The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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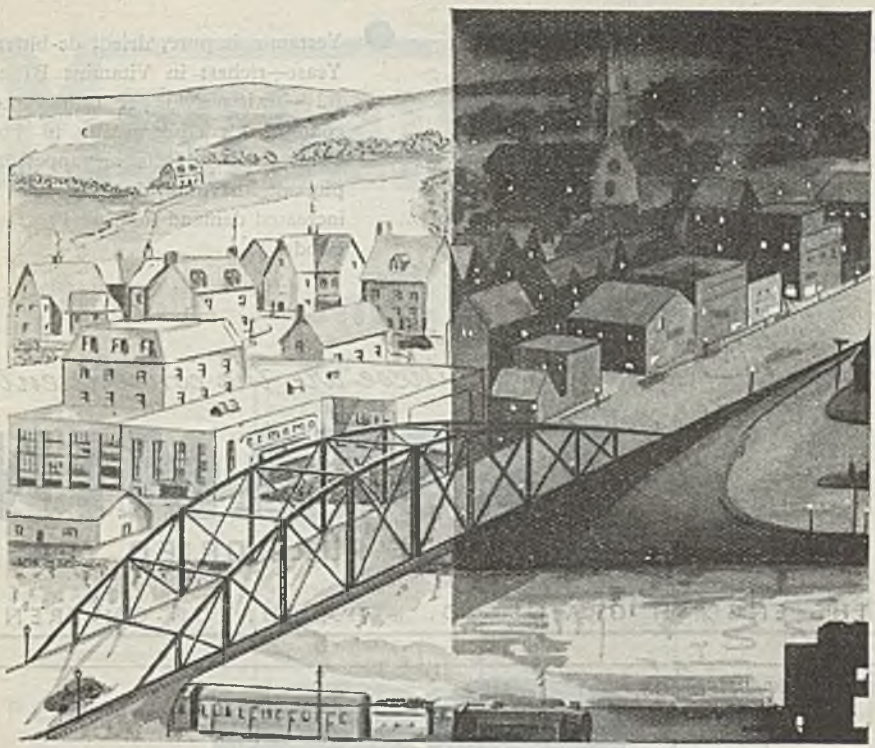

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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Public Control of Industry

IN our leading article last week we pointed out that the achievement of industrial efficiency was a condition of our survival as a nation, and that, having entered the scientific age, we had now to accept the consequences of the domination of science. In endeavouring to indicate something of the functions of Government in a scientific age, we largely ignored the actions of the present Government. This was necessary, since that Government has not yet clearly shown its hand so far as many details are concerned. Nevertheless, sufficient has now been said by its members to warrant some attempt to sum up its programme.

The transference of monopoly from the individual to the State makes little difference in the long run. Whereas the individual seldom possesses a true monopoly, the State must always do so, since it is the only owner and cannot decently compete with its own subjects. The incentive for the State as such, to seek industrial efficiency is small; but the State can only operate through persons. The success or otherwise of State control can only be evinced through the personalities of those who rise to the surface to control the new enterprises. Which will work the best, huge enterprises controlled by a few brilliant individuals, or a multiplicity of smaller enterprises controlled by a great many individuals of varying talents? For the answer to that question we must wait a generation. It is a matter for experiment.

In the meantime, the socialisation of industry is to proceed apace. Politics apart, is this desirable? Setting aside ideological theories which are impelling socialisation as a political stunt, let us argue the case from the commonsense point of view. Many outside the coal industry would agree that Government interference with that industry in two wars has now produced so disastrous a situation that the only thing to be done is for the nation to take the industry over to get it out of the morass. We may also freely agree that the morass has been getting deeper through the unplanned way in which the coal industry has grown up over the past 300 years. We cannot blame private enterprise for that. Clearly no one foresaw what would happen, nor could development have been planned a century ago in the light of the knowledge we possess now, but which was not in anyone's possession until recently. Most old-established industries, and equally most old-established works, tend to grow without

On Other Pages

any very good plan and to be encumbered with unfortunate arrangements that can only be swept away by a completely fresh start. It was getting time for a fresh start to be made in the coal industry—a matter of extreme difficulty and extreme costliness. It is rightly a national matter, though whether it was necessary to bring the industry under national ownership as distinct from national control is arguable.

The coming of the scientific age may well dictate the nationalisation of all industry ultimately. On the other hand it may not, and we must not forget that other attempts to nationalise industries abroad have not been successful. We are undertaking an experiment in a field where previous experiments have not shown promise. Commonsense and reasonable prudence would suggest that a start should be made with nationalisation of the coal industry. Let us make the experiment, and let us see the results. Five or ten years should elapse before the results are clear; then, and not till then, should we take the next step—if the experiment has proved successful. As scientific men, with the natural caution of our calling, we distrust this almost indecent haste in trying many vast socialistic experiments simultaneously. *Festina lente* was not written yesterday, and as a principle its wisdom is well proved. A great deal of criticism can be levelled against the coal bill now before Parliament, and it is becoming very clear that the whole thing is still in its laboratory stage; it has not even got to the pilot plant stage!

Meanwhile, Mr. Herbert Morrison, having travelled to Canada, is telling the world what the Government intends to do. He has pointed out the principles upon which it is proposed to conduct the nationalisation experiment. In Mr. Morrison's view it is the public interest that counts. In that he may be right, but that principle would not have been accepted 50 years ago, when the individual was the important unit. To-day, so far have we moved from that state of affairs, we accept it without question. The real field for argument, said Mr. Morrison, is how can industry best be organised or managed in order to secure economic public advantage. Quite rightly he declared that "it is up to the nationalisers to prove their case that there will be public advantage by nationalisation."

Even the Socialist Government agrees, however, that industry cannot be effectively managed by a Government, for not only Mr. Morrison, but other Cabinet Ministers too, have declared that there is no intention of managing nationalised industries by State departments of Civil Servants. The intention is plainly to set up public corporations in charge of fully qualified Boards. We are not necessarily opposed to nationalisation on these lines, provided proper compensation is given to dispossessed owners and they are left with the financial ability to engage in private enterprise in other directions. There is a certain possibility that an industry might be run efficiently on these lines, though whether the B.B.C. as a public corporation is an outstanding advertisement we venture to doubt. The difficulty must be to maintain that spirit of teamwork and enterprise throughout the industry which alone makes private enterprise so successful. Absence of competition has helped the coal industry to its present pass: *facilis descensus Averno*. Will a nationalised industry retain its spirit of adventure and enterprise a generation hence?

But to return to Mr. Morrison. He has promised that the great bulk of industry will remain under private enterprise, and that the Government "will not quarrel with it as long as it is private enterprise and not private unenterprise." Again we should agree; all industry must become efficient in the highest sense of the term, and to do so must show enterprise of a high order. Mr. Morrison has promised that the Government will seek to assist and encourage private enterprise in the solution of its problems "and will spur it to greater effort in the cause of industrial and economic progress." That is satisfactory so far as it goes, but let us not forget that the results of nationalisation in the basic industries must affect every other industry in the country, since the prices of the basic products of the nationalised industries will be the basic costs of those industries that are run by private enterprise. Let us also remember that Mr. Shinwell has stated that he does not expect the price of coal to fall as a result of nationalisation of the coal industry. Cannot we be scientific about it all and try one experiment at a time?

The organisation of the national resources, and the organisation of the industries that are exploiting the national resources is the necessary consequence of

the march of science. Science is proceeding rapidly and it is difficult for private individuals with limited financial resources to keep pace with the application of scientific discovery to industry. If the State made the finance available, no doubt private enterprise would keep itself industrially efficient. If there were enough chemists and chemical engineers trained each year to staff industrial enterprises, we should take a great many things in our stride that we now find difficult. There are a great many "ifs." But do not they come to this, that the pace of scientific discovery and the immense responsibilities created by the need to keep abreast of modern progress are so great that the day of the smaller private firm is passing fast, and we are on the threshold of an era in which every industry will be organised as a national entity, because only in that way can we obtain and retain industrial efficiency in the light of scientific discovery? How far, and how fast, can an old-established industry take advantage of modern methods? How frequently can such an industry scrap its plant and change its practice? How great must be the resources behind it to enable it to keep up-to-date? These are the problems we have to answer at the dawn of the scientific age. But again we urge upon our rulers, irrespective of their political colour: *Festina lente*! In the light of the F.B.I.'s recent statement we propose next week to enlarge upon this text.

NOTES AND COMMENTS

Man-Power for Research

TOO often is the easy assumption made that so long as sufficient money is forthcoming all will be well with industrial scientific research. International comparisons, unfavourable to this country, have been made of the amount of the national income spent on such research. That, however, is only one side of the question, and we feel that Sir Edward Appleton, in his speech last week to the National Union of Manufacturers, hit the nail pretty well on the head in his closing paragraphs. Having pointed out that no well-thought-out research scheme had been turned down in recent years in this country for lack of money, he fixed on the real difficulty—the question of man-power. "It does not matter," he said, "how good the organisation of industrial research may be, or how many millions we spend on it, its success in the end depends on the brains and enthusiasm of the research workers." There is the crux. Our sources of research workers, with a comparatively small population, are rigidly limited. This, of course, is a limitation that cannot be overcome in a hurry, and demands careful husbandry. Another limitation which *can* be overcome, however, is the paucity of training facilities. It is no use compiling a careful research programme if there are not enough trained men to carry it out. We remain convinced that the potential aggregate number of trained research workers in Britain has not yet been attained; that our opinion is shared by the most far-seeing industrialists is shown by the quantity of scholarships that have been endowed recently by business firms, especially in the chemical and allied industries. At the present time, we feel, that is the most economic way of dedicating money to the cause of industrial research.

The Gospel of Scientific Method

LEST we should appear to be aiming adverse criticism against Sir Edward Appleton's activities, we hasten to put in a disclaimer. As an apostle of the cause of industrial science he is doing magnificent work. It will soon be possible to say that if anybody remotely concerned with scientific industry has *not* heard of the D.S.I.R., and understood its purpose, then he has wilfully closed his ears to the gospel that is being preached. Perhaps even more fundamentally important is the inculcation of the doctrine of scientific method, especially in a country like this, abounding in old-established industrial traditions. Some manufacturers, as Sir Edward said, may have been using the scientific method unwittingly, like Molière's *bourgeois gentilhomme* who had been speaking prose, without knowing it, all his life. Many others, however, have preferred the method of the old foreman electroplater, who achieved the desired effect by "spitting into the bath for luck." We must agree that the traditional method is inflexible, and unsuited to the modern

world; and it is the firm that uses science every day that is going to be able to take advantage of the big spectacular advances as they come along. Working in partnership with the D.S.I.R., whether through their own, or through their trade research associations, firms can now apply the scientific method to their problems.

New Type of Appointment

THE appointment of Dr. Leslie Aitchison to the newly-established Chair of Industrial Metallurgy at Birmingham University, as briefly announced elsewhere in this issue, is an important one, inasmuch as it is the first of its kind in a British university. Moreover, it will lead to the training of metallurgists for industrial purposes as well as in the field of pure research and will give to students at Birmingham University courses of instruction available at no other school of metallurgy in the country. The choice of Dr. Aitchison is a particularly happy one in view of his mingled academic and industrial associations. After obtaining his doctor's degree in metallurgy at Sheffield University, he lectured in the metallurgical department there, but on going to Birmingham after the 1914-18 war, he transferred his activities to the industrial sphere, acting as consultant to several motor firms as well as to the Association of Drop Forgers & Stampers. He has even gone into the " official " side of metallurgy as consultant to the Air Ministry. Another signal advantage, bringing him in contact with metallurgists of all ranks in the area, was his period as president of the Birmingham Metallurgical Society.

