The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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The Chemical Age

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Metal Recuperators

IN a recent article in these columns (January 26, p. 103) on the general subject of fuel utilisation, reference was made to the recovery of heat from furnaces as a subject demanding more attention than it usually receives. Three methods of recovery are open: by regenerators, by recuperators, and by waste-heat boilers. Recovery by waste-heat boilers is a method which depends for its adoption upon the possibility of making use of the steam produced. The economics of recovery by the waste-heat boiler very often prevents the use of this method. It is necessary for the waste heat to be produced continuously for long enough and in sufficient quantity if such a boiler is to be used. It is often possible to connect a single boiler to a group of furnaces which are themselves operated intermittently. When the scale of operations is sufficient and the steam can be adequately utilised, recovery by waste-heat boilers should be closely investigated.

Recovery by regenerators or by recuperators involves the pre-heating of the air or gas used in the furnace. The effect of pre-heating the air or gas, or both, is to cause a higher flame temperature, and in consequence this method cannot easily be adopted in furnaces operating at low temperatures or requiring long, lazy flames for heating a considerable area. It is often said that air should be pre-heated only when it is desired to raise the flame temperature, but this is not strictly true. From the point of view of fuel efficiency and of cost of production, the recovery of the heat should be by using a recuperator or regenerator, rather than by the waste-heat boiler.

The argument is largely economic. In the furnace there is used a fuel which is frequently of high value per therm. This may be town gas or it may be producer gas; either of these will be higher initially in price per therm than raw coal. If coal is used in furnaces it is quite often of a high grade, whereas lower-grade fuels can be used for boiler firing. Obviously, the cost of fuel required by the furnace will be lowest if the sensible heat in the waste gases is returned to the furnace. If, on the other hand, a considerable proportion of this waste heat is utilised in a boiler the net effect is that fuel of high initial cost is being used for steam raising. It is therefore better practice, wherever possible, to use recuperators or regenerators for the recovery of heat leaving the furnace. In the past, an im-

On Other Pages

portant difficulty involved has been that regenerators are generally applicable only to the larger furnaces where a half-hourly reversal period can be used, and that brick recuperators have not been very satisfactory in their operation. Recuperators consist of a system of parallel passages along which waste gas and air travel either counter-current or in parallel. There are also cross-current recuperators in which the air and waste gas travel at right angles. When the partitions between the two gas streams are constructed of refractory firebrick there is the difficulty of leakage due to cracks. This has operated against the general adoption of recuperators.

A paper recently presented to the Institute of Fuel by Mr. G. N. Critchley has given much further information on the use of tubular metallic recuperators. Being made in metal, these recuperators are not subject to leakage to anything like the same extent as are brick recuperators. The thermal conductivity of the partition walls is high, and these recuperators have the further important advantage that they can be used with quite small furnaces. Mr. Critchley gave some particulars of the savings effected by these recuperators which have been applied to furnaces having temperatures between 450° and 1200° C. Some of these furnaces are so small that the cost of the recuperator equipment has been no more than £35-£40, while in other furnaces the cost of the equipment may run into figures of the order of £1000-£2000. The savings effected by these recuperators are such that, according to Mr. Critchley's figures, the annual return on the capital invested has been between 30 and 210 per cent. The percentage of fuel saved by recuperation depends upon the conditions ruling in the furnace, but will generally be between 8 and 20 per cent.

Chemical engineers will be interested in the information given by Mr. Critchley on the use of metals to withstand the high temperatures at which recuperators may work. So long as the waste-gas temperature does not exceed 500° C., mild steel can be used. Above this temperature it is necessary to go to cast iron, and at still higher temperatures to special metals. One manufacturer of metallic recuperators uses heat-resisting cast iron for waste-gas temperatures up to 850° C. and for air temperatures up to 450° C. and he uses 30-35 per cent. chrome iron for waste-gas temperatures up to 1050° C., and for air temperatures up to 700° C. material known as 30-35 per cent. chrome iron undoubtedly ranks among the best available for waste-gas temperatures up to 1050° C., and has been chosen for economic reasons as well as for technical reasons.

In considering the possibility of using metallic recuperators for waste-gas temperatures higer than 1050° C. it is of interest to review materials which might be technically suitable even though, at least initially, they might be too costly for normal commercial use. In blast-furnace stoves, a 25 per cent. Cr alloy has proved satisfactory at 1100° C., and a 25-20 Cr-Ni steel at 1100-1150° C. The incorporation of aluminium in steel increases resistance both to oxygen and to sulphur, and higher temperatures than those hitherto used in metallic recuperators might be possible with high Cr and Cr-Ni steels containing aluminium, although care is required to keep them outside the brittle range. A 6-8-1-1 Al-Cr-Si-Ti alloy is suitable for temperatures up to 1100° C., and a 24-1½-1½-½ Cr-Al-Si-Mo alloy for temperatures up to 1200° C. Alloys of these last two types are chiefly used as castings. They are somewhat brittle at room temperatures, but are entirely satisfactory, provided that the stresses are not great, at the temperatures indicated They satisfy all reasonable requirements in both oxidising and reducing atmospheres containing sulphur.

For temperatures higher than 1200° C., alloys containing about 80 per cent. Ni and from 13 to 20 per cent. Cr would appear to merit consideration. Their resistance to oxidation is very good at 1200° C., and possibly higher. They are susceptible to attack by sulphurous gases, especially in reducing atmospheres, but since Gruber has shown that the addition of 10 per cent. of aluminium to pure nickel reduces the rate of absorption of sulphur at 1000° C. by approximately 97 per cent., it would seem that this shortcoming might be overcome. There is also evidence that an alloy containing 30 per cent. chromium and 5-6 per cent. aluminium will resist oxidation at 1250-1300° C. While the alloy has satisfactory mechanical strength at these high temperatures, much grain

growth occurs, and this results in its being brittle when cold.

If a high degree of preheat is not required the difficulty of avoiding overheating of the metal can often be solved by using the parallel-flow recuperator in place of the counterflow. The latter type is generally greatly superior to the former both in regard to the temperature to which the air is heated and in the degree of heat recovered. In parallel-flow recuperators, for example, with an inlet waste gas at 1000° C. it is virtually impracticable to preheat the air to temperatures higher than about 500-600° C.; the danger of partition failure is, however, much less than with the counterflow type. Counterflow recuperators can, however, be used at 1000° C. quite safely if the heat-transfer coefficients at the hot end are carefully adjusted and controlled. This means that the rate of heat transfer from waste gas to metal must be less than that from metal to air.

The possibility of using metal recuperators has been increased considerably as a result of the advances made in metallurgy during the war. Our present purpose will have been served if this discussion has brought to the attention of chemical engineers generally the possibility of recovering heat from their furnaces through recuperation. The considerable saving in fuel and in operating costs thereby achieved is worthy of the closest investigation.

NOTES AND COMMENTS

A Penicillin Achievement

ONE of the most closely guarded secrets of the war has now been revealed—or at least partly. We should, however, say at once that we were never convinced of the necessity for maintaining secrecy in this instance, even during the war, and it is nothing less than a disgrace, now that the war is over, that no facts have been published about it until now. We are referring to that vexed subject, British production of penicillin. More or less accidentally, the remarkable figures of the January output from the Ministry of Supply factory at Speke have been revealed (*see* p. 196 of this issue). To judge by the hole-and-corner way in which the news was allowed to come out, one would have expected a wholly discreditable figure. Actually, the reverse is the case, and the output is completely to the credit of the Distillers Company and its employees who have been working in the factory. To achieve last month approximately one-eighth of the total monthly production of the United States is no mean feat, and we offer sincerest congratulations to all concerned in the task.

Official Story—Next Year ?

SO far as the Ministry of Supply is concerned, however, this remarkable feat would have passed unnoticed—no official comment has been forthcoming; no proud acknowledgment of the fact that British scientific industry can deliver the goods even under the present trying conditions. A magnificent "story," in fact, was casually "thrown away." There is a rumour, however, that the Ministry proposes to publish an official document on the subject—about next Christmas ! Lights under a bushel are all very well in war time; but really, if our Ministries are going to take on the job of running the country's industry, they must acquire some notion of how an industry is run. It is not commonly considered good industrial practice to keep silence about praiseworthy and public-spirited work. The Government's attitude towards the story of penicillin production is nothing less than official secrecy run mad; unless it is purely and simply incompetence or mismanagement—characteristics which (we are nowadays asked to believe) are the prerogative of private enterprise.

Wholesale Prices Increase

WITHDRAWAL of the subsidies from iron and steel was responsible for the most striking rise in wholesale prices in January, as compared with December last. The Board of Trade index figure for the iron and steel group (1930=100) went up from 189.9 to 205.9, the first general advance in the group since November, 1940, indicating the stability that has obtained throughout the war in iron and steel prices, despite higher costs. Manufactured iron showed the biggest movement, in some cases of over 20 per cent., while pig-iron advances ranged from 12½

to 18 per cent. In the non-ferrous metals group the increase of 1.4 per cent. (126.9 to 128.8) was largely due to an average increase of 24 per cent. in the price of English lead, including sheets and pipes. This had its reaction on the "chemicals and oils" group, where a rise of 0.5 per cent. (144.3 to 145.1) was in evidence. The average price of white lead paints went up by 3½ per cent. during the month, while, in addition, coal-tar products were dearer on the average by nearly 3 per cent., and there was a seasonal rise of under 1 per cent. in the price of fertilisers. The over-all figure for industrial materials and manufactures went up from 175.2 in December to 179.7 in January—2.6 per cent. in all.

Training in Military Chemistry

A MEMBER of the staff of an American Government Arsenal (on military leave from the University of Illinois) has contributed, to the *Journal of Chemical Education* (1945, *22*, 538), a thought-provoking article on post-war training in military chemistry. In this country it is not the custom for scientific men in such positions to be allowed to express themselves in the technical Press; indeed, more than one competent scientist has refused Government service (in time of peace) because he knew he would be debarred from public writing, and the country was the less well served on that account. However that may be, Mr. Audrieth (the American author in question) expresses himself forcibly on his subject. Americans, he says, are not going to let themselves be lulled into a feeling of false security, but "when the inevitable conflicts of the future do happen again we shall be prepared to meet any eventuality." This is (as Mr. Audrieth himself points out) a very different America from that of 1919, and such an attitude will have to be taken into serious account, for as long as it lasts. At any rate, it appears to be the official attitude to-day. Before the attack on Pearl Harbour, Mr. Audrieth remarks, the U.S. did have almost two years to prepare for "the inevitable." We wonder, in parenthesis, whether he would have been so ready to use that epithet during those two years; few of his compatriots, except the greatest of them all, Franklin D. Roosevelt, appeared, to our eyes, to view the situation in that way at the time.

