1, Sir Lawrence Bragg: "The Scientific Consequences of Röntgen's Discovery of X-rays." **November**

10. Royal Institution, 10 a.m.-1 p.m. Applications of X-rays to Metal structures (Dr. H. Lipson); Minerals (Dr. W. H. Taylor); Crystal chemistry (Dr. A. F. Wells); X-rays and geochemistry (Prof. V. M. Goldschmidt); and Organic structures (Prof. J. M. Robertson and Mrs. D. Hodgkin). Institution of Electrical Engineers. 3.30 to 5.0 p.m. and 6.0 to 7.30 p.m. Meeting for Historical Reviews.

November 13. Institution of Chemical Engineers and Chemical Engineering Group. Apartments of the Geological Society, Burlington House, Piccadilly, London, W.1, 5.30 p.m. Mr. Hemingway Jones: "Some Practical Aspects of Large-Scale Gas Distribution, with particular reference to Steelworks."

Commercial Intelligence

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

Mortgages and Charges

(Note.—The Companies Consolidation Act of 908 provides that every Mortgage or Charge, as described therein, 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 and 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.)

KENT CHEMICAL CO., LTD. (formerly Collective Exchange, Ltd.), Tenterden. (M., 3/11/45.) October 6, charge, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Old Brewery, Station Road, Tenterden. *Nil. August 25, 1945.

Satisfactions

BROOKES CHEMICALS, LTD., Lightcliffe, Yorks. (M.S., 3/11/45.) Satisfactions October 15, £50,000, registered August 11, 1919, and of an agreement registered March 27, 1929.

LABORATORY HOLDINGS, LTD., Denham, Middlesex. (M.S., 3/11/45.) Satisfaction October 12, £11,200, registered June 19, 1939.

Company News

Lightalloys, Ltd., for the year ended June 30, report a net profit of £49,183 (£44,220). A final dividend of 12½ per cent. is being paid, making a total of 25 per cent. (same).

Erinoid, Ltd., has made a net profit, for the year to July 31, of £2611 (£16,802), plus £15,000 transferred from taxation reserve not required. A final dividend of 10 per cent. brings the total up to 15 per cent. (same).

The United Steel Companies, Ltd., report a trading profit, for the year to June 30, of £2,254,829, including £200,000 estimated E.P.T. refund (£2,288,675). Net profit is £584,676 (£570,602). A final ordinary dividend of 5½ per cent. makes, again, a total distribution of 8 per cent.

Chemical and Allied Stocks and Shares

BUSINESS in stock markets has remained on a larger scale, and despite the sharp gains in industrial shares which followed the Budget, profit-taking has been moderate. Demand, however, became much more selective. It is recognised that the E.P.T. cut has been made with the object of giving a stimulus to modernisation of plant and machinery, and that while transition difficulties have to be overcome, there is little scope for any general improvement in dividend payments. Markets are taking a hopeful view of the long-term outlook; and for the time being the tendency is to value industrial shares not so much on current dividends as on the earnings yield.

British Funds, after further strength, were inclined to ease, although there was a good demand for long-dated stocks under the lead of 2½ per cent. Consols, contrasting with moderate declines in shorter-dated securities. Shares of the joint-stock banks rallied satisfactorily. The less active conditions in stock markets which tended to develop later in the week were attributed to indications that sentiment, now less under the influence of the Budget, is more affected by international uncertainties and the outcome of the important Anglo-U.S. loan talks.

Shares of chemical and kindred companies closely reflected surrounding market conditions, and in many cases were higher on balance, although best prices recorded in the past few days were not held. Imperial Chemical at 41s. 9d. continued to benefit from the view that the reduction in taxation opens up the prospect that in due course the dividend may exceed the current 6 per cent. Lever and Unilever were better on the assumption that latest developments appear to increase the likelihood of an improved dividend for the current year; but the price eased to 51s. 9d. following the meeting. Shares of companies with important overseas as well as home trade interests continued in favour. Metal Box shares advanced sharply to 100s., later easing to 98s. 9d. Babcock & Wilcox were better at 60s., William Cory at 90s., Goodlass Wall 10s. ordinary at 26s. 1½d., International Paint at 127s. 6d., and Pinchin Johnson 10s. shares at 39s. 3d. Turner & Newall at 83s. 6d. were also higher. Textiles responded well because in many cases profits