Chemists and Foodstuffs

EARLIER this month a correspondent of the *Manchester Guardian*, writing under the pseudonym of " Foodstuff Specialist," doubtless inspired by the despondent statement made by the Minister of Food shortly beforehand, asked somewhat indignantly whether our technical men and industries have done nothing to develop " the manufacture of fodder cellulose and fodder yeast on similar lines " to the production of cellulose fodder pulp for animal feeding purposes reported from Germany and Scandinavia during the war. It is implied that our technicians have in fact done little or nothing in this direction, but this implication does them less than justice. In 1943, Dr. H. E. Woodman, of the School of Agriculture at Cambridge, published, in *Agriculture* (*50*, No. 7, p. 308), an exhaustive and informative article on " Some Aspects of the Use of Cereal Straw as Fodder," which gave a full account of the work done both abroad and in this country, up to that date, on the lines indicated, and further work has been done since then. It should be noted that the apparently successful production of cellulose fodder in Sweden and Norway during the war was based on the use of wood pulp; the most easily available raw material in this country is straw, and it does not necessarily follow that the treatment of wood cellulose and the treatment of straw cellulose will give the same result. As a matter of fact, this point has been thoroughly appreciated by the technicians concerned, and experiments with straw cellulose have led to some quite definite conclusions. The story is an interesting one, and deserves telling at some length; we hope to do it full justice in a forthcoming issue.

No Government Advertising

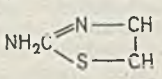
ADVERTISING space in THE CHEMICAL AGE has for some years past been strictly rationed. Owing to the paper shortage the Publisher has been placed, through no fault of his own, in the difficult position of declining the orders of regular customers and, as our advertisers know to their cost, their requirements have been only partially met. During the war, sometimes by direct Government order, the pressure on our space has been intensified by the necessity of printing advertisements from Government Departments and, so long as the war lasted, we felt fully justified in accommodating these announcements. Circumstances having changed, and the paper situation being almost as serious as ever, we have decided that it is no longer possible to allow Government Departments to occupy the advertising space so badly wanted by business concerns struggling to rehabilitate themselves in the market. From now on, therefore, we are declining absolutely to accept any Government advertisements. Our editorial columns will continue to be available for the publication, without charge, of any information from Government Departments which, in our judgment, is of value to our readers. This material will, as always, be judged strictly upon its editorial value.

Progress in Drugs, Fine Chemicals and Biological Products during 1945—IV

by G. COLMAN GREEN, B.Sc., F.R.I.C., A.M.I.Chem.E.

(*Continued from* THE CHEMICAL AGE, *February* 23, 1946, *p.* 210)

AN interesting advance in the therapy of hyperthyroidism has resulted from observations of personnel engaged in a French factory concerned with the manufacture of 2-aminothiazole, the heterocyclic moiety of the sulphonamide drug sulphathiazole (*J. Amer. Med. Ass.*, 1945, *129*, 761). Jeantet observed that workers engaged in this manufacture developed goitre with signs of hypothyroidism and lowering of the rate of basal metabolism. That this intermediate was responsible for the condition was confirmed by the fact that removal of the affected workers from the process caused the goitre to return to normal, while the condition of persons suffering from hyperthyroidism was improved by introducing them to the process. Clinical investigation showed that the administration of 2-aminothiazole in 0.1-gm. doses, four times a day during 3-4 weeks, gave improvement in cases of hyperthyroidism. In some cases suspension of the treatment caused relapse. So far, no accident arising from toxicity has occurred—a feature in contrast with the use of thiourea and thiouracil in the treatment of the same condition in Britain and the United States.



Bartels (*J. Amer. Med. Ass.*, 1945, *129*, 933) has investigated the use of diethylthiobarbituric acid ("thiobarbital") in the treatment of hyperthyroidism. The new drug is very potent, being twelve times as active as thiouracil; but its toxicity is much greater and its use is indicated only where patients are unable to tolerate thiouracil.

A thiourea derivative, α-naphthylthiourea has been found by Richter (*J. Amer. Med. Ass.*, 1945, *129*, 927) to be a potent rodenticide with a median lethal dose of 3.4 mg. per kg. body-weight. It is probably not toxic to man, although it is toxic to dogs where they have been unable to rid themselves of the substance by vomiting (rats cannot vomit). The material is very stable, easily stored, and practically insoluble in most liquids including water. It is very effective against the Norway rat; but its effectiveness against the black or Alexandrine rat is very disappointing. Further, there is a degree of strain variability as well as a variability due to the type of diet in its effectiveness against the Norway rat. Tolerance towards the poison builds up on feeding with sub-lethal doses over a period of 40 to 50 days; but—an important point—the tolerance quickly disappears during withdrawal of the poison. Death of the rat results from an increased permeability of (and possibly some damage to) the capillaries of the lung, leading to a drowning pulmonary œdema.

Insecticides

The past year saw the announcement of a new insecticide "Gammexane," the γ-isomer of hexachlorobenzene, $C_6H_6Cl_6$, a substance first isolated by Michael Faraday in 1825. It is insecticidal towards a wide range of insects with effectiveness varying towards the different species. It is more effective towards the troublesome grain-weevil than any other known insecticide (*see* Slade, *Chem. and Ind.*, 1945, *40*, 314). It is also the most powerful locust poison yet found and should have a wide application in this field. It can be used in dusts, paints, and sprays as a stomach poison, contact agent or—by reason of its heat stability—as a fumigant. In normal conditions of use it is not poisonous to man or animals. Structurally, the hexachlorocyclohexanes resemble the hexahydroxycyclohexanes, *i.e.*, the inositols, which may be regarded as members of the vitamin B_1 complex; inositol was, in fact, the first component of the bios complex to be recognised (*v. supra*). It has been conjectured that the mode of action of Gammexane may depend upon its blocking a vital action in which inositol would normally participate.

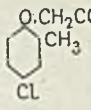
DDT, which is said to have only 1/15 the action of Gammexane against the grain-weevil, although it is equally, if not more, effective against other insect species, has been found to be highly toxic to man during the past twelve months when injected *per os* or percutaneously in an organic solvent. This is not unexpected in the light of information previously collected from animal toxicity experiments. For the first time a death and very severe toxic symptoms have been reported; but it is to be emphasised that the risks are negligible if it used with normal precautions. The available information on the toxicities of DDT and Gammexane has been summarised by Cameron (*Brit. Med. Bull.*, 1945, *3*, 783). Levis and Richards (*Science*, 1945, *102*, 330) have investigated the toxicity of DDT against hanging-drop cultures of various chick-embryo tissues. They found that living fibroblasts moving about in the cultures came into contact with DDT crystals

without injury, but emulsions of DDT, used in similar tests with tissue cultures and found equally non-toxic, gave a high rate of kill in from 45 minutes to 76 hours when injected into mice. The authors state that the seeming paradox of the lethal effects of DDT when administered to the intact animal as contrasted with non-toxicity for individual tissue cells is undergoing further investigation.

Martin suggests (*J. and Proc., R. Inst. of Chem.*, 1945, Pt. 5, 172) that there may be a common factor in the toxicity of Gammexane and DDT in that each is susceptible to dehydrohalogenation, the substance remaining being non-toxic or of substantially reduced toxicity. Martin summarises present knowledge of the relation between toxicity and chemical structure, and the paper should be consulted.

Methoxone

Members of the phenoxyacetic acid series have been known for some time as plant-growth promoters, and during 1945 the use of one member of the series as a selective weed-killer has been announced. This is 4 - chloro - 2 - methylphenoxyacetic acid (" methoxone "), preparations of which are to be marketed under the trade name of " Agroxone." This substance retards seed germination and early growth of certain weeds without any effect on cereals. When it is applied at the rate of 8 oz. per acre in aqueous solution or in dusts, such weeds as yellow and white charlock, pennyroyal and corn-buttercup are destroyed without damage to the cereal crop which they might be infecting. When absorbed by the susceptible weed plant the substance causes a profound physiological disturbance by a mechanism not yet understood. The stem and leaves become contorted, the stem may split, revealing an internally developed mass of rootlets, the foliage changes colour, and ultimately the plant dies. Death may take several weeks from the time of application, although the first effects may be detected after the first few hours. Methoxone is non-poisonous and non-inflammable, in which respect it has obvious advantages over many weed-killers at present in use.



A number of substances of the phenoxyacetic acid class are known promoters of plant-growth and cell-elongation; by contrast there is another group of substances, structurally less closely inter-related, represented to colchicine (*see* p. 209), acenaphthene, and chloral hydrate, which influence not cell-elongation but cell-division. The use of colchicine, in particular, for producing polyploidy has already been mentioned in connection with the production of a new polyploid strain of *Penicillium notatum* which produces enhanced yields of penicillin. A further practical application is in the use of camphor to induce polyploidy in the yeast which is at present being used to convert molasses to high-grade protein in Jamaica (*see* this journal, 1944, *50*, 1280, 52). Templeman and Sexton (*Nature*, 1945, *156*, 630) have found among this latter group of substances remarkable properties in that esters of the arylcarbamic acid series are able to arrest the growth of monocotyledonous plants, but not of dicotyledons. Ethyl phenyl carbamate arrested the growth of cereals at lower concentrations than did colchicine, acenaphthene, or chloral hydrate, while *iso*propyl-phenylcarbamate applied in concentrations which stopped cereal growth did not affect the growth of mangolds, sugar-beet, flax, rape, or yellow charlock.

Substances related to phenoxyacetic acid are not only capable of influencing the course of plant growth as indicated above, but, in some instances, of inducing parthenocarpy, that is the development of fruits without fertilisation by fusion of the gametes. Swarbrick (*Nature*, 1945, *156*, 300) now reports the successful parthenocarpic production of tomato fruits with the sex hormone stilbœstrol, and its fully hydrogenated form hexœstrol.

Wilds and Biggerstaff (*J. Amer. Chem. Soc.*, 1945, *67*, 789) report the production of stilbœstrol in 50 per cent. yield from α-(*p*-methoxyphenyl)-*n*-butyric acid, obtainable from by-products of the manufacture of the hypnotic drug phenobarbitone.

The synthesis of folic acid, the vitamin-like substance required for the growth of *Lactobacillus helveticus* (*L. casei*, *E*), which is found in green leaves and liver concentrates, has recently been announced by an American company, but no particulars are yet to hand. The isolation of folic acid in a state of purity was first announced in April, 1944.