The Programme Outlined

THAT is all past history now, however, and to-day the cry is for preparedness. The demand in the U.S. is that activities such as the Office of Scientific Research and Development "should be continued as a matter of national policy so that the latest advances of science and engineering will be brought to the attention of the Services." Mr. Audrieth's actual proposals confine themselves to a programme of training chemists and chemical engineers in those phases of their profession which apply to the art of war. In this respect our author's plan is admirably clear and concise. Military chemistry is to be included as an accepted phase of academic professional training. There will be no difficulty about instruction, as many competent teachers will have had sufficient experience in the military field. Not only civilian personnel, but also reserve officers, should be taught, and both classes must undergo more intensive training, especially with a view to keeping their imaginations alert for new developments. By these means Mr. Audrieth claims that it will be possible to attract men of ability and vision to the military side of the profession, thus providing a keen group of officers and civilians ready to take over responsibility for the production of explosives, etc., and keep the U.S. "ahead of the rest of the world in utilising the advances of chemical science for the defence of the country."

CHEMICALS IN BELGIUM

Recovery in the Belgian chemical industry continues, though it is still restrained by lack of fuel. The Produits Chimiques d'Auvelais, the Produits Chimiques de Fontaine-l'Evêque, and the Floridienne, at Charleroi, however, are all intensively occupied in the production of sodium silicate, while some deliveries of phosphoric slag have been made.

The improvement in the situation has enabled the Ministry of National Economy to lift certain restrictions. The regulations concerning the manufacture and consumption of lanoline, stearine, and other fats and greases from wool have been abolished, while washing powders may now contain a higher content of fatty acids. Those hitherto sold off the ration and containing no fatty acids may now contain 10 per cent., while those hitherto sold on the soap ration and containing 10 per cent. of fatty acids may now contain 40 per cent., bringing them up to their pre-war quality.

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

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

(*Continued from* THE CHEMICAL AGE, *February 9, 1946, p. 161*)

AN advance in penicillin production which may have consequences as profound as the adoption of corn-steep liquor in the medium, or the development of a submerged-culture technique, is the development of a solvent-extraction process by which penicillin is continuously extracted from the culture fluid. There is little information yet to hand, but the process probably involves the use of mixed solvents and is an extension of a patented method developed by one of the large oil interests for the solvent extraction of petroleum crudes. It has been claimed that the toxicity of penicillin produced by this process is half that of penicillin produced by other methods for equivalent therapeutic potency. This implies that, over all, this solvent-extraction process is more selective than the usual solvent-extraction methods employed, and that a purer penicillin is consequently produced. Penicillin of commerce is, of course, now up to about 80 per cent. pure penicillin, the balance of material not being toxic in the normal therapeutic dosages.

Increasing Penicillin Yields

The discovery that corn-steep liquor considerably enhanced the yield of penicillin revolutionised commercial production. The supply of this material is a difficult matter in this country especially in present conditions. It is freely available in the U.S.A., but the handling of this highly dilute material has presented difficult problems there. Cook and Tullock (*Nature*, 1945, *156*, 515) found that press juice from entire green peas (*i.e.*, peas and pods) contains a powerful stimulant for penicillin production by *Penicillium notatum*, results being equivalent to the Coghill medium which contains corn-steep liquor. The press cake was inactive. The material may be preserved in a dry form or in the frozen state and the cost of peas is equivalent to 9d. to 10d. per gallon of medium. Cook later attempted to fractionate the active material (*Biochem. J.*, 1945, *39*, 314) and found that an 80 per cent. ethanol precipitate of the extract contained the active substance.

A further development in the direction of promoting increased yields of penicillin has been reported by Gordon and McKechnie (*Lancet*, 1945, *2*, 47). These workers induced polyploidy in *Penicillium notatum* with colchicine. The polyploid strain gave a sixfold to eightfold increase in the yield of penicillin over that of the original diploid strain. If the strain proves to be biochemically stable it will, no doubt, soon be introduced to commercial-scale production.

The extension of the clinical uses of penicillin naturally has not maintained the pace of former years; but there have been noteworthy advances principally in the cure of gonorrhœa, and possibly in the cure of early syphilis. For gonorrhœa a method was elaborated in 1944 by which a single curative dose in an oily medium could be injected intramuscularly to form a depot from which the penicillin diffused over a period of time. The technique is not new. Morphine in an oily medium has been so injected to prolong the action, and to reduce the number of injections over a given time In 1942, Code extended the depot technique to the administration of histamine and heparin in a vehicle containing various oils to which beeswax had been added with the same objective in view. A peanut-oil vehicle containing beeswax has similarly been developed for penicillin. Satisfactory results have been obtained in the treatment of gonococcic urethritis and pneumococcic pneumonia, by providing a depot of this type of penicillin suspension. The injection of 600,000 units in 3 ml. by this method has given assayable levels of penicillin in the blood for at least 24 hours.

Variability of Absorption

The most striking feature is the variability found in the extent of absorption of the penicillin, and this variability is considered to depend upon the muscle selected for injection, and the position in the muscle relative to the fascial planes in which the depot is placed. Evidence has accumulated that the injection of the depot subcutaneously would give more uniform absorption though at a slower rate. The advantage in being able to give a single curative dose by this technique (as in gonorrhœa) is very great. There is less discomfort for the patient, who avoids hospitalisation and who may remain ambulatory and even follow his occupation during the treatment. Nevertheless, the administration of penicillin *per os* would obviously offer even greater advantages. With the increasing availability of penicillin both in Britain and in America, administration by the oral route has been increasingly explored during 1945. Administration *per os* and *per rectum* were explored in the very earliest days of penicillin therapy by Florey and his co-workers.

In the latter case the penicillin was destroyed by the enzyme penicillinase excreted by the microflora of the rectum. Administered by the oral route (in relatively small doses, reflecting the small amount then available) in phenyl salicylate coated gelatin capsules, the method was abandoned because the penicillin was inactivated by the stomach juices. Consequently, attempts to administer *per os* have involved steps to prevent inactivation of the penicillin in the stomach. Libby (*Science*, 1945, *101*, 178) found cotton-seed oil an effective adjuvant for this purpose. Later, penicillin dissolved in the peanut-oil/beeswax mixture developed for intramuscular injection was found effective.

Adjuvants

American workers (*J. Amer. Med. Ass.*, 1945, *127*, 639) obtained good results with penicillin taken with trisodium citrate as a buffer, both the blood level and the time during which penicillin could be detected in the blood being increased. Heatley *et al.* (*Lancet*, 1945, *1*, 599) reported good results when penicillin was taken with egg albumin as a stabiliser after the injection of sodium bicarbonate to neutralise the acidity of the stomach juices. Cutting *et al.* (*J. Amer. Med. Ass.*, 1945, *129*, 425) extensively explored the administration of penicillin *per os* with a large range of adjuvants. These adjuvants included, among others, antiseptics (to destroy penicillinase-producing bacteria) organic solvents, quinine, salicylates, and surface-tension reducers (which might be expected to improve absorption through the mucosa). They found that the substances which could be most usefully combined with penicillin were *iso*-propanolamine, trisodium citrate, and sodium carbonate enclosed in a resin/cellulose coated capsule. Penicillin administered in 50,000 unit doses every two hours for ten doses gave blood titres of 0.02 to 0.05 per ml., and 75 per cent. of a series of gonorrhœic cases were thus cured.

Ross *et al.* (*J. Amer. Med. Ass.*, 1945, *129*, 327) administered two aluminium hydroxide tablets half an hour before the administration of penicillin in 100,000-unit quantities in a plain gelatin capsule placed inside an outer gelatin capsule which was hardened with formalin and alcohol. The capsules were administered 3-hourly to maintain therapeutic blood levels. Basic aluminium aminoacetate and magnesium trisilicate have been reported to afford protection for the penicillin. Bunn and his co-workers (*vide supra*) have pointed out that about five times the amount of penicillin must be administered orally as need be administered intramuscularly to provide the same concentrations in the blood. There appears to be only one possible exception to this situation, and this appears to occur when penicillin is administered with aluminium hydroxide with which it has been previously mixed. Welch (*J. Amer. Med. Ass.*, 1945, *128*, 845) found that half of a 100,000 unit dose was absorbed on to the quantity of alumina used. Administered in this way the penicillin titre of the blood rose to 0.29 units per ml. (administration of penicillin in capsules exceeds this figure during a *short* period only after administration), and penicillin remained in the blood at detectable levels for 24 hours. On dividing the same total dose administered in this way into four two-hourly 25,000-unit doses, a maximum blood titre of 0.27 units per ml. was obtained, and a level in excess of 0.08 units per ml. was maintained for 8 hours. It has been pointed out that the total dose is equal to that usually administered by the parenteral route, but that the blood-level reached is higher than is reached by parenteral administration. It has to be remembered that to date oral administration has proved effective only where infection has been due to the most penicillin-sensitive organisms. Nevertheless, the technique is full of promise.

The Bactericide Question

No finality has been reached in the question as to whether or not penicillin is a bactericide. The accumulating evidence seems to be that with appropriately sensitive organisms in appropriate conditions penicillin is bactericidal in the true sense of the word, that is, in the sense that the whole metabolic mechanism of the organism is brought sharply to an end, and that the usual criteria of antiseptic action are generally satisfied. Garrod (*Brit. Med. J.*, 1945, No. 4386, 107) finds that one of the essential conditions of this antiseptic action by penicillin is that the micro-organism concerned should be actively dividing. This, of course, is not a condition necessarily imposed where orthodox antiseptics are concerned. For this reason Lee and his colleagues (*Nature*, 1945, *156*) suggest that agents which kill susceptible organisms when they are actively dividing should be classed as "fissibactericides." The complication in the situation is, of course, that if bacteriostasis is sufficiently prolonged the susceptible micro-organism dies. This is not true bactericidal action nor, possibly, a fissibactericidal action; nevertheless, the micro-organism dies. Todd (*Lancet*, 1945, January 20, p. 74) finds that all of a wide range of penicillin-sensitive micro-organism were lysed when the micro-organisms were actively dividing. He found staphylococci were lysed by penicillin in concentrations below those required for bacteriostasis and thinks this action may continue in the blood stream after bacteriostatic concentrations are gone. Todd inquires whether this bacteriolysis is distinct from bacteriostasis or

is a manifestion of the same process. Much is yet to be heard on this problem.

Benzyl Penicillin

An interesting development is in the use of benzyl penicillin. When penicillin is treated with phenyl diazomethane in an inert solvent, and the reaction mixture evaporated after the recovery of unconverted penicillin, a resinous product is obtained which can be heated to 100°C. without deterioration. The product is relatively ineffective *in vitro* against *S. aureus*; but Hickey (*Science*, 1945, *101*, 462) finds that when it is brought into contact with biological fluids such as, for example, guinea-pig serum, about half the penicillin is set free by enzymic cleavage. *In vivo* tests on mice infected with multi-lethal doses of streptococci and staphylococci show that when administered:

1. *Subcutaneously*, the product is nearly three times as effective therapeutically as sodium penicillin.
2. *Orally*, benzyl penicillin is about five times as effective therapeutically as sodium penicillin.
3. *Orally*, benzyl penicillin has about the same therapeutic effect as an equivalent weight of sodium penicillin administered subcutaneously.