have reached a level where any further improvement would be largely absorbed in taxes if E.P.T. had been retained at 100 per cent. Bradford Dyers rose to 27s. 7½d., Calico Printers to 21s. 9d., and Bleachers to 14s. 3d., while British Celanese 10s. shares touched 36s. Courtaulds moved up to 57s. 3d. on news of the acquisition of certain U.S. patents for the manufacture of viscose yarn.

Iron and steels have been in request, assisted by the view that the E.P.T. cut will be of considerable benefit in allowing acceleration of plant modernisation. Dorman Long responded with a rise to 26s. 9d., Guest Keen were 42s. 3d., Stewarts & Lloyds 55s. 6d., Colvilles 25s. 3d., and United Steel at 25s. 9d. xd kept steady on the financial results. Davy Engineering, among shares of equipment companies, were higher at 35s. 9d., also Mather & Platt at 55s., and Platt Bros. at 17s. 9d. In other directions, the units of the Distillers Co. were higher at 118s., also British Plaster Board at 36s. 3d. and United Molasses at 43s. 9d. Beechams deferred strengthened to 21s. 3d. British Drug Houses remained an active feature (the company should benefit considerably from the E.P.T. cut), but after further advancing to 50s. profit-taking brought the price back to 47s. 6d. B. Laporte showed firmness at 87s. Triplex Glass rallied to 40s., United Glass Bottle were higher at 72s. 6d., as were Canning Town Glass 5s. shares at 10s., and Forster's Glass 10s. shares at 40s. 7½d. In other directions, General Refractories improved to 18s. Oils were little changed, apart from a sharp rise to 98s. 9d. in Anglo-Egyptian "B." Anglo-Iranian were better on the E.P.T. cuts.

British Chemical Prices

Market Reports

CONTINUED active trade is reported this week in most sections of the London general chemical market and a fair amount of fresh business has been reported both for home and export markets. A firm tone is in evidence throughout the market and deliveries against contracts are of fairly substantial dimensions. There has been little change in the soda products section, where a steady pressure for supplies of soda ash and bicarbonate of soda is reported. Caustic soda is in good demand and values are well maintained in acetate and nitrate of soda, with a certain amount of fresh inquiry in circulation. Glauber salt and salt cake are being absorbed in fair quantities and a reasonably steady trade is reported in hyposulphite of soda. In the potash section offers of caustic liquor are extremely limited and solid caustic is quickly taken up. There is a steady call for supplies of acid phosphate of potash, while permanganate of potash is a good market. There has been some fresh inquiry for British-made formaldehyde, quotations for which are well held, and a fairly active demand is reported for white powdered arsenic and refined glycerine. Peroxide of hydrogen is meeting with a steady inquiry. In the coal-tar products section a fair trade is passing in pitch, including business for export to the Continent, and crude tar is finding a ready outlet on the home market. Buying interest in creosote oil and the anthracene oils is satisfactorily maintained The pyridines are quiet.

MANCHESTER.—Values are steady to firm in most sections of the Manchester market for industrial chemicals and from the point of view of business conditions are reasonably satisfactory. The heavy products are in steady demand against existing commitments and fresh inquiry and actual new bookings during the week have been of fair extent. Overseas business in the alkalis and other leading "heavies" appears to be developing and additional orders, including a fair proportion for Empire outlets, have been reported. In the fertiliser trade, basic slag, lime, superphosphates and sulphate of ammonia are the most active sections. Crude tar, creosote oil, carbolic acid, motor benzol, and naphthalene are meeting with a good demand in the by-products market.

GLASGOW.—In the Scottish heavy chemical trade during the past week business has been rather quiet in the home market owing to the labour troubles at the various docks. Prices keep firm. Export business also remains unchanged, shipping being quite out of the question.

SITUATIONS VACANT

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