Treatment of Starvation

Immediately before the invasion of Europe in June, 1944, a great amount of work was accomplished by a number of British firms in a short time in connection with the bulk preparation of protein hydrolysates for administration in the conditions of acute starvation which were expected to be found to be prevalent in the countries to be liberated. Particulars were made available during mid-1945. Especially was it expected that the population of Holland would be found to have particularly suffered in this way during the occupation. Little was known at the time of the invasion as to the treatment of acute starvation. Some limited experience had been gained during the past two decades in the feeding of premature infants, in wounding involving severe blood losses, and in cases of impaired

assimilation such as carcinoma of the stomach. The basis of this work rested on the fundamental observation by Henrique and Anderson in 1913 that the nitrogen equilibrium of the goat could be maintained by intravenous alimentation with amino acids produced by enzymic digestion of goat flesh. Some experience with enzymic digests in the treatment of starvation was also gained at the time of the Bengal famine in 1941. Consequently, it was decided to prepare large quantities of protein hydrolysate in preparation for D-day, the work being undertaken in a short time by Ashe Laboratories, Ltd., Crookes Laboratories, Ltd., Genatosan, Ltd. (in association with Bengers, Ltd.), Glaxo Laboratories, Ltd., and Herts Pharmaceuticals, Ltd.

Protein Hydrolysis Methods

Regarding the hydrolysis of the protein the possibilities were: (1) Acid hydrolysis, which with 5*N* acid for 18 hours gives 100 per cent. conversion, a sterile product, but causes also the partial loss of tryptophane through the formation of humic substances. This loss must be made good by the subsequent addition of the not very easily accessible *dl*-tryptophane, which in any case is only half as active as the natural amino acid. Slight racemisation of the amino acids occurs.

(2) Alkaline hydrolysis, which causes considerable racemisation, and the destruction of methionine and cystine.

(3) Enzymic hydrolysis by pancreatin from hog pancreas at 37° C. and *p*H 8.0. The principal complication here is that in these conditions the digest is very susceptible to bacterial infection and the consequent production of filter-passing pyrogenic substances. The hydrolysis is not by any means as complete as with acid digestion, and the hydrolysate must be sterilised at 12 lb./sq. in. for 15 minutes.

(4) Enzymic hydrolysis with the proteolytic enzyme, papain, obtained from the melon-tree. Since the hydrolysis is carried out at *p*H 5.5 at 50-60° C., it is easy to keep the digest fairly sterile. Hydrolysis is quite rapid but incomplete, about 25 per cent. conversion to amino acids being attained in 24 hours, the balance consisting of polypeptides and peptones. These protein breakdown products of high-molecular weight may cause "shock" on intravenous administration. The digestion may be rendered more complete to the extent of a 60 per cent. conversion by a subsequent digestion with pancreatin (as in method 3). Papain gives a more complete conversion of meat protein (to the extent of 60 per cent. conversion) than it does with casein.

These preparations may be administered by intravenous drip or orally. By the latter route the digest may be taken normally or by intragastric drip through a nasal tube. Enzymic hydrolysates have an obnoxious taste which has led to the introduction in America of synthetic mixtures which, however, are less readily accessible and correspondingly more costly. Intravenous administration carries the usual risk of the development of thrombosis, a risk which appears greater in the case of acid hydrolysates than in the case of enzyme digests.

Ultimately two main forms of protein hydrolysate were prepared in bulk for the liberation. The first consisted of an acid hydrolysate with the addition of *dl*-tryptophane and glucose. This preparation was intended for administration intravenously at the rate of 2 litres daily, equivalent to 50 gm. protein. A 3½ per cent. solution of amino-acids is isotonic with blood plasma, but rapid absorption offers some latitude, and on the Continent and in the U.S.A. concentrations of as high as 5 per cent. have been used. The second form consisted of a spray-dried enzyme digest of casein and meat, representing a mixture of amino acids with simple di- and tri-peptides intended for oral administration. To the powder are added vitamins A, D, and C together with thiamine, riboflavine, and nicotinic acid. Before admin.stration the powder is mixed with glucose and dissolved in water. One dose is equivalent to 50 gm. protein.

Happily, the condition of the Dutch people, taken generally, was found not to be so extreme as had been anticipated, and experience in administration was gained principally in the concentration camps such as that at Belsen. It was found, surprisingly enough, that few patients were unable to take the preparations orally, and those who were unable to do so were so collapsed that they were not likely to survive even with parenteral alimentation. It appeared that so long as the epithelium of the stomach was intact the simplest and most convenient treatment was by feeding with skimmed milk by the mouth. Treatment in this way with skimmed milk or the less palatable enzymic milk-and-meat digest led to a sufficient degree of recovery in three days to enable the patient to take ordinary food.

B.P. Addendum

Another addendum to the 1932 Pharmacopœia has been issued during 1945 so that they are now equal in number to the plagues visited upon Egypt. A new Pharmacopœia which would consolidate the advances of the past 14 years is long overdue, a fact not lost sight of in official quarters. Sulphacetamide, sulphadiazine, sulphaguanidine, sulphapyridine, and sulphathiazole are each given monographs, while œstradiol benzoate, œstrone, and progesterone are now official. The 7th Addendum is, perhaps, most noteworthy for the inclusion of a monograph on tablets which, for the first time, places permitted tolerances, both as regards uniform-

ity of weight of the tablets and limits of the standards for the average weight of drug in the tablet, on a statistical basis. Percentage deviations are given for random samples of 10 or 5 tablets for tablets of different nominal weights. A table of variation of standards is given for random samples of 20, 15, 10 or 5 tablets, and these are framed to allow for variations due to manufacturing processes, to permitted variations in the standards of purity of pharmacopœial drugs, "and to any other permissible causes." Those interested in the background of this important monograph should consult a paper by N. Evers entitled "The Standardisation of Medicinal Tablets: Statistical Considerations" (*Quart. J. Pharmacol*, 1942, *15*, 6). The application of statistical method in industry is becoming widespread in Britain and America and those readers interested in application to the pharmaceutical industry are referred to a useful summary by W. R. Sartin (*Pharm. J.*, 1945, *154*, 98) entitled "Statistical Quality Control in Pharmaceutical Manufacture."

German Technical Reports

Details from Latest List

APPENDED are details from the latest list of industrial reports by the Combined Intelligence Objectives Sub-committee (CIOS) and the British Intelligence Objectives Sub-committee (BIOS).

CIOS V—30, *XXII*—18. *Chemical Industries in Belgium and France during German Occupation* (5s.).

CIOS XII—17. *Etablissements Alphonse Wyns, Vilvorde*: Paint manufacture (6d.).

CIOS XXVI—11. *I.G. Farbenindustrie Höchst am Main*: Miscellaneous chemicals (7s. 6d.).

CIOS XXVI—25. *Pulverised Magnesium* (1s. 6d.).

CIOS XXVI—75. *I.G. Farbenindustrie, Dormagen-Cologne*: Production of cellulose acetate (6d.).

CIOS XXVI—80. *Steinkohlen-Bergwerk Rheinpreussen Moers-Meerbeck*: Synthetic fuel plant (13s.).

CIOS XXVII—49. *I.G. Farbenindustrie, Oppau*: Thermocolour paints (6d.).

CIOS XXVII—51. *I.G. Farbenindustrie, Schkopau*: Manufacture of vinyl chloride and polyvinyl chloride (6d.).

CIOS XXIX—4. *I.G. Farbenindustrie, Wolfen*: Fodder yeast plants (2s. 6d.).

CIOS XXX—73. *Osnabrücker Kupfer and Drahtwerk, Osnabrück*: Aluminium fabrication (2s.).

CIOS XXXI—28. *Fuel Technology and the Reichsvereinigung Kohle* (1s. 6d.).

CIOS XXXII—3. *Deutsche Erdöl A.G., Mineralölwerke Rositz*: Production of fuels and fuel oils from brown coal-tar oil (1s.).

CIOS XXXII—11. *Interrogation of Dr. Haberland*: Miscellaneous chemicals (1s.).

BIOS 75. *The Production of Acetaldehyde, Acetic Acid, Acetic Anhydride and Acetone from Acetylene at the Bunawerke, Schkopau* (2s. 6d.).

BIOS 125. *Ernst Beattler Werke Dinglingen, nr. Lahr*: Manufacture of active charcoal used in German Service respirator (1s.).

BIOS 126. *Aluminium Reduction Plants in Italy* (1s.).

BIOS 127. *The Aluminium Fabricating Plant of Aluminium Wals-en-Persbedrijven N.V., Utrecht, Holland* (1s.).

BIOS 128. *Wood Distillation Plant at Brilon-Wald* (1s.).

BIOS 137. *Cyclopolyolefines (Paper by Dr. J. W. Reppe, I.G. Farben Research Chemist)* (2s. 6d.).

BIOS 167. *Séailles-Dyckerhoff Alumina Process Portlandzement Fabrik Dyckerhoff and Sohne at Amoneburg bei Biebrich*: Process for recovery of alumina from coal ashes (1s.).

Filter Manufacturers

Standards Committee Set Up

AT the General Council meeting of the British Society of Associated Filter Manufacturers, held in London on February 12, it was reported that one of the large oil companies had written to the Society suggesting that they might co-operate in connection with filtration matters. This suggestion is receiving careful consideration.

The chairman reported that the Society's application to the British Standards Institution, for a committee to be formed to go into the question of specifications and test procedure for filters of all classes, had been agreed to by the B.S.I., who had formed a technical committee for this purpose. The committee has been divided into eight sub-committees and Mr. C. G. Vokes has been elected chairman of this British Standards Committee, known as ME/95.

On the subject of the disposal of surplus Government equipment the secretaries reported that, owing to the large number of departments concerned with the purchase of filtration equipment from members, there appeared to be difficulties in dealing with the matter. It was, therefore, decided that an endeavour should be made to clarify the position and ascertain which department would ultimately be responsible for handling disposals.

Selected chemical industries may be developed in British India in connection with proposals put forward by the All-India Manufacturers' Association.

Forbidden German Industries

Allied List of Restrictions

AN Allied statement issued on Thursday last week gave a list of the industries which are to be eliminated or restricted in Germany, with a view to industrial disarmament.

Production of the following will be entirely prohibited: Magnesium, primary aluminium, beryllium, vanadium, radioactive material, and hydrogen peroxide above 50 per cent. strength. Production of synthetic petrol, oil, and rubber will be permitted until sufficient imports can be secured. Output of the following will be restricted to the satisfaction of Germany's peace-time requirements: Synthetic ammonia, heavy chemicals including sulphuric acid, chlorifine, calcium chloride, methanol, and hydrogen peroxide below 50 per cent. strength, and raw optical glass.

Autoxidation of Fats

An Interpretation of the Theories

THE fact that a rancid fat has a lower mean unsaturation and mean molecular weight, and lesser amounts of unsaturated fatty acids than a freshly refined fat has been known for some time. The impression seems to prevail that these characteristics cannot be used as criteria of the extent of oxidative rancidity. The basis for this impression is not readily apparent in the absence of rate studies on the decrease in iodine value, saponification equivalent, and the disappearance of specific unsaturated fatty acids. Therefore it seemed desirable to study the rates of change of peroxide and iodine values, saponification equivalents, and the amounts of "linoleic and linolenic acids" during accelerated rancidification of a fat. An attempt has been made, by Filer *et al.*, Department of Chemistry, University of Pittsburgh (*Oil and Soap*, August, 1945), to correlate and interpret the experimental data in terms of existing theories concerning autoxidate deterioration.