Large-scale clinical trials are reported to be in progress with this penicillin derivative and results will be awaited with interest.

Pulvertaft and Yudkin (*Nature*, 1945, *156*, 82) find that aqueous solutions of penicillin, while more stable than hitherto thought, may be stabilised by the addition of Sörenson's phosphate buffer mixture, an effect not due to *p*H. There appear to be a number of uncontrollable variables in the problem; but these workers give an instance in which one sample of penicillin which lost 50 per cent. of its activity in 15 minutes at 100°C. in aqueous solution, lost only 15 per cent. of its activity in the same conditions in M/15 phosphate buffer. This technique may allow batches of penicillin solution which are not completely used in the wards of hospitals to be sterilised by boiling without serious loss of potency and thus the solutions may be kept free of infection, particularly by *Ps. pyocyanea*, to infection by which the preparations are especially liable.

Pharmaceutical Preparations

The increasing availability of penicillin has, as has already been indicated, allowed attention to be directed towards methods of use other than by injection. Consequently, much attention has been given, during 1945, to pharmaceutical preparations containing penicillin. Butler (*Pharm. J.*, 1945, April 21) has indicated that when penicillin comes into general pharmaceutical practice in Britain it will be available in the form of the calcium or sodium salt in ampoules or tablets with stated titres. Preparations likely to be required of the pharmacist would consist mainly of solutions, creams, and powders. In the last case the calcium salt would be diluted to a known strength with sulphanilamide or sulphathiazole. Special precautions needed in storage and dispensing would include avoidance of moisture and elevated temperatures, the exercise of strict aseptic precautions, the use of sterile vessels, water distilled from glass, and storage in a refrigerator.

Penicillin Tablets

Penicillin pastilles are now available for clinical experiment and have been found effective in Vincent's gingivitis and will benefit tonsillitis due to infection by hæmolytic streptococci. Their preparation has been described (*Bull. Mass Coll. Pharm.*, 1945, *34*, 6). Grainger and White (*Pharm. J.*, 1945, July 7) point out that penicillin pastilles are difficult to prepare in bulk if only because of the variability of jelly strength of the gelatin used. They consider tablets, which are more easily made, to be equally effective when dissolved in the mouth. They prepare tablets by granulating 98 per cent. anhydrous dextrose with 2 per cent. promulsin, adding 30 ml. liquid paraffin per 1000 tablets, The granules are dried, sieved, and sterilised by heating at 60°C. for two hours on each of three successive days. Talc at the rate of 60 gm. per 1000 tablets is sterilised in a hot-air oven for 3 hours. Penicillin is mixed with the talc and then the granules are mixed in; 1000-tablet batches are prepared, each tablet weighing one gram, being ½ in. in diameter, and containing 500 units. The tablets are collected in sterile bottles each containing 100 tablets. All mortars, pestles, etc., are flamed, and mixing is carried out in sterile mortars under aseptic conditions by masked and gowned personnel in a small draught-proof laboratory. The tableting machine is boxed in, with tightly fitting doors provided for access to hopper and adjustments. After cleaning the machine it is swabbed with acetone and flamed. Before use, formalin is burnt in the casing overnight. Tablets prepared in this way maintained a reasonable level of potency for five weeks.

The preparation of calcium penicillin in peanut oil with beeswax has also been described (*J. Amer. Med. Ass.*, 1945, *128*, 404). Agar has been recommended as a vehicle for the tropical application of penicillin (*Lancet*, 1945, *1*, 720).

Penicillin cream has been found to maintain its potency longer when compounded with Eucerin Base LM than with the usual stearate base or Lanette Wax SX recommended in the M.R.C. War Memorandum, No. 12 (*Lancet*, 1945, *1*, 906). Berry, however, has reviewed aseptic procedure for the manufacture of penicillin creams with the

recommended Lanette Wax SX (*Pharm. J.*, 1945, *155*, 77). Perryman claims that no vehicles so far used prove entirely satisfactory, and finds polyvinyl alcohol a suitable medium for application to wounds and burns. He has also developed a new technique (*Lancet*, 1945) for the treatment of difficultly accessible sinuses and body cavities. A sterile solution of 5 per cent. to 10 per cent. PVA containing a high concentration of penicillin is run into the cavity concerned and allowed to penetrate the fine structures. A few drops of a sterile gelling agent, such as Congo red, are injected into the PVA solution with a hypodermic needle. The penicillin slowly diffuses from the gel so formed.

It may be of interest to complete the summary of advances during 1945 in pharmaceutical preparations of penicillin by giving the principal features of four specialities offered by one penicillin manufacturer in the United States.

1. Tablets containing 20,000 units calcium penicillin buffered with 0.5 gm. trisodium citrate to prevent inactivation by stomach juices. Each tablet is hermetically sealed in aluminium foil.
2. A sterile suspension of calcium penicillin in peanut oil containing 4.8 per cent. beeswax. The titre is 300,000 units per c.c. The preparation is available in 1-c.c. and 10-c.c. vials for intramuscular injection.
3. Chewing troches each containing 20,000 units in a flavoured, tinted, paraffin base. The titre is deliberately high to prevent development of penicillin resistance in the invading organism through insufficient dosage.
4. Ointment containing 1000 units penicillin per gm. in a stable ointment base of beeswax, peanut oil, petrolatum, and anhydrous lanolin.

Tyrothricin

While penicillin production has been brought to commercial-scale operation and its clinical applications developed, attention has been turned to other antibiotics. This has been promoted especially as a consequence of the more precise defining of the limitations of penicillin therapy as a result of the restriction of its activity preponderantly towards gram-positive bacteria. Among the other known antibiotics, therefore, attention has been directed particularly towards those to which gram-negative microorganisms have been found to be susceptible, although this has not been exclusively so. The hope has always been that an equally potent and non-toxic antibiotic might be found which would be effective in controlling such a range of organisms that it might be regarded as the clinical complement to penicillin. Major developments have, in fact, occurred during 1945 with respect to two antibiotics—tyrothricin and streptomycin.

Tyrothricin is a metabolic product of the soil organism *Bacillus brevis*. It is not a single substance but consists of two entities, tyrocidin and gramicidin. Its usefulness is unfortunately limited by its toxicity when administered parenterally, and by its ineffectiveness when administered orally. Its utilisation, therefore, lies in topical application, especially where infection is due to pneumococci, streptococci, staphylococci, diphtheria bacilli, and certain anærobic bacteria. Gramicidin and tyrocidin are complex polypeptides and are principally effective against gram-positive organisms. The range of effectiveness of tyrothricin does not differ widely from that of penicillin, but it is produced in much greater yield and is far more stable. Tyrothricin has already been made available on the American market in the form of specialities, among which are bandages impregnated with tyrothricin to a specified concentration. The New York City Public Health Department permits these impregnated bandages to be sold for application to the human skin without prescription. All other antibiotics, including penicillin, are supplied only on the prescription of a physician, dentist, pædiatrist, or veterinary surgeon. Tyrothricin is also offered for instillation into those body cavities, such as the prenasal sinuses, urinary bladder, and pleural cavity, which are not in connection with blood stream.

In 10 mm. layers, after 10 to 16 days incubation, Lews *et al.* (*Ind. Eng. Chem.*, 1945, *37*, 996) obtained yields of tyrothricin in excess of 2 gm. per litre of medium. They found that, while *B. brevis* would give good yields on synthetic mixtures with simple sources of nitrogen, better yields were obtained when the nitrogen source was more complex. Processed asparagus concentrates were found to give the best yields and to this medium the addition of neither sugar, nitrogen, nor inorganic salts was necessary.

The gramicidin entity of tyrothricin has been extensively examined by Gordon *et al.* and by Synge during 1944 and 1945. Gramicidin is found to be a polypeptide in which the stoichiometrical minimum unit which accounts completely for the nitrogen comprises 6-tryptophane (*l*), 6-leucine (*l*), 5-valine (*d* and *l*), 3-alanine (*l*), 2-glycine, and 2-ethanolamine residues.

Gramicidins

Synge (*Biochem. J.*, 1945, *39*, 363) has examined the over-all chemical characteristics and amino-acid composition of gramicidin-S (or Soviet gramicidin) discovered by the Soviet workers Gause and Brazhnikova as a metabolic product obtained from a *B. brevis* type of organism isolated from garden soil (*Nature*, 1944, *154*, 703; *Lancet*, 1944, *2*, 715). Gramicidin-S was found more effective against staphylococci, whereas tyrothricin was more effective against streptococci and pneumococci. No more toxic than tyrothricin, the thermostable gramicidin-S was less selective in its antibacterial action. Yields of 400 to 500 mgm. per litre of culture fluid were obtained on 10 per cent. yeast autolysate with 0.5 per cent. glucose in a

depth of 5 to 6 cm., incubated for 6 days at 40-41°C. Synge thinks that gramicidin-S is a cyclopolypeptide hydrochloride containing one each of the residues *l*-ornithine, *l*-proline, *l*-valine, *l*-leucine, and *d*-phenylalanine. He expresses the view that this substance is so much more closely related to tyrocidin than to gramicidin in its structure and characteristics that it should be re-named to bring out this relation.

Streptomycin

Streptomycin, a water-soluble base insoluble in the usual organic solvents and produced by the soil organism *Streptomyces griseus*, has undergone an even more intensive development than tyrothricin. This, no doubt, has been promoted by its bacteriostatic activity towards gram-negative organisms against which penicillin is quite or relatively ineffective. Streptomycin, however, is not only bacteriostatic towards gram-negative organisms but also towards gram-positive organisms. In addition, it is also active against *Ps. pyocyaneus, Streptococcus faecalis* (against which sulphonamides are not effective), as well as *B. mycoides*. Smith and McClosky (*U.S. Public Health Report*, 1945, *60*, 1129) find that, in the treatment of tuberculosis, streptomycin is more effective than promin (*p* : *p'* - diaminodiphenylsulphone - *N* : *N'*-didextrose-sulphonate), and that treatment by a suitable combination of those two tuberculostatic substances gives better results than have been achieved hitherto in the treatment of this disease. Streptomycin is generally bacteriostatic in low concentrations and bactericidal in higher concentrations and this effect is exhibited towards *M. tuberculosis*. Streptomycin has recently been found effective by Reimann (*J. Amer. Med. Ass.*, 1945, *128*, 175) in the treatment of typhoid. The daily administration of from 1 to 4 $\times$ 10^6 units maintains a blood level theoretically sufficient to kill *E. typhosa*. Oral streptomycin is administered simultaneously but, being poorly absorbed, it is mainly excreted in the fæces. Thus, the parenterally administered streptomycin controls the systemic and urinary infection, while that which is orally administered sterilises fæces, prevents reinfection and the development of a " carrier " state.

The activity of streptomycin is inhibited by low *p*H, glucose, and sulphur-containing substances such as cysteine, 2-aminoethanediol, and thioglycollic acid. It is readily absorbed from parenteral injection and excreted in the urine and hence finds application in controlling (as already indicated) urinary infections by susceptible organisms. It is the drug of choice in controlling tularemia. It has a very low toxicity towards man, but impure preparations have an undesirable histamine-like effect. Reimann considers it to be no more toxic than penicillin when in a pure state.

S. A. Waksman, whose name is so closely associated with the study of soil organisms, especially of the Actinomycete group, has described the method of preparation of streptomycin (*J. Amer. Pharm. Ass.*, 1945, *34*, 273). The organism is grown in shaken or stationary conditions on a medium containing a non-specific carbohydrate, but containing a complex source of nitrogen such as meat extract or corn-steep liquor. In stationary culture maximum yield is obtained in nine days, while it is attained in two days in shaken culture. The culture fluid is filtered or centrifuged, and then treated with activated charcoal on which the streptomycin is adsorbed. The filtered charcoal is washed with alcohol to remove impurities and then with acid alcohol to elute the streptomycin. Impurities in the filtrate are removed by *p*H adjustment. The solution is concentrated by treatment with ether which takes up the alcohol, leaving the streptomycin in an aqueous concentrate. Streptomycin is obtained by precipitation with acetone or by desiccation. The material is further purified by solution and precipitation, chromatographic treatment of the picrate, and crystallisation of the reineckate or helianthate from which the hydrochloride is finally obtained. A somewhat modified procedure is described by Carter *et al.* (*J. Biol. Chem.*, 1945, *160*, 337).

Streptomycin hydrochloride is non-crystalline; but Peck *et al.* (*J.A.C.S.*, 1945, *67*, 1866) have found the double salt of streptomycin hydrochloride and calcium chloride to be crystalline, and to have constant biological, chemical, and physical properties. It is prepared by adding calcium chloride to an acid aqueous suspension of the helianthate, filtering off the insoluble calcium helianthate and evaporating *in vacuo* to the point of crystallisation.

Large-scale production of streptomycin is already under way in the U.S.A. by four companies, each of which has been associated with penicillin production. One of these, Merck & Co., is reported to be building a plant for the production of streptomycin at a cost of $2,000,000. The U.S.A. War Department has estimated that military requirements alone (principally for the control of urinary infections due to gram-negative bacteria against which penicillin is not effective) amounts to 2000 oz. per month. At about the middle of 1945 the American output, however, amounted to only 28 oz. per month, equivalent to 8 $\times$ 10^6 units. (In terms of dry weight one streptomycin unit is equal to one gamma whereas one Oxford unit of penicillin is equal to 0.6 gamma; but it is to be remembered that each is assayed against a different test organism.) It is probable that penicillin is the more cheaply

produced, and therefore streptomycin is likely to find a field of application which is supplementary to that of penicillin.

A number of antibiotic substances which have been less completely explored than penicillin, tyrothricin, or streptomycin have been reported upon during 1945. Bose (*Nature*, 1945, *156*, 171) reports the isolation of polyporin from *Polyporus* species grown on Czapek-Dox medium. Stable at room temperatures for one month, it is non-hæmolytic and non-toxic towards laboratory animals, and has no pyrogenic effect on man. Aqueous extracts of the fruiting body itself are lytic towards *S. aureus* and towards typhoid and cholera cultures *in vitro*. Clinical experiments with polyporin are in progress in Calcutta. Among a nearly related family of fungi, the Basidiomycetes, six new antibiotic substances have been isolated at the New York Botanical Gardens, and are undergoing examination. Hays *et al.* have isolated a number of antibacterial substances from a beef-extract/peptone broth culture of *Ps. æruginosa* (*B. pyocyaneus*). Four of these substances are found, by ultraviolet absorption methods, to be structurally related. The substances are found to be non-toxic to animals, and principally effective against gram-positive organisms (*J. Biol. Chem.*, 1945, *159*, 725).

Bacitracin

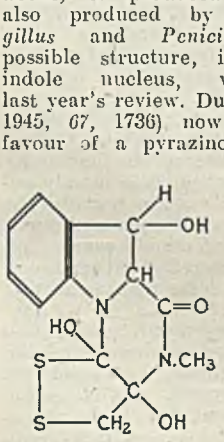
Johnson *et al.* (*Science*, 1945, *102*, 376), studying the bacterial flora of wounds, found that some bacteria developed on blood-agar plates inoculated by the direct plating method, which did not develop in broth cultures inoculated simultaneously from the same wound. The cause of the inhibition appeared to be due to an antibiotic substance excreted by a non-pathogenic, gram-positive, sporing rod of the *B. subtilis* group. The antibiotic was isolated from cell-free fluid and named bacitracin. Bacitracin is produced by surface, but not submerged, growth of the organism at 37° C. for five days, is extractable by *n*-butanol, but not by the usual organic solvents, and is not precipitated by manipulating the *p*H. It is non-hæmolytic and is non-toxic to laboratory animals and to human beings on subcutaneous injection. It is bacteriostatic towards gram-positive organisms; but gram-negative organisms are insensitive. It is stable in acid, but not in alkaline conditions. Bacitracin protects laboratory animals from lethal doses of hæmolytic streptococci, *Cl. Welchii* and *Cl. septicum*. In the treatment of local infections by hæmolytic streptococci and staphylococci in man, results have been obtained equal in response to penicillin therapy. Attempts are being made to produce bacitracin commercially, and it is claimed that it should be available at less cost than penicillin.

Brian and McGowan (*Nature*, 1945, *156*, 145) have isolated a metabolic product which they call viridin from culture filtrates of *Trichoderma viride*, another soil organism. This is of special interest since, by contrast with the other antibiotics discussed, it is highly fungistatic and not appreciably bacteriostatic. Strains of this mould are already known to produce the bacteriostatic substance gliotoxin (*see* this journal, 1945, January 13, p. 53), which, however, is quite dissimilar from viridin. Yields of 45 mgm. per litre of culture fluid have been obtained. Viridin prevents the germination of spores of *Botrylis alii* at a minimum concentration of 0.005 µgm. per ml. as compared with a corresponding figure 3.0 for gliotoxin, 0.5 for mercuric chloride and 0.025 for di-(ethylmercuri)-hydrogen phosphate. Viridin is said to be stable in acid, but not alkaline conditions. Another fungistat is reported to have been isolated by Widding from cultures of *Es. coli*. It is thermostable and inhibits the growth of the penicillin-producing mould, *P. notatum*.

It had previously been observed that certain Jamaican soils were inhibitory to the spread of Panama disease (caused by *Fusarium oxysporum cubense*), and that certain Actinomycetes inhabited such soils. Growth of the Actinomycetes concerned in waste liquor from food-yeast manufacture has been found by Thaysen and Butlin (*Nature*, 1945, *156*, 781) to inhibit the growth of the *Fusarium* on agar plates. So far the active substance has been found to fail to pass a porcelain filter and to be thermolabile.

Gliotoxin

Gliotoxin which, as has been mentioned above, is produced by *Tr. viride*, is also produced by *Gliocadium*, *Aspergillus* and *Penicillium* species. Its possible structure, involving a pyrazino-indole nucleus, was mentioned in last year's review. Dutcher *et al.* (*J.A.C.S.*, 1945, *67*, 1736) now present evidence in favour of a pyrazino-indolene system con-



Gliotoxin

densed with a disulphide structure. They consider that the antibacterial activity of gliotoxin may be closely connected with this disulphide structure.

(To be continued)

SAFETY FIRST

Safety Considerations in Plant Design—I

by JOHN CREEVEY

VARIOUS conditions giving rise to accidents may be more or less eliminated in design of plant and equipment for chemical works. To be really accident-free, it is desirable for plant to be operated *conveniently*, so far as possible; conditions should be such that the personnel acquire a liking for the plant. It is likewise true that only when the personnel grow to like a particular assembly of plant, can we be sure that that plant will attain its full potential efficiency, no matter how perfect the individual details of design. Thus, at the very outset of design, there is a need for close contact between the designing engineer and essential members of personnel; most certainly between the designing engineer and those who have been responsible for operating the pilot plant, if the latter exists. It is still better if one of the designing engineers can be detailed to work several shifts as a member of the pilot-plant crew, for experience gathered first-hand will often outweigh all other advice as regards operating snags.

Foolproof Plant

Troubles are greatly reduced by designing the plant to be operated with a minimum of intelligence—as distinct from commonsense—as well as with a minimum of maintenance. In other words, plant should be made as nearly foolproof as that is possible. This does not mean that all features of control must be automatic, but rather that there must be a happy blending of automatic control and manual control. Control effected entirely by instruments is unsatisfactory, both for operating efficiency and for freedom from accidents. No matter how well plant may be equipped with indicating and recording instruments, control valves, etc., there is still advantage to be gained by letting an operator see what is going on inside a particular piece of equipment, by means of sight glasses or inspection windows. Direct observation of conditions inside a reaction vessel not only helps in maintaining good conditions of operation; it is also the means by which useful suggestions are forthcoming with regard to the progress of a reaction, because that reaction may be kept continuously under observation at a time when possibly not much is known about it.

I can remember how the provision of an inspection window on a ring-filled fractionating column saved the filling from being eaten away while distillation of a product containing a certain percentage of butyl alcohol was in progress. Similar products had passed through the still on many former occasions and had given no adverse conditions, but when one particular batch reached a certain degree of concentration for butyl alcohol in the vapour passing through the column, there was rapid interaction between vapour and the aluminium tower filling, a state of affairs wholly unsuspected at the time, which, but for the inspection window, would not have been discovered soon enough to avoid serious damage to the tower filling.

Cleaning and Maintenance

Cleaning and maintenance reduced to the minimum may give a reduction of accidents, but both must still be carried out in a satisfactory manner and as often as necessary. Maintenance left in the hands of operating personnel is rarely as satisfactory as might be expected; not necessarily because it is done inefficiently, but rather because there is a tendency to let it stand over until the renewing of gland packings and the like becomes absolutely necessary. It is far better to assign maintenance to a proper maintenance staff, who make their inspections regularly and do whatever appears necessary.

Maintenance is greatly eased by accessibility and convenience; as in the case of operating plant, perhaps nothing causes more difficulty than does an inaccessible control feature. Physical discomfort in reaching, say, the hand-wheel of a valve causes a definite element of tiredness, and accident as a consequence is not unlikely. To keep equipment trouble-free, it must be maintained in good operating condition, and this is done most effectively when access is easy and direct. When installing a pump, it is certainly desirable so to arrange matters that glands are in a position where any re-packing may be done without inconvenience to eye or hand. Valve hand-wheels, like any levers connected with other control devices, should be of sufficient size to fill the hand comfortably; position, dimensions, and stiffness must never be such as to arouse the temptation to use a wrench or some other tool which is handy.