A general pattern of chemical changes has been observed to accompany the oxidative destruction of a fat during the accelerated development of rancidity in the presence of oxygen at 110° C. During a variable period of time (the "induction period") no detectable changes occur. However, at the time when peroxide formation increases appreciably, several chemical changes appear simultaneously: linoleic acid decreases; the total unsaturation (as measured by the iodine value) decreases; and the mean length of the carbon chain of the acids decreases. The formation of conjugated unsaturation in an autoxidising edible fat or oil seems probable. It has been demonstrated that a fat may become quite rancid and still retain at least 90 per cent. of its original octadecadienoic "linoleic" acid. These chemical changes have been observed consistently irrespective of the fat or oil under study, the length of its induction period, or the presence of added antioxidant or synergist

EAST AFRICAN RESEARCH

A sub-committee of the Colonial Agricultural Research Committee is now in East Africa examining the problem of decreasing fertility in that area. It comprises Sir Harold Tempany, F.R.I.C., F.C.S., Sir Frank Engledow, and Professor J. W. Munro. One of their principal tasks will be to recommend a site for an East African agricultural research station to replace the Amani station in Tanganyika. Sir Harold Tempany's services to agricultural chemistry have extended, during more than 30 years, from the West Indies to the East Indies, and he has been an active member of the Chemical Council and the Council of the Royal Institute of Chemistry; Sir Frank Engledow is Drapers' Professor of Agriculture at Cambridge; while Professor Munro is Professor of Zoology and Director of the Biological Field Station at Imperial College.

A TRADE INNOVATION

The respective boards of the Sulfurophosphate Manufacturing Co., Ltd., of Ocean Quay, Richmond Walk, Devonport, and James Gibbs & Finch, Ltd., Cattedown, Plymouth, have constituted a Plymouth board of directors. This local board, which operated as from March 1, comprises Mr. A. Ridge, commercial manager of James Gibbs & Finch, Ltd.; Mr. T. D. Foulds, manager of the Sulfurophosphate Manufacturing Co., Ltd.; and Mr. F. A. Gray, who now resides in Plymouth and acts as chairman of the local board and representative of Mr. J. MacGregor, chairman of the two companies. Mr. Gray was with the Fertiliser Control of the Ministry of Supply, where he acted for six years as Deputy Controller.

All the blocks and standing type for their catalogues having been destroyed by enemy action in 1941, Doulton & Co., Ltd., are now issuing their new catalogue in separate sections, ultimately to be bound together. The first section dealing with products of interest to the chemical industries is now ready—No. 11, Chemical Laboratory Porcelain—and contains several items which did not appear before the war. In our opinion this production is a model of clarity, as well as being an excellent example of dignified printing and design.

Reducing Properties of Methane

Experiments with Metallic Oxides

IN *Comptes Rendus* (1945, *220*, 823), Jean Racine describes results of experiments on the reducing properties of methane with a number of metallic oxides. The pure gas, dried by concentrated sulphuric acid, is passed through a porcelain or quartz tube of 2 cm. diam., heated in the electric oven, and containing a porcelain boat with the oxide under test. Temperatures up to 1100°C. are controlled by thermo-electric couple. In a general way it is concluded that methane has reducing properties like hydrogen, but at higher temperatures and somewhat slower. The hydrogen atoms combine with part of the oxide's oxygen, yielding water, and at relatively low temperatures the carbon continues with the remaining oxygen to produce CO_2. It seems fairly certain that with oxides of the iron group (Mn, Fe, Co) the carbon may combine with the reduced metal and yield a metallic carbide decomposable by acidulated water with formation of hydrocarbons. In many cases acetylene, tarry products, and carbon appear. Alumina, magnesia, and lime are not reduced by methane.

Summary of Results

Group I: CuO is reduced to metal at about 530°C. At about 800° acetylene is formed, and above 880° some tar and a carbon deposit.

Group II: MgO is not reduced even at 1000°. From about 800° it is converted into a black substance which, when calcined, reforms into the white oxide. From about 780° there are small amounts of acetylene, and tarry matter above 930°. With CaO the results are somewhat similar. ZnO is reduced from about 830° to metal and partly distilled; reduction at that temperature is very slow, and is quicker at a higher temperature, but with formation of tar and copious deposition of carbon; also some acetylene at about 830°. CdO is about the same as zinc, but reduction is more rapid, and starts at about 670°. With HgO reduction—and distillation—begin at 560° for the yellow variety and at 600° for the red.

Group III: Alumina is not reduced. Acetylene appears at 930° and then some tar and carbon.

Group IV: PbO_2 is first reduced to Pb_3O_4 at about 440°; and at 600° or thereabouts a brownish-green suboxide appears, but the PbO stage is not formed. At about 750° the suboxide is reduced to Pb. At higher temperatures, acetylene and a little tar appear.

Group VI: Cr_2O_3 is reduced at 285° with formation of an unidentified brownish substance; acetylene appears at 800°, increasing with temperature rise, together with carbon and a little tar at 980°. MoO_3 is reduced at 700° to MoO_2 together with some of the blue oxide Mo_2O_5. At about 900° reduction to metal is nearly complete. Acetylene does not appear, even at 1050°, and there is little tarry matter. The reduction of WO_3 is similar, and in stages, beginning at about 670°; the blue oxide W_2O_5 first, and then at 825° the brown dioxide WO_2, and finally the metal at 950°; acetylene at 800°. There is also formation of some carbon, and, above 1000°, some tarry matter.

Group VII: MnO is converted at 800° into a black substance which, treated with hot water, yields a garlic-smelling gas. Very probably, and in accordance with the experiments of Fischer and Bangert (*Brennstoff Chem.*, 1929, *10*, 261), the carbide is formed, decomposable by water or more readily by weak acid solution, with production of gaseous hydrocarbons but no acetylene.

Group VIII: Ferric oxide, Fe_2O_3, from about 400° is converted into an unidentified lower oxide and at 800° reduction to metallic iron is complete. At about 1050° a substance is obtained which, treated with dilute HCl, yields a garlic-smelling gas. Acetylene appears at 800° and some carbon deposit above 1000°. Results with Co_2O_3 are about the same. A hypothetical cobalt carbide is found at 1000°. NiO is reduced to nickel at 590°, with acetylene and carbon at 830° or thereabouts.

The British Re-Inforced Asbestos Co., Ltd., Worcester, are manufacturing woven asbestos sheeting with metallic insertion. This packing material is very flexible; it can, therefore, be rolled, bent, or used in strips and is claimed to fulfil the desiderata of a perfect jointing. It is especially recommended for use under exacting conditions, such as where high pressure and-temperature are to be dealt with, or when hot or cold water, steam, spirit, or acids are concerned. A most important feature is that this universal jointing can be used over and over again without being injured in any way, resulting in the elimination of waste.

The largest lead deposit discovered during the last 20 years occurs in South-West Tanganyika. It extends over eight miles, but one shoot only has so far been opened up, with an estimated ore reserve of 5,000,000 tons. Deposits of copper, tungsten, gold, and silver have also been located in the area.

Metallurgical Section

Published the first Saturday in the month

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March 2, 1946

The Refining of Copper Residues—II

Working the Reverberatory Furnace

by O. P. EINERL, Dr.Eng., and FREDERIC NEURATH, Ph.D.

(*Continued from* THE CHEMICAL AGE, *February 2, 1946, p. 143*)

THE process of fire refining consists in an oxidising fusion with a view to volatilising some metals and oxidising and slagging others which have a greater affinity for oxygen than has copper. This is followed by a reducing fusion in which most of the Cu_2O formed—and held in solution by the copper—is reduced to copper.

Zinc should be burnt away as quickly as possible by raising the temperature of the liquid metal well above the boiling point of zinc (about 960°C.) to about 1100-1130°C., because slowly oxidised zinc is more prone to combine with SiO_2, thus forming one of the most infusible slags as already indicated. If the zinc is allowed to pass off through the flues as zinc (and not as zinc oxide) by quick melting, there is less chance of its combining with the SiO_2 present as sand or slag.

The zinc, passing off as vapour, burns in the flue to ZnO and is collected in a bag filter plant, after passing a pre-cooler. It is, however, impossible to prevent the zinc vapours from carrying away with them part of the other constituents of the original charge. Certain amounts of tin are also burnt with the zinc by means of the combustion gases. The zinc oxide thus obtained contains considerable amounts of tin oxide and lead oxide, usually in the proportion of 75-82 per cent. ZnO, 4-8 per cent. SnO_2, 6-12 per cent. PbO. These "mixed oxides" are brought on to the market as such. They are usually further worked up in a reverberatory furnace by melting with Na_2CO_3 and anthracite.

An American Method

The American Smelting and Refining Company has developed a method for the treatment of such mixed oxides[15] resulting from the melting and blowing with air of scrap radiators. The mixed oxides, analysing 27 per cent. Pb, 44 per cent. Sn, 12 per cent. Zn, are mixed with 8 per cent. of coke and pulped with water to facilitate handling. The material is charged to a furnace and fired with a strongly reducing flame in contact with the charge at a temperature of 1270-1300°C. Over 99 per cent. of the zinc is eliminated as fume in about three hours, and the resulting metal contains about 29 per cent. Pb, 71 per cent. Sn, and only 0.01 per cent. Zn, thus obtaining lead and tin in a readily marketable form of solder.

This method can theoretically be explained as follows: When the oxides are heated with carbon at temperatures rising from 970 to 1350°C., the ZnO is reduced in proportion to the partial pressure of CO in contact with the material. By sweeping reducing gases over the material the ZnO, being reduced to the metallic state, is volatilised and carried away, thus allowing more zinc to be volatilised. Thus it is possible to remove the Zn completely at a temperature below and with a lower partial pressure of CO than that which can normally be used for the distillation of zinc.

As an alternative to this metallurgical process a chemical process can be used, consisting in leaching the mixed oxides selectively with H_2SO_4 in order to remove the Zn as water-soluble $ZnSO_4$, whereas $PbSO_4$ and SnO_2 remain.

Final Operations in the Furnace

After the removal of most of the zinc, and by maintaining the temperature of the liquid metal, the remaining copper base alloy, being more and more oxidised, gives its alloying constituents up to the thick covering layer of slag (composition of which will be discussed later on) according to the following scale of relative "slagability."

Pb	50
Fe	20
Mn	10
Sb	6
As	5
Co	4
Ni	3
S	2
Se	1
Cu	1
Te	0.8
Bi	0.7

This means that for each 1 per cent. of copper slagged there goes into the slag a large amount of Pb, a fair amount of Fe and Mn, a small amount of Sb, As, Co, and

Ni, and that impurities such as S, Se, Te, and Bi are taken up by the slag in about the same proportion as copper. The removal of Zn, and later on of all the other impurities, is facilitated by blowing compressed air into the furnace—preferably hot compressed air—the heat of the flue gases being mostly made use of for this purpose.

Oxidation of the iron takes place during the melting period and the iron soon goes into the slag when the copper has become sufficiently liquid and blowing has begun. Iron is oxidised and removed as silicate in the slag, but only provided that there is the requisite amount of oxidation to trivalent Fe. Experienced furnacemen can gauge this by judging the colour and thickness of the slag, and the progress of oxidation can also be followed up and supervised by taking occasional small samples out of the furnace. These samples are drilled, weighed, and dissolved on the spot in HNO_3 and the iron precipitated with ammonia as hydroxide.