Manholes also call for a good deal of criticism. In many cases they are badly proportioned; indeed, often they are far

too small to be universally useful. It is true that size is often reduced to the minimum in order that the periphery and consequent area of the joint be maintainable in good condition with use of the lowest number of studs and nuts; yet a small manhole has distinct disadvantages outweighing the ease with which a tight joint may be rapidly obtained. Where accidents happen—and the removal of a man through a manhole too small to facilitate easy removal has dire consequences—censure should be directed against the owner of the plant. But apart from size, which must be large enough for a man to pass through (in or out) without great effort, the provision of hand grips both inside and outside the vessel will do much to aid entry and exit, especially where this has to be done quickly as in an emergency. A manhole cover, moreover, should, if possible be provided with hinges, so that the weight of the cover is not inconvenient for one man to move. If covers are particularly heavy, there should be counterweights. Yet the provision of hinges and counterweights is no excuse for not reducing the weight of metal entering the construction of a manhole cover, so far as that may be possible. These remarks apply likewise to covers for vacuum chambers, and both these and manholes may be provided with latch bolts and hand-levers in place of the usual studs and nuts requiring a spanner.

Efficiency in Shutting Down

Certain plant construction details call for more thought in providing better conditions of safety. In some cases conditions as existing have been primarily due to cutting the cost, yet with careful design a refined form of feature is rarely more costly than the commonly adopted pattern. Simplicity of construction should be a primary aim, making due allowance for efficiency and meeting those conditions of use which have to be met. For the effective shutting down of a continuous plant under conditions of extreme urgency, for instance, it is desirable that the amount of material in process at any instant be very small in relation to the total hourly output. For instance, if an evaporator handles 20,000 gallons of liquor per hour, designing for approximately 200 gallons of liquor in the entire system (apart from feed storage and reception of product) would make it extremely easy to shut down in the minimum of time.

The choice of materials of construction for chemical plant has received much consideration; yet in minor matters which influence safe working of chemical plant there are details which are not always considered exhaustively. In asking for data upon available materials, the designing engineer does not always fully describe the general nature of the process, nor accentuate the outstanding differences between intermittent and continuous working. In the intermittent process, for instance, there is less chance that some unsuspected harmful impurity will be introduced from one of the constructional materials, and there is also much less danger of corrosion due to contact between dissimilar material. Again, a material which proves to be entirely satisfactory for small pieces of equipment may not be at all suitable for equipment of larger size. This has to be borne in mind when translating any process from pilot plant to commercial production, for unexpected corrosion when the plant is in operation may adversely affect its safety aspect. The velocity of a liquid passing through the non-ferrous metal tubes of condenser or heat-exchanger, under some conditions, has pronounced effect upon the life of the tubes; they may fail rapidly at velocities above a certain critical point, with consequent danger of trouble by sudden escape of liquid or vapour.

Distortion Troubles

Where reaction vessels are provided with a simple form of welded-on jacket, in the need of alternate heating and cooling by steam and cold water respectively, any rapid change of temperature may easily distort the top of the jacket. Occurring at each heating and cooling cycle, this slight distortion will sooner or later cause a failure of adjacent welding. Such failure usually occurs when water begins to circulate in the jacket; yet consequences really become serious when steam is again admitted and quickly reaches full pressure. To avoid this the ring closing the annular space between the shell of the jacket and that of the vessel itself must be one which will "flex" and therefore avoid rupture of the welding. This involves a construction more expensive than that commonly adopted, the latter being one generally regarded as quite practicable for merely heating with steam up to a pressure of 40 lb./sq. in.

Vessels which are heated by an external steam-jacket are likely to develop considerable vibration when the charge of liquid is boiling rapidly; this vibration becomes still greater when the vessel is agitated simultaneously. To carry such a jacketed vessel by structural steelwork, it is usual for angle brackets to be welded to the jacket near the top of the latter, so that most of the weight of the charge is below the level of these supports. Yet when the capacity of such a vessel is subsequently increased by extending the top, there often is no readjustment of the level at which the angle brackets are fixed. Stability, under these conditions, leaves much to be desired when vibration sets in, due to boiling of the charge and agitation simultaneously, even when the extent of this vibration previously was negligible.

Industrial Safety Gleanings

Fire Risk from Wool Oils

A USEFUL leaflet, published by Benjn. R. Vickers & Sons, Ltd., 3 Grosvenor Road, Leeds, 6, deals with the Spontaneous Heating of Woollen Blends. It points out that such heating may vary from a gentle warmth to actual charring or combustion of the wool, and son constitutes a major fire hazard. Since heat generated in the centre of sheeted wool has little chance of being dissipated by conduction, the effect is cumulative, and if it is the result of chemical reaction the reaction itself is accelerated by the heat produced.

Two main causes are assigned: (1) the presence of excessive water together with unscoured wool, or scoured wool which has been over-dried; (2) the use of an unsuitable wool oil.

The exact reasons why heating takes place between water and greasy wool do not appear to have been satisfactorily explained, but there are reasons for supposing that it may be due to bacterial and/or enzymic activity arising from the raw wool. Lower fatty acids and ketones are formed, having a somewhat sharp acrid smell, which, however, usually disappears during the carding of the wool. In the case of over-dried scoured wool, the heating may be due to the "heat of wetting" of dry wool, which is not inconsiderable.

The second main cause of spontaneous combustion is more capable of scientific treatment, as knowledge of the technology of wool oiling is now sufficiently far advanced. The introduction of strict chemical control into the industry has resulted in the setting up of high standards based on increasing technical knowledge and skill.

Antioxidants and Pro-oxidants

When a fatty oil is exposed to the action of oxygen or air, there is a period during which oxidation is either nil or very small; when this period is exceeded oxidation sets in and usually increases in severity for reasons already stated. This delay in oxidation is thought to be due to the presence in the oil of certain natural substances, to which the general name of antioxidants is given. The exact composition of the naturally occurring antioxidants is in many cases not known, but there are a number of known chemical substances which may be added to oils in small quantities to give the same effect. Almost any fatty oil or fatty acid of whatever oxidising capacity may be improved in respect of its rate of oxidation, and hence its heat-producing tendencies, by the addition of appropriate amounts of a suitable antioxidant. Oils which would normally be classed as dangerous may, after such treatment, be found to satisfy the exacting requirements of the fire offices, and also to be satisfactory in actual working conditions.

There are also pro-oxidants, which, as their name implies, accelerate the rate of oxidation. Among these substances, from a wool oiling standpoint, are the salts of iron and chromium, either of which metals is likely to be present on the wool, and therefore to become a contaminant of the wool oil. Chromium is a normal constituent of wool which has been dyed with the assistance of sodium or potassium bichromate; iron is frequently found as an impurity in wool oils which have been stored in iron tanks or drums. Suppose a wool oil treated with antioxidant comes into association with either of these metals on the wool, the result is a sort of battle between the antioxidant and the pro-oxidant. If the pro-oxidant has the more powerful effect, then the protective action of the antioxidant may be completely offset, with the result that oxidation may then proceed at a rate equal to or greater than that shown by the original oil without antioxidant. This is not so much an argument against the use of antioxidants in wool oils, but rather against their use for the purpose of masking an otherwise unsuitable oil. The protection afforded by antioxidants is not permanent; they merely delay the onset of oxidation, though admittedly for long periods.

A frequent cause of fires in woollen mills is to be found in accumulations of oily card fettlings, which are often bagged up and allowed to lie about. Three reasons may be given why this must be regarded as a special fire risk: (1) there is usually a high percentage of oil in the fettlings; (2) there is almost always heavy iron contamination; and (3) the fettlings will contain a fair percentage of old, highly oxidised oil, which may act as an oxidation catalyst to new oil.

Suggestions for Avoiding Heating

(1) The wool oil should show a slow oxidation rate in the "Mackey" test, but should also have a low total capacity for oxidation, *i.e.*, it should have a low iodine value and not contain appreciable quantities of acids of a greater unsaturation than is represented by one double bond.

(2) A semi-neutral type of oil as opposed to the highly acid type is less likely to become contaminated by iron soaps, which are known to accelerate heating.

(3) Oil emulsions should not be used on blends containing greasy wool. For blends containing grease, suint, lime and recovered materials, dry oiling should always be used.

(4) Fettlings should be disposed of immediately.

Science in Welfare

Scientists and the United Nations

(from a Correspondent)

SINCE comment was made, in last week's issue of THE CHEMICAL AGE, concerning the two-day conference on "Science and the Welfare of Mankind," which the Association of Scientific Workers, along with a number of other scientific organisations, is to hold at the Beaver Hall over the present week-end, further interesting details have been revealed. The Lord President, Mr. Herbert Morrison, who will open the conference, will deal with the place and organisation of science in this country in the immediate future, as well as with questions concerning the supply of scientists. A truly representative team of leading British scientists will be joined by some 40 scientists from abroad, notably from Canada, Holland, France, and China. It is hoped that a delegation representing the United States Federation of Atomic Scientists, and one from Soviet Russia, will arrive in time.

World Food Crisis

The recent abrupt developments in the world food crisis and means for its alleviation, as well as the prevention of similar future catastrophes, will undoubtedly be discussed by a number of speakers. Special interest will, however, be attached to what Dr. H. L. Richardson, adviser on Overseas Agricultural Research and Development to I.C.I., who has had long experience in land-maintenance work in South-Eastern Asia, will have to say on this subject.

As the United Nations have been meeting in London during recent weeks, the third session, devoted to both the International and the National Organisation of Science, assumes special significance. As Professor J. D. Bernal emphasised to your correspondent, steps are being taken to ensure that the counsel of scientists will be heard in the United Nations Organisation, for science should have its place in the Economic and Social Council, in the Trusteeship Council, and in such special bodies as the Food and Agricultural Organisation (the director-general of which, Sir John Boyd Orr, has been a vice-president of the organising body.

Finally, the great part scientists can play in the reconstruction of Britain will receive due recognition at the conference. Never before has there been such a determination among scientists to bend their skill to serve their country's needs, for they believe that there will be no return to the sad wastage of science, which formed such a depressing feature of the inter-war years. Peace has brought many new constructive tasks to the fore and scientists in all lands are anxious to co-operate in their solution.

Electrodepositors' Dinner

Presentation to Honorary Officers

ON February 1 the Electrodepositors' Technical Society revived an old custom by holding their first post-war annual dinner and dance (at the Holborn Restaurant, London). A large attendance witnessed the presentations made on behalf of the members to Dr. S. Wernick (past hon. secretary), and Mr. F. L. James (hon. treasurer).

Dr. Hepburn (immediate past president) pointed out that both Dr. Wernick and Mr. James had served the Society well for many years—the former for some 19 years, and the latter for 15. Their services had proved particularly valuable during the war years when the Society carried on at its London headquarters. He presented an inscribed silver inkstand to Dr. Wernick, and a silver tea service to Mr. James.

President's Response

Dr. Wernick (president), responding, said that although conditions were difficult to-day in the electrodeposition industry, they had much to be thankful for, and cited his experiences during a visit to France last October when he found their opposite numbers struggling against almost insuperable difficulties. For example, it was necessary to buy the various chemicals used in electroplating in the Black Market at an exorbitant price, and it was not uncommon for the electricity supply to fail at crucial moments.

Electrodeposition, he said, was very much the handmaiden of the metallurgical industries and in consequence he feared that its war record was apt to be largely overlooked; yet there was no phase of the war which it did not enter. The metallurgical performance of almost every device of war owed something to the metal finisher. Every aero component was protected by anodising; much of the steel by cadmium and zinc plating; while heavy nickel and hard chromium deposits immensely improved the surface properties of vital war components.

The arrival of peace conditions meant a rapid change over from hard chromium to decorative chromium plating, which was now being applied on a great diversity of goods. The new plating would be different from the old, in that, out of the stern necessities of war, quality plating had been born. This fully vindicated the policy of the E.T.S., which had throughout stood for electro-deposits which would give adequate service. Electroplate would lose its stigma of being a cheap and shoddy finish and become the hall-mark for service and value.

Mr. James also replied to Dr. Hepburn's toast, and Dr. H. J. T. Ellingham (past president), with many amusing stories, proposed the toast of "The Guests," to which Mr. G. Marlow (Faraday Society) responded.

B.T.-H. Research

Some Notes on Recent Laboratory Work

AMONG the many and varied problems examined during 1945 by the Research Laboratory of the British Thomson-Houston Co., Ltd., Rugby, the following points appear to be of special interest to the chemical and allied industries

Glass Research

In the department concerned with glass, much effort has been devoted to a search for new glass compositions in lamp and valve manufacture. Many new glasses have been made on a laboratory scale, several on a semi-commercial scale (melts of about 100 lb.) and some, for example, glass known as C.40, on a full commercial scale. C.40 glass was specially designed for sealing to Kovar and Fernico type iron-nickel-cobalt alloys and the glass has been in commercial production for several months, following more intermittent production during the last two or three years. The Glass Research Laboratory has co-operated closely with several manufacturers of alloys in the development and standardisation of alloys of the Kovar type, as a result of these combined efforts British-made alloys is now available. Valves and lamps using this alloy and glass are now in development.

A leadless glass has been designed for sealing to iron and mild steel, and has been made successfully on a production of steel-glass "Windonuts" in which the seal between glass and metal (copper-plated mild steel) is oil tight. Experiments with new aluminosilicate glasses sealing to molybdenum, harder than any glass previously founded in a glass works, are giving interesting results in conjunction with discharge lamp design. These glasses are also useful in making chemical apparatus, particularly combustion tubing. Of glasses melted so far only on a laboratory scale, special mention may be made of research on phosphate glasses. Alkali-free phosphate glasses are extremely fluid at very high temperature, yet harder than borosilicate glasses at, say, 650°C. The d.c. resistivity is higher than fused silica.

Other work has included the search for better materials for gas and steam turbines; the development of a non-destructive method of detecting internal flaws in ferrous and non-ferrous materials, and of an apparatus for detecting splits in tungsten wire; the study of the effect of varnishes on insulating oils; and of the problems of fungus (mould) growth on insulating materials.

Study of the use of polythene in connection with Radar applications have been of considerable value. Being a new type of material, it has been necessary to devise new equipment, tools, and fabricating methods. Original development work carried out in the B.T.-H. laboratory enabled the factory, and other firms, to accomplish successfully the intricate production operations involved in producing precision parts (± 0.001 in.) having high performance characteristics. The main new method of fabrication has been welding, and equipment has been designed for welding parts of polythene and similar thermo-plastic materials.

The development of an enamelled wire, which would have the mechanical resistance to abrasion and handling that is so characteristic of silk or cotton covered wire, was of extreme urgency during the war period, and it became necessary to concentrate on the production of a suitable varnish base. After considerable experiment and development work, an enamelled wire varnish base was made which was considered to give uniformly satisfactory results. The resulting enamelled wire, "Thermex," was developed in co-operation with the London Electric Wire Co. & Smith, Ltd.

Silicones

Of various insulating materials under investigation, perhaps the most interesting are the silicones. In many respects these products possess outstanding advantages, and the electrical industry is primarily interested in them because of their exceptional heat stability. Thus conventional varnished glass cloth has a fabric base which will withstand 500°C., but the varnish film itself cannot be used safely above 100°C. in so far as continuous operation is concerned. Silicone varnish films will withstand 175°C. continuously, and much higher temperatures of the order of 200-250°C., for very considerable periods without any perceptible sign of mechanical or electrical deterioration.

The technical difficulties in regard to producing silicone rubbers have been largely overcome, and at the moment attention is being concentrated on the oils and greases. Here again the inherent thermal stability is evidenced by the fact that the silicone oils will withstand continuous heating at 150°C. without showing any tendency to acid formation, sludging, etc., which constitute some of the major disadvantages of hydrocarbon oils—disadvantages which manifest themselves at temperatures of about 60°C. The other peculiar characteristic of such oils is that they have practically a negligible change in viscosity with increase in temperature. This is best illustrated by the greases, which have a vaseline-like consistency at room temperature. They retain this consistency at temperatures as low as -50°C., and, what is perhaps more remarkable still, at temperatures as high as 250°C.

A CHEMIST'S BOOKSHELF

QUANTITATIVE ORGANIC MICROANALYSIS; based on the methods of Fritz Pregl, 4th English Ed. Revised and Edited by Julius Grant. London: Churchill. Pp., 238; Figs. 94. 21s.

The appearance of this book should not be treated casually as being merely the re-emergence of a standard work for some time unobtainable. On the contrary, it should provide a landmark in the history of micro-chemistry in this country. Dr. Grant's work indicates clearly to the British reader for the first time a fact which was realised by America quite a few years ago, but implicitly ignored in much of this country's literature, that organic quantitative micro-analysis must no longer be regarded as a technique labelled "made in Germany." For the first time, too, a translation of this book—it would be fairer to call it a rendering—gets away from the impression that it has been prepared with the original under one hand and a German-English dictionary under the other.

No one, unless hopelessly biased, would attempt to belittle the value of the late Fritz Pregl's contributions to organic analysis; but there has been for long a Pregl cult, which Pregl himself, as a pioneer, would have been the first to deplore. This has held that microanalysis and the Pregl methods were synonymous, and that to dare to deviate from the methods of Pregl and his immediate pupils, or to alter one jot of the original presentation, would be almost as sacrilegious as to paraphrase and gloss the Ten Commandments. There is much truth in the parallel that might be presented if one imagined that German physicists had refused to accept physics other than as propounded by Newton.

This is not to say that the present edition is without flaws. But the idea behind the book is one that has long been desirable—to produce for British analysts something that should contain the best of all the available methods.

The very useful section on manipulations required for the purification of organic compounds could, in the reviewer's opinion, be improved by further extension. Purity is an important consort of accurate analysis which is too often neglected. In this connection it is suggested that Dr. Grant might also consider, for a future edition, the inclusion of methods for the detection of organic elements. In general, qualitative analysis must precede quantitative analysis.

The main bulk of the analytical work has been revised, rewritten, and arranged in more logical order, and a much clearer picture, on the whole, is presented to the reader than in previous editions. The introductory chapter on microchemical balances recognises that balances other than German models exist. It might, however, be clearer and fuller on the subjects of precision and sensitivity, factors which the United States have shown to be too much taken for granted.

There is a chapter dealing with some physical methods of use to the organic analyst. In its present form this offers little more aid than would a series of references. In future editions it would not be out of place to expand it considerably. The section dealing with absorption spectroscopy could well have diverged more from the original, since it surely does not present the best nor the most convenient method of obtaining an absorption spectrum. In the almost equally abbreviated section dealing with chromatographic analysis, no mention is made of alumina as an adsorbent, the book stating that "the oxides, hydroxides and salts of the alkaline earths are best for this purpose." This is not the reviewer's finding. Finally, Figs. 26 and 29 are upside down, while Fig. 24 can hardly be considered as drawn to scale if it portrays *micro* apparatus, as described on page 28.

It must be stressed that most of the faults noted are faults of omission, and in view of present paper supplies these must occur in any book. In other words, the reviewer regards most of the faults as minor, and perhaps unavoidable. The importance of the new edition for microanalysis in this country can hardly be over-emphasised. The book should be bought by all microanalysts, whether or not—perhaps, indeed, especially if—they already possess a copy of the previous edition.

Mexican Import Restriction

Chemicals Affected

A MEXICAN official circular, dated November 27, and reproduced in full in the *Board of Trade Journal* of January 19, subjects the following goods to restriction on importation into Mexico:

Carbonate of calcium; liquid organic acids, unspecified; solid organic acids, unspecified; mixtures of ethers and alcohols used for paints and varnishes; ethers, unspecified, weighing with immediate container over 200 kg.; ethers, unspecified; salts, unspecified, of organic origin, weighing with immediate containers more than 20 kg.; salts, of organic origin, unspecified; acetylene; mixtures and preparations of organic origin used in the manufacture of pharmaceutical products; inorganic liquids, acids, unspecified; inorganic solids, acids, unspecified; lead chromate; hypochlorite of calcium; calcium chloride in flakes, not deliquescent, packed in cloth or paper sacks, weighing with immediate containers more than 45 kg.; chlorates of potassium and sodium; mixtures and preparations of

mineral origin used in the manufacture of pharmaceutical products; mixtures and preparations with a chloride base, used as bleaches in industry; calcium carbide; mixtures and preparations of organo-metallic origin, used in the manufacture of pharmaceutical products; arsenite or arsenate of calcium and their insecticide preparations, arsenite or arsenate of copper and their insecticide preparations, weighing with immediate containers more than 20 kg.; arsenite or arsenate of lead and their insecticides; liquid insecticide preparations derived from pyrethrum with aromatic substances; arsenites or arsenates, unspecified, and their insecticides, weighing with immediate containers more than 20 kg.; insecticide preparations, unspecified; acetate-arsenate of copper (Paris green).

German Technical Reports

The List Continues

THE following reports submitted by teams of industrial experts who have visited Germany under the auspices of the Combined Intelligence Objectives Sub-Committee and the British Intelligence Objectives Sub-Committee are available and may be purchased at H.M. Stationery Office. The last list appeared in THE CHEMICAL AGE on February 2, 1946.

CIOS XXIII—13. *Clinical Testing of Antimalarials by I.G. Farben, Elberfeld* (1s. 6d.).

CIOS XXIII—23. *Pharmaceuticals and Insecticides, I.G. Farben, Höchst-Main* (3s. 6d.).

CIOS XXV—19. *I.G. Farbenindustrie, Wolfen Farbenfabrik, Wolfen near Halle* (1s.).

CIOS XXVI—86. *German Steel Foundry Methods* (1s. 6d.).

CIOS XXVI—87. *Dachs* 1. *Lubricating Oil Plant, Porta, Germany* (1s.).

CIOS XXVII—26. *Deutsche Edelstahlwerke A.G., Krefeld* (1s.).

CIOS XXVII—29. *Metallurgical High Lights in the recent Manufacture of Rolled Steel Plates and Sheets in Germany* (1s.).

CIOS XXVII—39. *I.G. Farbenindustrie, Uerdigen*: Scientific laboratory, lacquers and paints, glues (2s.).

CIOS XXVII—40. *Deutsche Edelstahlwerke A.G., Hochfrequenz-Tregelstahl, G.m.b.H., Bochum*: Centrifugal casting of high alloy steel (6d.).