Removal of Nickel

Nickel is difficult to remove and is slagged only after all the iron (and Co also if present) has been slagged (before the boiling stage). Most of the Ni can be removed by cautious oxidation of the molten copper, followed by a final reduction by the addition of phosphor copper, assuming that the percentage of Ni is not too high. If this is the case, however, only a copper-nickel alloy can be obtained.

Manganese is oxidised partly directly, and partly after the formation of Cu_2O, and goes into the slag as silicate (like iron). Tin can be quickly removed as soon as oxidation of the liquid metal begins, and equally well by a highly basic or a highly siliceous slag. Lead is oxidised and goes into slag during the oxidising period, except a small quantity (0.2-0.15 per cent. Pb) which remains in the copper and cannot be removed.

Aluminium is oxidised to Al_2O_3 without going into the silicate slag and without rising completely to the surface, where the Al_2O_3 would be wrapped into the slag mechanically. Up to 0.05 per cent. aluminium (as Al_2O_3?) may remain in the copper when large amounts of Al (about 1 per cent. or more) were present in the raw material or had accumulated in the liquid metal because of the elimination of zinc, etc., even after careful handling during the blowing period. High Al-containing residues, from aluminium bronzes with 8-12 per cent. Al or complex beta-manganese brasses, should therefore be treated apart, as the resulting copper, which is contaminated with the remaining aluminium, may always be used in the manufacture of secondary manganese bronzes—provided that Pb is almost completely removed—as Al, Fe, Mn, Ni, and Sn are desired alloying constituents and not harmful impurities for such alloys.

Antimony is difficult to eliminate and appears to be slagged to a greater extent during the melting than in the fining period, the "boiling of the copper" being favourable to oxidation. Arsenic behaves similarly to antimony, a large part being oxidised in the melting period, while fining favours elimination. Poling has no effect. Arsenic can be more successfully eliminated from the copper bath in the reverberatory furnace by injecting Na_2CO_3 with the hot compressed air into the metal at the end of the oxidising period, when sulphur has been removed and the oxygen has risen to about 0.55-0.65 per cent.

This amount of oxygen is present in copper in the form of cuprous oxide—Cu_2O—and an oxygen content of 0.55 to 0.65 per cent. is equal to a content of 5 to 6 per cent. Cu_2O in copper. The microstructure shown in Fig. 7 represents such a composition. The unetched polished surface shows red crystals of Cu_2O embedded in a eutectic matrix which consists of copper and further

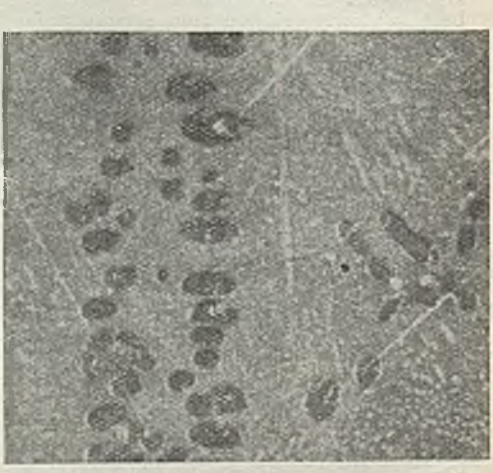

Fig. 7. Microstructure of copper matrix showing embedded crystals of cuprous oxide.

quantities of cuprous oxide. The melting point of the eutectic is about 1065° C. compared with a melting point of about 1083° C. for pure copper. The matrix still contains small amounts of copper sulphide, bluish-grey in colour, but all the arsenic, converted into Na_3AsO_4, has gone into the slag.

Summarising it can be said that (1) Zn, Fe, Co, and Sn are removed completely at the beginning of the fining period, S at the end of dense poling; (2) the elimination of Ni, Al, Pb, As, Sb (and of Ag and Bi if present) continues through the entire pro-

cess and is imperfect. Silver is removed mainly by volatilisation, bismuth mainly by oxidising and slagging.

At the beginning of the blowing period the temperature in the reverberatory furnace should be kept as high as possible (1100-1200° C.) to assist oxidation and slagging, but it has to be dropped towards the end to about 1100° to facilitate the formation of Cu_2O and the solution of the same in the copper. This is especially necessary when the refining material contains larger amounts of sulphur, as the reaction $Cu_2S + 2\,Cu_2O \rightleftarrows 6\,Cu + SO_2$ takes place from the left to the right only at lower temperatures and is reversed at higher temperatures.

Fig. 8 (left). Micrograph of cast "tough pitch" copper, showing the eutectic of Cu-Cu_2O at grain boundaries. Fig. 9 (right). The same copper after working and annealing, showing a twinned crystal structure with globules of Cu_2 (both × 100).

The formed slags, at first black and tough, later on brownish, reddish and thinner, should be taken off as often as possible. The reddish colour indicates the increasing formation of Cu_2O of which the copper contains at the end of the blowing period—*i.e.*, at the end of the formation of slags—up to 6 per cent., already pointed out. Further blowing would bring an excess of Cu_2O to the surface and this should be avoided. The blowing has to be stopped when the "boiling" of the copper bath indicates that the formation of SO_2 from the reaction shown above is nearing completion.

As the introduction of an excess of oxygen into the copper has now completed its task, the oxygen has now to be removed by exposing the metal to reducing conditions created in the furnace. This is done by one of several methods.

(a) By "poling," *i.e.*, by thrusting green wood poles beneath the surface of the molten metal, which is covered with charcoal, coke, or other carbonaceous matter. Although other methods for poling have been suggested, this process is still almost invariably used because of its cheapness and general efficiency.

(b) By blowing superheated steam through the molten metal, which is covered with a layer of powdered coal or wood charcoal.

(c) A method developed by Metallurgica Bresciana già Tempini[16] removes oxygen and sulphur from the copper and introduces a small quantity of hydrogen into it by passing H_2 through the molten metal through a submerged refractory nozzle and then cooling rapidly, *e.g.*, by pouring into cooled moulds.

(d) The Société d'Electrochimie d'Ugine claims a method for refining copper[17] using a flux of, or containing, boric anhydride, metaphosphoric acid or sodium silicate which has to be violently intermixed with the copper; whereupon a metallic-reducing agent, which may be an alkali or alkaline earth metal or magnesium, iron, aluminium, or zinc, is added.

(e) Another patent[18] claims that molten metals, *e.g.*, copper, can be deoxidised by means of a product comprising boron carbide B_4C and boron.

(f) Other improvements in methods for melting, converting and refining metals are claimed by Rifometal (Turin)[19], and it appears possible that a method developed by the British Non-Ferrous Metals Research Association[20] could also be used for copper-base alloys.

Poling is continued until the oxygen con-

tent of the copper is reduced to within the limits best suited to the particular type and purity of copper to be made. An important guide to the refiner when poling copper is the shape and appearance of the top or "set" surface of a sample ingot, from which the "pitch" (virtually the oxygen content) of the copper is determined. Poling ends when the copper has reached the "tough pitch" condition. The oxygen content is now within the percentage range 0.025-0.08, but in certain grades of copper which contain a small percentage of other elements, oxygen may be present in amounts exceeding 0.10 per cent.

If the oxygen content is not brought down to the limits indicated, the resulting "underpoled" copper possesses poor mechanical properties, the oxide content making it brittle. If poling is carried beyond the "tough pitch" state, the oxygen content becomes too low and porosity develops in the copper.

The copper of correct "pitch" is next poured either by hand or mechanically by casting machines into water-cooled copper moulds, which are first coated with bone ash or other refractory of dressing. Sometimes, instead, the red hot copper ingots are dropped into cold water, when they are immediately transferred into a pickling bath containing common salt, soda ash, or other pickling agent.

This latter method is applied mostly when the copper is not refined to more than 99.5 per cent. purity; the purpose of the pickling is to retain the salmon colour on the surface and to prevent the formation of traces of yellow brass on the surface of the copper when zinc is present in small amounts. The resulting copper will rarely reach the quality of high-conductivity copper, but

Fig. 10. American copper blast furnace.

commercially refined copper can be obtained which will fall under the classification of the Ministry of Supply (Control of Non-Ferrous Metals No. 5 Order, 1939) as follows:

(a) High-grade fire-refined copper ..... min. 99.85% Cu
(b) Ordinary fire-refined copper ..... min. 99.70% Cu
(c) Fire-refined copper ... min. 99.20% Cu

It will be noted in this classification that such obsolete and ill-defined terms as "Best Select," "Fine," "Tough," are absent.

The fire-refined copper can also be cast into anodes and electrolytically refined, but no plant for this purpose appears to exist in this country. In the American "Straight-Line" casting machine the anodes, after cooling, are brought by overhead cranes direct to the tank room of the electrolytic copper refinery. The tanks are arranged in "nests" and are interconnected. Bus-bars are tapered. Anode scrap is returned by truck to the smelting furnaces.

Another method for the production of copper free from oxygen and other gases has been developed by Heraeus Vacuumschmelze A.G., Hanau, Germany.[21] The copper is first subjected to a normal oxidising treatment in a hearth furnace or in a converter for removing the oxidisable impurities; then the oxygen arising from such treatment and other gases contained in the copper are removed by treating the molten copper under reduced pressure on a carbon hearth in the presence of carbon. Any residual bismuth, lead, zinc, etc., is reduced in the vacuum in the presence of carbon and distilled off.

Chemistry of Slags

The slags resulting from the reverberatory furnace still hold up to 4 per cent. Cu, and can be used again in the reverberatory furnace as long as they are not saturated with silicates other than iron and calcium silicates and as long as the zinc content of the slag does not exceed 5 per cent.

Iron-containing brass is therefore always a welcome addition to a reverberatory melt. A 5-ton charge has to be blown for 4-5 hours to burn off the zinc; while zinc goes up the stack, the iron is oxidised and the SiO_2 present fluxes the iron oxide, making a silicate slag which can be used again or smelted in a blast furnace (*see* Fig. 10).

Copper scale is another welcome addition to a reverberatory melt; it is usually ground with coal and charged into the furnace to assist oxidation. It must not, however, be added before practically all the zinc has been removed, otherwise the zinc would reduce the oxides of copper in the scale. Copper scale is especially useful when larger quantities of aluminium are present or have accumulated in the bath after the removal of zinc, as aluminium reacts violently with Cu_2O and CuO.

The amount of coal dust depends on the proportion of Cu_2O and CuO, besides metallic copper, in the scale, which may

also contain Fe_2O_3. As a rough indication, as much coal dust should be added as is necessary to combine with half the oxygen present in the copper scale in the form of Cu_2O and CuO. The coal dust has, however, the further function of creating the reducing atmosphere of CO, necessary to remove the last traces of zinc.

When large quantities of buffings and grindings are added to a charge in a reverberatory furnace, the fine nature of the mass causes much loss by dusting, and so many small particles are exposed on the surface that a considerable proportion must be burnt off if the molten globules are to find their way through the sticky mass of slag. In this special case of copper-base residues it is preferable to melt first in a rotary furnace with a rammed lining, using large amounts of blast-furnace slag, and afterwards to refine the resulting impure metal in the reverberatory furnace.