CIOS XXVII—42. *Bochumer Verein A.G., Abt. Stahlwerke Bochum*: Centrifugal casting (6d.).

CIOS XXVII—48. *Chemische Werke Albert and other Pharmaceutical Targets, Weisbaden* (1s. 6d.).

CIOS XXVII—54. *Chemische Werke Essener Steinkohle A.G., Bergkamen, Germany*: Inspection of Fischer-Tropsch plant (1s.).

CIOS XXVII—70. *Gutehoffnungshütte A.G., Sterkrade*: Reaction vessels for the Fischer-Tropsch synthesis (6d.).

CIOS XXVII—88. *Manufacture of Steel Tubing by Hot Extrusion, Mannesmann Rohrenwerke, Annen-Witten* (2s.).

CIOS XXVII—93. *Wirtschaftliche Forschungs G.m.b.H. Fuel Blending Station, Heiligenstadt* (1s.).

CIOS XXVII—100. *Stahlwerke Krieger, Oberkassel* (6d.).

BIOS 13. *The German Montan-Wax Industry* (1s. 6d.).

BIOS 94. *Kali-Chemie, Rhenania Phosphat Werke Brunsbüttelkoog*: Manufacture of phosphate fertiliser (2s.).

BIOS 116. *Pharmaceuticals*: *Research and Manufacture at I.G. Farben* (23s.).

BIOS 119. *Deutsche Versuchsanstalt für Luftfahrt (D.V.L.) Institut für Betriebstofforschung*: Aviation fuels and lubricating oils (3s. 6d.).

BIOS 121. *Wirtschaftliche Forschungsgesellschaft m.b.H. (WIFO) Heiligenstadt Installation*: Fuel blending station (1s. 6d.).

LETTER TO THE EDITOR

Irish Barytes Exports

SIR,—Since the start of this company in 1942 we have been getting your excellent journal THE CHEMICAL AGE and were very pleased with your reference to barytes from Eire in the issue dated February 2. However, as the export figures quoted for November, 1944, and 1945, are liable to lead to a misunderstanding of our potentialities, we would appreciate your noting the following export figures. The main reason for such variations has been the difficulty in procuring ships, which has been no easy matter in recent years.

1944	*To England*	*To Scotland*
October	704	45
November		30
December	509	42
1945		
September	648 (crude)	107
,,	840 (refined)	
October	20	10
November	140	
December	598	154
,,	277 (crude)	
1946		
January	898 (refined)	

The main development plans to increase our production to 12,000 tons annually, and 20,000 tons eventually, caused the small figures in October and November last year. —Yours faithfully,

BENBULBEN BARYTES, LTD.,
A. G. JENNINGS,
Sligo, February 4. General Manager.

Parliamentary Topics

Nigerian Palm Oil

IN the House of Commons last week, Mr. Skinnard asked the Secretary for the Colonies whether, in the light of the threatened deterioration of the palm oil industry of Nigeria, plans were being formulated for modernising it, preferably on the basis of the co-operative effort of the people.

Mr. George Hall said he was considering with the Government of Nigeria comprehensive schemes with the object of securing the greatest efficiency in palm oil production in that country. These schemes include a programme of research into the improvement of the industry's methods and the provision of pioneer mills to demonstrate the advantages of improved methods of oil extraction. Their success would depend on the co-operation of the people of Nigeria, but it was hoped that they would demonstrate conclusively to them the advantages of modern methods.

Coal for Alkali Works

Sir R. Glyn asked the President of the Board of Trade whether he was aware that the I.C.I. Northwich alkali works were receiving but 80 per cent. of their minimum coal requirements, and have, in consequence, reduced production and have been instructed by the Ministry of Supply to cut exports by 50 per cent.

Sir S. Cripps regretted that it had not been possible, in present winter conditions, to secure the coal requirements of the Northwich alkali works in full. There had consequently been a reduction in production, which had necessitated a temporary curtailment of about 4000 tons a week in the rate of export of alkali.

Potash

Mr. G. Williams asked the President of the Board of Trade whether he had been able to obtain supplies of potash from Germany; and if so, in what quantity; while Mr. Hurd asked what steps he was taking to expedite the delivery of potash fertilisers from the Continent and Palestine.

Sir S. Cripps said that all steps were being taken to expedite deliveries from Palestine, Spain, and France, and every endeavour was being made to secure the restoration of potash supplies from Germany. Owing largely to coal shortage little was likely to be available from that source in the near future.

Lt.-Col. Corbett asked the President of the Board of Trade whether he realised that artificial manure firms expect to be able to fulfil not more than 20 per cent. of their orders for potash; and what action he proposed to take.

Sir S. Cripps said that owing to delays to shipping and production difficulties in Spain, deliveries of potash to our compound fertiliser manufacturers had fallen short of expectations. Up to the end of January, however, about 40 per cent. of manufacturers' stated requirements for the season had been supplied. It was hoped that the total quantity of potash to be made available to agriculture would not be less than that provided last season.

Sheet and Strip Metal

Flt.-Lt. Beswick asked the Minister of Supply why, on certain tenders, the stipulation was made that useful materials, such as duralumin sheets and strips, would be sold only on the condition that they were smelted and not sold in their original form.

Mr. Wilmot: Parcels of light metal sheet and strip unsuitable for aircraft or other use have been sold with a re-melt clause to prevent their resale for aircraft purposes.

Metalliferous Mining

In reply to Commander Agnew, who asked the Minister of Fuel and Power whether he would announce the names of the members of the committee to inquire into the future of the metalliferous mining industry, its terms of reference, and when it would begin its sittings, Mr. Shinwell said he would not, as a good deal of consideration had to be given to the scope of the inquiry before deciding the personnel, etc., of the proposed committee.

Physics in Industry

Summer School at Bristol

A SUMMER School will be held in the H. H. Wills Physical Laboratory, Bristol, in co-operation with the Institute of Physics, from May 30 to June 6. Subjects studied will cover the general field of conduction of electricity in non-metals and will include luminescence, dielectric phenomena and reaction in solids. The course is intended mainly for members of the research staffs of Government and Industrial Laboratories who are engaged on experimental research in these subjects. Further particulars from the Director, Department of Adult Education, The University, Bristol, 8, or from the Secretary, Institute of Physics, 19 Albemarle Street, London, W.1.

BRITISH INDUSTRIAL SOLVENTS, LTD., of 21 St. James's Square, London, S.W.1, and Welbeck House, Downs Side, Belmont, Surrey, have just published a booklet and supplement giving a comprehensive survey of their manufactures to date. Specification, method of testing, properties, commercial information and uses are given for each product and, where available, British Standard Specifications are included.

Personal Notes

MR. H. G. JAMES, B.Sc., A.R.I.C., late of I.C.I., has become production manager of Scott Bader & Co., Ltd.

MR. A. L. HADFIELD, secretary to the Anchor Chemical Co. since 1935, has been appointed to the board of that company.

LORD ROYDEN has resigned the chairmanship of Imperial Continental Gas Association, and also from the board. Mr. H. G. PALMER has been elected chairman and SIR GEORGE JESSEL, Bt., deputy chairman.

MR. T. C. PACKMAN, who retired recently from the position of buyer for the Staveley Coal & Iron Co., has arrived in South Africa, where he intends spending a long holiday.

MR. G. W. AUSTIN, principal scientific officer until recently at the Royal Naval Torpedo Factory, Greenock, has been appointed Professor of Metallurgy at Cambridge University.

MR. KEVIN C. FITZGERALD, Irish manager of I.C.I., Ltd., was guest speaker at a recent luncheon of the Insurance Institute of Ireland in Dublin. He gave his audience his impressions of life in Ireland after the first sixteen months of his return to the country.

DR. R. S. JANE has been appointed vice-president in charge of research of Shawinigan Chemicals, Ltd., and MR. C. M. CARMICHAEL has been appointed a vice-president. DR. H. S. SUTHERLAND becomes general sales manager, and MR. C. K. LOCKWOOD sales manager in the stainless steel and alloys division. Dr. Jane was chairman of the Montreal Section of the Society of Chemical Industry in 1942-43.

DR. T. F. WEST, Ph.D., M.Sc., F.R.I.C., is joining the board of the Hygienic Chemical Co., Ltd., as director in charge of scientific research and development, having recently resigned his appointment as chief chemist to Stafford Allen & Sons, Ltd. Dr. West is co-author with Mr. G. A. Campbell of a scientific text-book entitled "DDT, the Synthetic Insecticide," shortly to be published by Chapman & Hall.

Obituary

MR. ALBERT JOHN PALMER, formerly chairman and managing director of Messrs. Cox Bros. & Co. (Derby), Ltd., lead manufacturers, has died at the age of 66.

MR. DENNIS MORTON, whose death at the early age of 45 has been announced, had been associated with John Nicholson & Sons, Ltd., chemical manufacturers, Hunslet, Leeds, since 1923. Acting as their representative, he was well known in the Yorkshire area in the textile trade in connection with intermediates, dyes, and the like.

French Insecticides

Ambitious Programme Planned

WITH the exception of the arsenicals, all antiparasitic products used in France are mainly provided by imports, and the war years aggravated the situation constantly. However, considerable efforts have been made to overcome the difficulty, and the situation is beginning to improve. The following table shows comparable figures for before the war and for two war-time seasons.

	Pre-war mean consumption	1943-44	1944-45
Copper sulphate	90,000 tons	15,000 tons	25,100 tons
Sulphur...	65,000	2,300	48,335
Arsenicals	6,000	4,945	6,830
Rotenone	3,500	—	—
Nicotine ...	75 (pure)	40 (pure)	40 (nicotine sulphate at 40%) 3 (nicotine alkaloid)

It will be seen that notable progress has already been made in the production of sulphur. The following is the plan for the current year. Of copper sulphate, 100,000 tons are to be secured, consisting of 80,000 tons home-produced and 20,000 tons imported. It is likely that a pre-war consumption figure will be realised. Of sulphur, 70,000 tons are to be imported, which is slightly higher than pre-war consumption. Some 15,000 tons of arsenical products are to be manufactured; this will involve certain difficulties, but it is hoped that replacement products imported from England will be available. Of the 100 tons of nicotine which are envisaged, about 52 tons will be manufactured in France, up to 20 tons imported, and the deficit made up by replacement products.

Eire's Industrial Alcohol

Production Increasing

ALTHOUGH one of Eire's industrial alcohol factories—that at Carrickmacross, Co. Monaghan—received only enough potatoes to enable it to operate for four weeks on the production of industrial alcohol from this source, it is believed that the comparatively low output may be more than counterbalanced by a season at the Cooley factory, in Co. Louth, as in that district the potato crop has been unusually high.

Replying to a question in the Dail, the Minister for Industry and Commerce gave the following statistics of industrial alcohol production, in gallons: 1937, 18,208; 1943, 140,320; 1944, 303,191; 1945, 232,399. The Minister for Finance stated on the same day that the cost of producing the alcohol varied between 3s. per gallon in 1938 and 7s. 6d. per gallon in 1945.