Practically all the slag mixtures used are based on calcium-iron-silicate. As SiO_2 is being continually introduced into the furnace by foundry sands, grindings, etc., the slag can be adjusted by the addition of calcium oxide, iron oxide (scale), and the like. Examples of good slag mixtures are: up to 35 per cent. iron oxide, 30-35 per cent. SiO_2, 20-25 per cent. CaO; or 40 per cent. iron oxide, 35-40 per cent. SiO_2, 10 per cent. CaO, 5 per cent. BaO, and 5 per cent. CaF_2.

A copper refinery, using pulverised coal for the reverberatory furnace had a fuel consumption of 3-4 tons of pulverised coal per 24 hours for refining, on the average, 12-15 tons of copper scrap and residues daily. The daily recovery was 8 to 10 tons of fire-refined copper, as well as slag and zinc oxide (mixed oxides) in flue-dust and ashes.

(To be concluded)

Metallic Creep

Work on Metals at High Temperatures

SOME 150 scientists attended a recent conference at the Royal Society to discuss various aspects of metallic creep at high temperatures. Sir Charles Darwin, Director of the N.P.L., was in the chair. During the war years there was little time available for that liaison between persons and organisations working on related problems which is so valuable in accelerating progress and avoiding duplication; and the subject of metallic creep seemed one in which a "gap" between theory and experiment might well have grown. It was to bridge any such gap and to re-establish liaison that Sir Charles Darwin had arranged the conference.

Professor E. N. da C. Andrade, a pioneer worker in this field, opened the discussion. He described briefly his early work on metallic wires which had suggested that "creep curves" were, in general, of similar form, and could thus be fitted, by a suitable choice of arbitrary constants, to an empirical formula which he had put forward in 1910. He explained the early ideas on the mechanism of creep and described the process of deformation by slipping along specific planes in the metallic crystal with the consequent formation of "slip bands" on the surface of the test specimen. The propagation of such slip along an atomic glide plane was illustrated by means of an ingenious model using wooden cylinders, which by their interlocking showed high resistance to sideways movement when in the regular sequence typifying a "perfect crystal," but which slid easily when one or two of the cylinders were out of place as in the two-dimensional representation of an atomic irregularity or fault. Professor Andrade explained that the formation of a slip was accompanied by strain-hardening in the immediate neighbourhood so that the deformation proceeded by series of slips on successive planes, each containing a fault.

Mr. H. J. Tapsell, of the Engineering Division of the N.P.L., described the equipment installed at that establishment for measuring creep rates down to 10^{-8} strain per hour. He described the creep rate as the most discriminating measure of the mechanical strength of a metal under stress at high temperature, and illustrated this by showing the wide divergence of creep rates at 450°C. of some mild steels. He stressed the point that engineers are normally interested in very small amounts of creep over periods of thousands of hours and showed that the creep behaviour of a metal over a few hours gave little indication of the probable creep over thousands of hours. He illustrated the laws governing the creep-rate changes with stress and time, applicable only to conditions involving continued decrease in creep rate with time. Under such conditions creep curves at various stresses had the same geometric form, and satisfactory equations for creep under complex stress systems had been developed. He described the deductions drawn from experiments on creep recovery and creep relaxation, and stated that X-ray studies of lattice structure changes during creep were beginning at the N.P.L.

Dr. Orowan, speaking on "Physical

Theory," paid tribute to the early pioneer work of Professor Andrade. He criticised current theories of the form of the typical time-extension curve under constant stress, and developed a novel theory, based on the conception that the activation energy of the glide process depended on the prior strain in a manner deducible from the stress/strain relation determined under conditions of rapid loading. An equation for the time/strain curve was developed which was shown to agree closely with the behaviour of certain samples of copper and aluminium at a number of widely differing temperatures.

Dr. Allen presented the viewpoint of the metallurgist on the control of creep-resistance. He emphasised the need for developing the use of metals of high melting-point, and showed how the creep resistance of available metals could be improved by control of grain-size and softening-temperature, and by the use of precipitation-hardening. Reference was made to several factors which influenced the creep-resistance of alloys in a profound but unexplained way, and the practical necessity of a fuller understanding of these effects was brought out.

A general discussion was opened by Sir Lawrence Bragg, who drew attention to the differences of outlook between theoretical physicists and engineers and expressed the opinion that studies from both viewpoints should be carried out in collaboration. He also drew attention to possible differences in the results of slip in the interior of the metallic grain and in the neighbourhood of the grain boundary.

After Dr. McCance had described another theoretical formula for the time/strain curve, a number of other speakers followed, and finally Sir Charles Darwin said that the meeting had proved the need for closer collaboration between engineers and physicists in this branch of work and that it had thus served a most useful purpose.

Metallurgical Research

An Australian Innovation

A NEW Chair of Metallurgical Research has been established at the University of Melbourne, and Professor J. Neil] Greenwood, D.Sc., M.Met.E., who has been professor of metallurgy at the University since 1924, has accepted the invitation of the Council to occupy the chair.

Initial research work will be carried out in three main fields of physical metallurgy, as follows: (1) Study of the properties of metals at high temperatures, including effects of prolonged application of stress; (2) application of X-ray technique to the examination of the detailed structure of metals; (3) fundamental problems in powder metallurgy.

An example of work in all three fields is provided by recent investigations by Mr. R. H. Myers in the production of metallic tantalum and its alloys from the rare mineral tantalite, deposits of which occur in Western Australia. Some of the men trained in this new department will, it is hoped, pass into industrial research laboratories and the laboratories of the Council for Scientific and Industrial Research

Professor Greenwood, who graduated at the Victoria University, Manchester, went to Australia from Sheffield in 1924. He has been instrumental in establishing the teaching of physical metallurgy on a high level, and the metallurgical department of the University of Melbourne has grown in status under his direction, both as a teaching institution and a research centre.

The new chair has been made possible by contributions from the Broken Hill group of metal companies.

Magnesium Alloy Ingots

New Standard Specifications

THE British Standards Institution has issued a series of specifications for magnesium alloy ingots and castings in the general engineering series. Broadly, the series covers three types of magnesium alloy, and these are obtainable in varying conditions of heat treatment; there are thus three specifications for ingots and eight specifications for castings.

The form of the publication is similar to that which has been adopted for copper alloy castings in which the chemical composition, the condition of the material and the mechanical properties for each specification are given on a separate page, and there is a general section covering clauses dealing with provision of test pieces, the making of the tests, inspection procedure, facilities for testing, etc.

The series are all in one publication, which is obtainable from the British Standards Institution, 28 Victoria Street, London, S.W.1, at 2s. each.

Parliamentary Topics

Linseed Oil

IN the House of Commons last week, Major Legge-Bourke asked the President of the Board of Trade why, in cases of Government and export orders, linseed oil was allowed up to 100 per cent. of the requirements, whereas, with another order, the supply was based on a pre-war quota.

Sir S. Cripps replied that allocation was made of linseed oil in accordance with the importance of the object.

Steel Output

Mr. Turner-Samuels asked the President of the Board of Trade what was the output of steel in 1939 and 1945 in Germany (including Austria and the Saar), U.S.A., and Great Britain; what was the number of people employed in the industry in each of those countries during the same years.

Sir S. Cripps circulated the following figures:

	1939	1945
	Million tons.	
Germany (including Austria and the Saar)	22.0	2.0*
United States	47.1	71.4
United Kingdom	13.2	11.8

*Excluding the Saar in 1945.

No information about the numbers employed in the steel industry in Germany is available. For the U.S. the figures include blast furnaces as well as steel works and rolling mills, 389,000 being employed on the average in 1939, and 457,000 in August, 1945. In the U.K. 178,000 were employed in steel works and rolling mills in 1939, and 174,800 in 1945, both figures relating to the middle of the year.

Uranium and Thorium

Captain Blackburn asked the Prime Minister whether arrangements were being made for a survey of the resources, in the British Commonwealth and Empire, of uranium and thorium. The Prime Minister replied that a number of special surveys had been carried out.

In answer to a further question by Captain Blackburn, the Under-Secretary for India (Mr. A. Henderson) said he was asking the Government of India for information about the owners of the extensive deposits of thorium in India.

I.G. Farben

In reply to a question from Captain Marples, Mr. Hynd (Chancellor of the Duchy of Lancaster) regretted that he could not express, as a percentage of its pre-war or war-time capacity, the extent to which the vast I.G. Farben industrial nexus had been disorganised, dismantled or destroyed. It could, however, be said that I.G. Farben had ceased to exist as an organised unit. No part of it might operate except under licence of the control authorities in accordance with the industrial policy for Germany of the occupying Powers. No cartel ties now operated between I.G. Farben and firms outside Germany.

DDT

Mr. Austin asked the Minister of Health whether he was satisfied that the commercial and domestic use of DDT was in no way injurious to the public health.

Mr. Bevan: I am advised that, according to present knowledge, there is little risk attaching to the use of DDT in the form in which it is commonly used, namely, as a powder or a watery suspension. Further investigations are proceeding into the toxicity of DDT in oily solution.

University Grants

In reply to Sir E. Graham-Little, Mr. Dalton said he proposed to ask Parliament to vote £9,450,000 for grants to the universities for 1946-7. This was £3,800,000 more than was voted last year. In order to encourage universities to plan future development over a term of years he would be prepared, if good cause was shown, to ask Parliament to vote even larger capital sums.

Sulphate of Ammonia and Nitro-Chalk

Mr. Watkins asked the President of the Board of Trade whether he would inquire into the prices now charged for sulphate of ammonia and nitro-chalk.

Sir S. Cripps: Prices of sulphate of ammonia and nitro-chalk are controlled, the former by statutory Order and the latter by agreement between the Raw Materials Department and the suppliers. The maximum prices for sulphate of ammonia range from £9 10s. to £11 2s. per ton according to the month and the quantity in which delivery is taken. The prices for nitro-chalk range from £9 14s. to £10 14s. per ton according to quantity.

German Chemical Reports

In reply to Sir Thomas Moore, Sir Stafford Cripps said that all the intelligence reports received from the manufacturers who have investigated, on behalf of the Government, the chemical factories of Germany, would be published, except for a small number which may have to be withheld for the present for reasons of security.

Paint Exports

Sir S. Cripps, in reply to Mr. Touche, said that, according to the export group of the paint industry, export orders held by the industry at January 12, 1946, were valued at £3,000,000. The shortage of linseed oil has been, and still was, the limiting factor in the manufacture of paint for export. The quantity allocated for that purpose during the current quarter would, it was estimated, permit the execution of export orders to the value of £540,000.

Personal Notes

MR. J. ARTHUR REDFERN, chairman and managing director of Redfern's Rubber Works, Ltd., has been appointed a J.P. for the borough of Hyde.

VISCOUNT BENNETT has been appointed chairman of the Council of the Royal Society of Arts in succession to the late Dr. E. F. Armstrong, F.R.S.

DR. L. HUNTER is to have the title of Professor of Chemistry conferred upon him by the Council of Leicester University College in respect of the post now held by him.

LIEUT.-COMMANDER B. J. JONES has returned after several years with the Forces and is resuming his position of publicity manager to Johnson Matthey & Co., Ltd., 73/83 Hatton Garden, London, E.C.1.

DR. LESLIE AITCHISON, who has been appointed to the newly-established Chair of Industrial Metallurgy at Birmingham University, was awarded £100 by the Iron and Steel Institute in 1921, through the Andrew Carnegie Research Scholarship Fund, to assist in an investigation of the low apparent elastic limit in quenched and work-hardened steels, with particular reference to fatigue, strength, proof, stress and constitution.

MR. H. COURTNEY BRYSON is taking up the post of managing director of Bryson Processes, Ltd., having resigned the position he held for many years of chief chemist to Scott Bader & Co., Ltd. In his new position Mr. Bryson will continue working on the production of new synthetic resins and products relating to them, such as emulsions, paints, adhesives. Mr. Bryson will welcome hearing from his many friends in the trade. The address of the company is Station Road, Irthlingborough, Northants (Irthlingborough 151) and the London offices are at 312 Sardinia House, Kingsway, W.C.2.

MR. A. J. SOMERS, B.Sc., F.R.I.C., whose appointment as a director of Borax Consolidated, Ltd., was briefly recorded last week, has been sales manager since 1940, and has served the company for 25 years. He studied at the Royal College of Science, gaining an honours degree in chemistry, and, during the 1914-18 war, he served in the R.A.M.C. and R.E. Anti-Gas Section.

On the left, Dr. E. Voce, recently appointed Metallurgist to the Copper Development Association, as announced last week. On the right, Mr. A. J. Somers, the new director of Borax Consolidated, Ltd.

Obituary

MR. ARNOLD SHEPHERDSON, whose death occurred at Chorlton-cum-Hardy recently, had been a member of the research staff of I.C.I. at Blackley for many years and a member of the Manchester Section of the Society of Chemical Industry.

From France is reported the death of PROFESSOR ALBERT RECOURA, who died recently at Grenoble at the age of 84. Formerly head of the Faculty of Science at Grenoble University, he received the degree of D. ès Sc., Paris, in 1886 and was appointed Professor of Chemistry at Grenoble in 1901. He had been a collaborator of Marcelin Berthelot, one of the great French chemists of the 19th century.

DR. JOHN BRITTAIN, who was killed in an aeroplane crash at Chelsham, Surrey, on February 13, was Director of Research, Explosives Projectiles. At Manchester University he graduated B.Sc. and was awarded a graduate research scholarship and the special scientific and industrial award. He proceeded rapidly to the M.Sc. and Ph.D. degrees, and at the age of 25 entered the Royal Arsenal, Woolwich, as a research chemist, soon afterwards beginning his series of experiments with rockets which culminated in the firing of V2's at Cuxhaven a few months ago.

General News

From Week to Week

Air-mail letters at 1s. 3d. per ½ oz. (post-cards 7d.) may now be sent to the Netherlands East Indies.

Spencer, Chapman & Messel, Ltd., of 23 Grange Road, Sutton, Surrey, are removing their head office on March 4 to 33 Chancery Lane, W.C.2, to which all communications should be sent.

During the quarter ended December 31 last, 119 suggestions from members of the Post Office staff for improving the telegraph, telephone and postal services were judged good enough to receive money awards.

The Council of Leeds University has announced the receipt of a gift of £450 for the Department of Inorganic and Physical Chemistry and one of £157 10s. for the Department of Colour Chemistry and Dyeing.

The new plastics factory now under construction at Tynemouth for the Thomas De La Rue group is expected to be in production by July. Occupying 150,000 sq. ft., it will largely be devoted to the production of laminated material known as "Delaron."

Refresher courses in paint technology, arranged by the London Section of the Oil and Colour Chemists' Association for ex-Servicemen in the paint industry, began at East Ham Technical College this week, and others will begin next week at Borough Polytechnic and Acton Technical College.

In the latest Fuel Efficiency poster some new characters have been introduced in the person of "fuel hogs." The poster is of general fuel-economy appeal, and our one criticism would be that the "hogs" depicted are not sufficiently revolting in appearance; they recall rather too vividly those engaging characters the "three little pigs."

The following items have been exempted from Key Industry Duty until August 19, 1946: R. acid carbolic; acid carbolic (synthetic); alcohol isopropyl, unrefined, containing not less than 0.5 per cent. by weight of ketones; R. benzol-phenol; benzo-phenol (synthetic); phenol (synthetic); R. phenol; isobornyl thiocyanoacetate (S.R. & O. 1946, No. 232).

The present acute shortage of raw materials in the paint and allied industries was stressed by Mr. C. Owen Morley, president of the National Federation of Paint, Colour and Varnish Manufacturers of the United Kingdom, when he spoke at the annual dinner of the paint and oil section of Glasgow Chamber of Commerce last week. If the industry did not obtain adequate supplies soon of raw materials, he said, it was impossible to see how manufacturers could carry on.

A Furnaceman's Manual, parallel with the already-issued Stoker's Manual, is to be published by the Fuel Efficiency Committee. Being on a rather higher technical plane, it will appeal also to junior technical staff. Subjects discussed will include fuels and the theory and technique of combustion, sources of fuel loss, and maintenance work.

An agreement has been signed between Cinema-Television, Ltd., of London, and the Rauland Corporation of Chicago, Illinois, placing at the disposal of Cinema-Television the very advanced television technique of Raulands. Both companies are leaders in the production of cathode-ray tubes and photo-electric cells, and the pooling of the results of all future research should be of mutual benefit.

A meeting of the London and S.E. Counties Section of the Royal Institute of Chemistry was held in the Pharmaceutical Society's lecture hall, London, on February 20. Dr. Ellingham, secretary of the Institute, lectured on "Chemical Affinity Data and their Industrial Applications," and dealt with the calculation of the free energies of reactions, and their application to such problems as the stability of hydrocarbons, metallurgy based on the reduction of metal oxides and sulphides, and the design of voltaic fuel cells.

The American Section of the Society of Chemical Industry has arranged to hold an "Anglo-American Meeting" in New York on April 4, when official delegates from this country will attend. The officers of the Society are anxious to have the support of any members who are likely to be in New York on that date, and they would be glad if such members will write to the honorary foreign secretary, Mr. S. Robson, so that their names may be passed on to the secretary of the American Section.

Foreign News

To combat the locust plague in Uruguay, up to 500,000 litres of naphtha are being imported, free of import duty and surtax.

French steel output totalled 1,587,000 tons last year, compared with an output of 6,186,000 tons in 1938.

Of 292 new industries established in Mexico since 1940, 41 manufacture chemical and allied products.

Because of the need for bigger supplies of fertilisers for farms, fertiliser works in all the occupation zones of Germany are receiving special attention.

The 1945-46 pyrethrum crop of Rio Grande do Sul, Brazil, is estimated to reach 2000 metric tons, which will be a 40 per cent. increase over the 1944-45 total.

Certain chemicals hitherto subject to export licensing in Mexico have now been removed from the list of controlled products and may be exported freely.

Argentina's sulphur industry is likely to be expanded considerably, there already being extensive development of large deposits in the province of Los Andes.

The first of a series of alcohol distilleries in agricultural regions of Uruguay is to be established at Paysandu and will have an estimated annual capacity of 6,000,000 litres.

Turkish iron ore output in 1944 totalled about 90,000 tons, which was almost the same as in the previous year and output of the country's rolling mills totalled 44,300 tons, against 36,200 tons.

The number of establishments manufacturing chemicals and allied products in Canada in 1944 was 955, the largest number—489—being in Ontario, followed by Quebec with 318.

Southern Rhodesia's imports of chemicals, drugs and allied products during the first seven months of 1945 increased in value about 13 per cent. over those for the like period of 1944.

Seventy-five per cent. of the caustic soda imports into Syria and Lebanon in 1944 came from the United Kingdom. The total imports were slightly less in volume than those during 1943, but were of greater value.

The cultivation of penicillin in bottles is the only method so far used in France, no equipment being yet available for manufacture by the deep-tank method. Production has, however, increased considerably of late.

The production and distribution of chemical products in Bavaria is to be arranged by a Central Chemical Office, which is also, apparently, to prepare for exchanges of chemical products with other parts of Germany and foreign countries.

The Solvay Nitrogen Division of the Allied Chemical and Dye Corporation has opened a new bench-scale research laboratory at Hopewell, Virginia, for the development of new products and the improvement of existing products.

The United States steel strike will inevitably lead to a titanium shortage, lasting for many months. It is estimated that present output will meet only half the requirements, which have increased considerably as compared with pre-war years.

Included in an official list of supplies for which import permits will be granted by the Turkish authorities are chemical fertilisers and technical instruments and apparatus for laboratory purposes. Chemical products are imported by authority of the Ministry of Commerce.

The world's largest uranium deposit is reported to have been found near Stanthrope, Queensland. Samples sent to this country have yielded upwards of 3 per cent. uranium.

The first stage in the construction of a new fertiliser and chemical plant in Alwaye, in Travancore State, India, has been completed and production is expected to begin in July. The manufacture of 50,000 tons of ammonium sulphate fertiliser annually, besides sulphuric acid, caustic soda, etc., is contemplated.

A recently concluded trade agreement between Czechoslovakia and Austria provides for the supply, by Austria, of 11,000 tons of salt for industrial and food purposes, 10,000 tons of dolomite, 10,000 tons of soda, gypsum and chalk, and 4000 tons of graphite and magnesite, while Czechoslovakia will send 30,000 tons of coke, hard coal and lignite and 1000 tons of sulphuric acid.

Atomic heat is being produced on a large scale in United States Government plutonium factories, but no effort has been made to put it to practical use, according to Dr. Glenn T. Seaborg, co-discoverer of plutonium. Dr. Seaborg, a University of California chemistry professor, who has been working on the atomic bomb project, said disposal of the heat has created a problem for the Government plutonium factories.

The Royal Netherland Industries Fair will be held from April 2 to 11. Further information is obtainable from the Koninklijke Nederlandsche Jaarbeurs, Utrecht, Holland. The Paris International Trade Fair will take place at the Porte de Versailles, Paris, May 25 to June 10. Further information from Miss E. Lambert, London representative of the Fair, 11/13 Rugby Chambers, Rugby Street, London, W.C.1.

The French Minister of Colonies has announced that the tin mines of Indochina will have to be restored before production can be resumed; the work will take about six months. Stocks of tin ore discovered in Indochina amounted to about 570 metric tons, with an average tin content—in samples taken—of 40 to 70 per cent. In addition, 550 tons of block tin were discovered. The tin-smelting plant at Haiphong is intact.

Finland may have a new source of lead, according to the Finnish Press. A deposit discovered accidentally in Pakila, near Helsinki, during excavations for a new building, is being investigated to ascertain its extent. Although a small quantity of lead is obtained from a mine at Orijärvi, the two main domestic sources have been Petsamo and a mine in Karelia on the coast of the Gulf of Finland. Since this territory has now been ceded to the Soviet Union, it is hoped that the deposit at Pakila will prove of sufficient size to provide at least part of the lead needed by the country.

The small amount spent on research work in Eire was the subject of comment by Lieut.-Col. K. E. Edgeworth, speaking in Dublin recently. He said the annual expenditure on research in Eire was estimated at about £113,000. Based on the rate of expenditure on such work in Britain, Eire should be spending about £330,000 or £400,000. He urged Government assistance.

Reports from Siam indicate that the Siamese Government has formed a company to take over and operate the tin mines of the country. Upwards of 20 British mining companies operated in Siam (many under Australian auspices) and production, which was mostly done by dredging, reached 17,500 tons yearly before the war. The ore was, for the most part, shipped to Penang for smelting.

Forthcoming Events

March 4. Society of Chemical Industry (London Section). Chemical Society's Rooms, Burlington House, Piccadilly, W.1. Dr. G. Newton Friend: "The Rare Earths."

March 4. Society of Chemical Industry (London Section). Rooms of the Chemical Society, Burlington House, Piccadilly, W.1, 6.15 p.m. Mr. Alan Speedy: "Carbon Blacks—their Manufacture and Use in Industry."

March 5. Chadwick Public Lecture. Sheffield University, 4.30 p.m. Dr. S. A. Henry: "Medical Service in Industry."

March 5. Hull Chemical and Engineering Society. Regal Cinema, Ferensway, Hull, 7.30 p.m. Mr. D. Bellamy: "Aspects of the Commercial Utilisation of Electricity."

March 5. The Chemical Society. Leeds University, 6.30 p.m. Dr. Kathleen Lonsdale: "Crystal Analysis as a Clue to Chemical Problems."

March 5. Electrodepositors' Technical Society. James Watt Memorial Institute, Great Charles Street, Birmingham, 6.30 p.m. Open discussion: "Electroplating and the Automobile Industry."

March 5. Association of British Chemical Manufacturers. Lecture Theatre, Geological Society, Burlington House, Piccadilly, W.1, 2.30 p.m. Fuel brains trust. (Messrs. E. F. Hall, T. F. Hurley, O. Lyle, J. B. M. Mason and J. S. Merry, with H. M. Peacock as question master.)

March 6. Institute of Fuel (North-Western Section). Engineers' Club, Manchester, 2.30 p.m. Question meeting: "Boiler maintenance and operation."

March 7. The Chemical Society. Burlington House, Piccadilly, W.1, 5 p.m. Professor A. R. Todd: "Synthesis in the Study of Nucleotides" (Pedler Lecture).

March 7. Royal Society of Arts (India and Burma Section). John Adam Street, Adelphi, W.C.2, 1.45 p.m. Mr. Percy Evans: "The Oilfields of India and Burma."

March 7. Royal Institute of Chemistry (Liverpool and North-West Section). Municipal Technical College, Widnes, 6.30 p.m. Mr. J. L. Burrage: "Benzene Hexachloride as an Insecticide."

March 7. Royal Institution of Great Britain. 21 Albemarle Street, W.1, 5.15 p.m. Sir Henry Dale: "Chemical Transmitters of the Effects of Nervous Impulses—II."

March 8. Institute of Fuel (North-Western Section). Municipal Annexe, Dale Street, Liverpool, 2.30 p.m. Mr. J. Eccles: "Sources of Energy."

March 8. The Chemical Society. Sheffield University, 5.30 p.m. Prof. F. Challenger: "Some Aspects of the Chemistry of Mono- and Di-sulphide Links."

March 8. Society of Public Analysts. Chemical Society's Rooms, Burlington House, W.1, 5.15 p.m. Annual general meeting. Dr. J. H.. Quastel: "Biochemistry of Soil."

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.)

ANTIGEN LABORATORIES, LTD., London, W. (M., 2/3/46.) February 7, debenture to National Bank, Ltd., securing all moneys due or to become due to the bank; general charge. *£1780. April 18, 1945.

Satisfaction

ANTIGEN LABORATORIES, LTD., London, W. (M.S., 2/3/46.) Satisfaction February 7. £2500, registered October 11, 1943.

Companies Winding-Up Voluntarily

BRIXTON NON-FERROUS METALS, LTD. (C.W.U.V., 2/3/46.) February 7. F. T. Smith, 150 Southampton Row, W.C.1, liquidator.

STERI VITA PRODUCTS CO., LTD. (C.W.U.V., 2/3/46.) Feb. 8. By special resolution. M. Weiner, 50 Barlow Moor Road, Didsbury, Manchester, appointed liquidator.

Company News

Midland Tar Distillers, Ltd., are issuing 68,308 new £1 ordinary shares at 28s. 6d. each; 63,615 new shares are being offered to shareholders in the ratio of one new share for every six old, and the remaining 4693 shares are being offered to members of the company's staff.

Savory & Moore, Ltd., report net profit of £15,279 (£25,017) for the year ended March 31, 1945. Dividends totalling £13,235 will be paid on 5½ per cent., 6 per cent. and 7½ per cent. preference shares and two months' dividend totalling £800 on 6 per cent. non-cumulative preference shares to May 31, 1944.

Wolverhampton Steel & Iron Company is reported to be about to be sold by Thos. W. Ward to a private company recently registered under the name of Wolverhampton Steel & Iron Company. Capital, £175,000 in £1 shares. Directors: H. W. Secker, a director of Thos. W. Ward; C. L. Fry and S. J. Dyal, both on the local board of Thos. W. Ward; W. H. Hickman, general manager; A. J. Wainford, a director of Midland Iron Company; and R. B. Trotman, commercial manager.

New Companies Registered

H. K. Duckworth, Ltd. (404,669).—Private company. Capital, £5000 in £1 shares. Manufacturers of and dealers in chemicals, etc. Directors: A. R. Hemingway, T. A. Morton. Registered office: Grange Pharmacy, Grange-over-Sands, Lancs.

Metra Art Products, Ltd. (404,765).—Private company. Capital, £100 in £1 shares. Manufacturers of and dealers in chemicals, etc. Directors: A. E. Zeumer, Mrs. N. F. Zeumer. Registered office: 539 Holloway Road, N.19.

Cleveland Processors, Ltd. (404,697.)—Private company. Capital, £3000 in £1 shares. Manufacturers of and dealers in chemicals and chemical products, etc. Directors: R. D. Davis, L. V. Davis. Registered office: 125 Clapham Road, S.W.9.

G. O. Woodward & Company, Ltd. (404,605).—Private company. Capital, £1000 in £1 shares. Manufacturing chemists, etc. Directors: G. O. Woodward, Mrs. W. M. Woodward, Mrs. E. E. Woodward. Registered office: 146 Larkhill Rise, Clapham, S.W.4.

Plathens, Ltd. (404,717).—Private company. Capital, £100 in £1 shares. Manufacturers of and dealers in chemicals, chemical products, etc. Directors: L. W. J. Henton, R. Platings. Registered office: 6 Dene Mansions, Dennington Park Road, N.W.6.

Chemical and Allied Stocks and Shares

ALTHOUGH business in stock markets was again well maintained in most sections, price movements were generally small, and a waiting attitude prevailed pending the decision of Congress in respect of the loan to Britain. With uncertainty tending to develop, there was a disposition for investment business to be further centred on British Funds, which resumed their upward trend, accompanied by continued talk that a big new Government loan is in prospect. Home rails reflected further profit-taking following completion of the dividend announcements, but gas stocks and electric supply shares held recent gains on the improved distributions. Insurance shares attracted more attention, but dollar stocks receded after an earlier rise on the ending of the American steel strike.

Firmness ruled among chemical and kindred shares with movements generally not exceeding more than a few pence. Imperial Chemical at 40s. 6d. were little changed, Turner & Newall were 84s. and, awaiting the financial results, Borax Consolidated deferred held firm at 48s. 9d. Lever & Unilever rose further to 52s. 9d., and Lever N.V. to 55s., but United Molasses at 49s. 6d. lost part of their recent rise, as did Dunlop Rubber at 53s. 6d. There was steady demand for British Oxygen, which advanced to 86s. 6d. partly on expected benefits from Dominion income-tax relief. The excellent dividend increase resulted in a sharp advance of 1s. 3d. to 10s. 6d. in British Ropes 2s. 6d. ordinary shares.

Paint shares benefited from recent dividend announcements, International Paint rising to 125s., and Blundell Spence to 35s. 9d. on the higher payments. Goodlass Wall 10s. ordinary held firm at 27s. 10½d., but Pinchin Johnson receded to 36s. 6d., and Wall Paper Manufacturers deferred eased to 41s. 3d. British Match 44s. 3d., British Aluminium 39s., and Metal Box 96s. 3d. have been well maintained. British Glues & Chemicals 4s. ordinary held their recent rise to 14s. 4½d. American buying was given as the reason for a sharp rise to 22s. 3d. in Beechams deferred. Griffiths Hughes were 53s. 9d., Sangers 31s., and British Drug Houses 48s. 6d. De La Rue showed firmness at £10½ on news that the group's new plastic factory will start production in July.

There was steadiness in the iron and steel section, with Allied Iron 57s. 3d. ex rights to the new shares, Colvilles 25s. 6d., Guest Keen 42s., and United Steel 24s. 9d. xd.

Dorman Long, however, eased slightly to 26s. 9d. awaiting the financial results. Textiles were well maintained, Bradford Dyers being 25s. 6d., Bleachers 13s. 3d., and Calico Printers 19s. 10½d. Courtaulds changed hands around 54s. 6d. awaiting the results, British Celanese were 34s. 9d., and British Enka held firm at 25s., the last mentioned on talk of a capital reconstruction to pave the way for dividends.

Greeff-Chemicals Holdings 5s. shares changed hands around 13s., B. Laporte kept at 83s. 9d., and Monsanto Chemicals 5¼ per cent. preference shares at 23s. Midland Tar Distillers shares were firm at 31s. 3d. on the new capital and expansion programme. W. J. Bush were 80s., Burt Boulton 25s., and Lawes Chemical 13s. 6d., while William Blythe 3s. ordinary were 11s. 9d., the last named yielding 3¾ per cent. on the basis of last year's 15 per cent. dividend, which was a very conservative payment. Triplex Glass became rather more active around 42s. Tube Investments strengthened to £6¾. Oil shares rallied, both Anglo-Iranian and Burmah regaining part of earlier declines. Attock Oil were easier at 50s. "ex" the interim dividend, but Ultramar moved up to 74s. 9d.

British Chemical Prices

Market Reports

STEADY conditions have prevailed in the London chemical market during the past week and a moderate weight of fresh home inquiry has been in circulation. The export demand continues to be in excess of available supplies and there is no evidence of any improvement yet. There are no important price alterations to record and quotations generally are firm. There is a good call for soda ash, hyposulphite of soda, caustic soda, bichromate of soda, and hypochlorite of soda, while all the potash compounds are in active request. There is little of interest to report in other directions where movements to the consuming industries are steady. The main feature in the coal-tar products market is the scarcity of spot offers. Prices are unchanged and the undertone firm.

MANCHESTER.—Fresh inquiries from shippers for both light and heavy products have been a feature of business during the past week on the Manchester chemical market and a steady expansion of overseas trade during the coming months is confidently anticipated, more especially with the expected easing of the shipping space problem in the near future. On home trade account, contracts are being steadily drawn against by the textile mills and other industrial users and replacement business in the alkalis and other such lines is coming forward satisfactorily. A fair trade is reported in most of the fertiliser materials, and, with one or two exceptions, a steady demand is being dealt with in the tar products market, pitch, crude tar, creosote oil, carbolic acid, and benzol being the busiest spots.

GLASGOW.—In spite of continued shortage of supplies, the Scottish heavy chemical market experienced considerable activity during the past week, inquiries both for home and export trades being plentiful. There were very considerable export demands for formaldehyde, sulphur, and the alkalis. Prices remain firm. The demand is far ahead of supplies and considerable difficulty is being experienced in conducting normal business.

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