General News From Week to Week

All the honorary officers of the Chemical Council were re-elected for the current year at the annual meeting last month.

A British Industries Fair is to be held in the first half of 1947, according to a written Parliamentary reply by Sir Stafford Cripps.

Letters, postcards, and printed papers up to a limit of 4 lb. may now be sent to the Philippine Islands, and a restricted parcel post service is also available.

The upper storey of the premises occupied by the Marvis Chemical Manufacturing Co., Ltd., of Luton, was recently destroyed by fire. Large quantities of raw materials and manufactured products were destroyed.

The Explosives Division of I.C.I. is to revert to its former location, Glasgow, at an early date, and will occupy premises at 15-27 Bothwell Street. During the war the control has been at Ardeer.

The effect of prolonged storage on natural and synthetic rubbers at low temperatures is the subject of Users' Memorandum No. U15, published by the Services Rubber Investigations.

The Bristol branch office of The British Aluminium Co., Ltd., has been removed to 62 Queen Square, Bristol, 1. (Telephone: Bristol 23957. Telegrams: "Britalumin, Bristol.") The branch manager is Mr. F. H. Vince.

Private trade between the United Kingdom and Malaya is now permissible in goods for which the Malayan authorities have granted an import licence, subject to compliance with any export licensing or other requirements in the United Kingdom.

The Waste Paper Recovery Association, Ltd., is continuing, at the invitation of the Board of Trade, to assist in improving the recovery of waste paper, now an essential raw material for peace-time industry. The Association has new offices at 52 Mount Street, London, W.1.

The Iron and Steel Institute proposes to issue a monthly journal, though this is unlikely to appear before January, 1947. The page-size will be 11 in. by 8¼ in., and this size will therefore be adopted for the two 1946 volumes of the Institute's journal as well as for the monthly bulletin of abstracts.

George Cohen, Sons & Co., Ltd., have acquired a major holding in the Hygienic Chemical Co., Ltd., and its subsidiary, Pesticide (D.D.T.), Ltd. Measures already in hand include the equipment of works at Neath and the planning of a research and production programme which should yield some new and interesting developments in the pest control field.

Safety Week posters issued by the Ministry of Labour are now obtainable from the Royal Society for the Prevention of Accidents, 52, Grosvenor Gardens, London, S.W.1. Prices 4s. 6d. per dozen or 30s. per 100.

An extensive water supply scheme, to meet the needs of the factory to be built by I.C.I., Ltd., at Wilton, on the south side of the Tees, is to be embarked upon by Tees Valley Water Board, who hope to have it completed in two years. The factory is estimated to require 42,000,000 gal. of water weekly.

The North-Western Fuel Luncheon Club is holding a "President's Social Evening" at the Engineers' Club, Manchester, on March 29, beginning at 6.30 p.m. Applications for tickets (22s. 6d.) should be made to the hon. secretary of the club (Mr. R. Baker) at Selas Works, City Road, Manchester, 15.

Speaking at the opening of a canteen for the employees of Messrs. Peter Lunt & Co., Ltd., soap manufacturers, Liverpool, Mr. G. H. Woolton-Davies, chairman and managing director, said he did not know whether there were to be "working parties" in the soap industry, but the Government should free industry if they wanted their revenue and should take steps against combines.

The Inter-departmental Committee on Food Standards has recommended that the present Food Standards (Self-Raising Flour) Order, 1944, be amended by reducing the minimum standard for available carbon dioxide from 0.45 to 0.40 per cent. The Self-Raising Flour Association had expressed the opinion, in general meeting, that a figure of 0.35 per cent. would have been reasonable and fair to both manufacturers and housewives.

Two alterations are made in the Schedule of processes in Section 15 of the Factories Act, 1937, by the Operations at Unfenced Machinery (Amended Schedule) Regulations, 1946 (S.R. & O., 1946, No. 156), dated January 30. (a) The item "sodium hydrosulphide" is replaced by "sodium hyposulphite ('hydrosulphide') or sodium sulphoxylate" and (b) a new process is added, *viz.*: "the kier process in the manufacture of aluminium from bauxite."

Production of penicillin at the Speke factory, Liverpool, reached 80,000 mega-units in January, it is reported—about one-eighth of the total U.S. output (*see* THE CHEMICAL AGE, February 9, p. 158). This is a great improvement over the December figure of 11,000 mega-units. The rated capacity of the plant is only 48,000 mega-units a month, and the larger output has evidently been secured by the employment of a better strain for production.

British manufacturers of gas cylinders have orders on their books for about 20,000 cylinders for oxygen, acetylene and carbon dioxide. The largest order, for 12,000 cylinders, comes from the Netherlands.

The first number of a new Government publication, the *Monthly Digest of Statistics* (H.M.S.O.: 2s. 6d.) was placed on sale last Thursday. Its intention is to show the changing pattern of the economic activity of the United Kingdom, by figures in the form of time-series, yearly or monthly.

A new research and development centre is being established in a large modern building leased to Dunlop by the Board of Trade on the site of the Spitfire factory at Castle Bromwich. Physicists, chemists, rubber technologists and engineers will extend the work done at Fort Dunlop in developing new materials and products to meet the peace-time needs, particularly in matters related to the rubber industry.

The appeal by Lever Bros. and Unilever, Ltd., against the Court of Appeal decision that for the purpose of computing excess profits tax, the capital must be taken to be reduced by sums paid by the company into superannuation funds to enable additional liabilities to be assumed for payments to employees and widows and dependants of former employees, came before the House of Lords on February 8, and judgment was reserved.

Bristol Oil and Colour Chemists listened, at their last meeting, to an interesting lecture on Lithography, by one of their own members, Mr. R. M. Irving. Particular stress was laid on the chemistry and physics of inks. Their non-bleeding in water was important, while, in drying, polymerisation was desirable rather than oxidation, so that a linseed stand oil or litho varnish type of medium is employed, and precautions taken to avoid "scumming" or emulsification.

Foreign News

A plant has been erected in Brazil by the Revere Copper and Brass Company of the U.S.A. for the manufacture of copper, brass, and other alloy products.

The American Section of the Society of Chemical Industry has arranged to hold a meeting in New York on April 5, 1946, which will be known as the "Anglo-American Meeting," when official delegates from this country will attend.

The production of basic chemicals in Germany, according to the progress report on reparations, is to be limited to the country's domestic requirements; no exports will be allowed. In machine manufacturing and heavy engineering almost as rigorous a control will be exercised, and little or no capacity will be retained for export.

A new light plastic material, called Flotofoam, has been developed during the war by the U.S. Rubber Company. Its weight is less than 1½ lb. per cubic foot, but it can also be manufactured with a weight of less than ¾ lb. per cubic foot.

Plastics are being used on an increasing scale in the Soviet Union in the manufacture of machinery, aircraft and motor vehicles. Undercarriages of aircraft are being made from plastic materials and it is proposed to make plastic motor car bodies.

The Argentine Foreign Minister has announced the nationalisation of the Argentine subsidiary of the firm Thyssen Lametal and of the subsidiary of I. G. Farben. These firms will be operated under the names of "Taem" and "Anilinas Alemanas" respectively.

Forthcoming Events

February 18. Institute of Fuel. Institution of Mechanical Engineers, Storey's Gate, S.W.1, 6 p.m. Mr. D. V. H. Smith: "Individual and District Heating Systems: Cost, Technique and Planning."

February 19. Hull Chemical and Engineering Society. Regal Cinema, Ferensway, Hull, 7.30 p.m. Mr. R. M. Gavin: "High Frequency Heating."

February 19. Royal Institute of Chemistry (Belfast Section). Royal Academical Institution, Belfast, 7.30 p.m. Dr. A. J. Turner: "Natural and Man-made Fibres."

February 19. Institution of Chemical Engineers and Chemical Engineering Group, S.C.I. Geological Society's Rooms, Burlington House, London, S.W.1, 5.30 p.m. Dr. E. T. Wilkins: "The Preparation of Clean Coal for Special Purposes."

February 20. Tar Industry Meetings. National Creosote Executive Committee at Brown's Hotel, Albemarle Street, London, W.1, 10 a.m. Association of Tar Distillers at 166 Piccadilly, London, W.1, 2 p.m.

February 20. Institute of Fuel (Yorkshire Section). Danum Hotel, Doncaster, 2.30 p.m. Dr. H. A. Fells, Mr. W. A. Wordley, Dr. J. E. Garside: "Technical Progress in Smoke Abatement."

February 20. Institute of Welding. At Manchester. Mr. W. K. B. Marshall: "The Fabrication of Aircraft Fuel Tanks in Aluminium Alloy containing 3 per cent. Magnesium."

February 20. Society of Chemical Industry (Plastics Group). Gas Industry House, 1 Grosvenor Place, London, S.W.1, 2.30 p.m. Dr. P. A. Small: "The Diffusion of Plasticisers from Polyvinyl Chloride Compositions."

February 20. Society of Chemical Industry (Food Group, Microbiological Panel). Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1, 6.30 p.m. Dr. S. E. Jacobs: "Aspects of Disinfection."

February 21. The Chemical Society. Muspratt Lecture Theatre, Liverpool University, 4 p.m. Dr. F. E. King: "The Chemical Investigation of some new Therapeutic Agents."

February 21. The Chemical Society. Department of Chemistry, University College, Bangor, 5.30 p.m. Mr. R. P. Bell: "The Structure of Boron Hydrides and Similar Compounds."

February 21. Institute of Fuel (East Midland Section). Gas Department, Parliament Street, Nottingham, 3 p.m. Dr. J. G. King and Dr. F. J. Dent: "The Utilisation of Waste Heat in the Carbonising Industries."

February 22. Institute of Welding (East Scotland Branch). Heriot Watt College, Chambers Street, Edinburgh, 7.30 p.m. R. R. Sillifant: "Automatic Welding."

February 22. The Chemical Society. North British Station Hotel, Edinburgh, 7 p.m. Professor E. L. Hirst: "Some Problems in Polysaccharide Chemistry."

February 22. Oil and Colour Chemists' Association (Bristol Section). Grand Hotel, Broad Street, Bristol, 6.15 p.m. Mr. H. F. Clay and Mr. V. Watson: "Some New Aspects of Chrome."

February 22. British Association of Chemists (St. Helens Section). Y.M.C.A. Buildings, St. Helens, 7.30 p.m. Mr. H. Cole: "Chemistry of Coloured Glasses."

February 22. Association for Scientific Photography. Royal Society of Arts, John Adam Street, Strand, London, W.C.2, 6.30 p.m. Mr. F. J. Tritton: "The Photographic Copying of Documents and Plans."

February 22. Oil and Colour Chemists' Association (Manchester Section). Engineers' Club, Manchester, 6.30 p.m. Mr. A. Hancock: "A New Penetrometer for the Examination of Settled Paints."

February 25. Royal Society for the Prevention of Accidents (London Industrial Groups). Caxton Hall, Westminster, S.W.1, 10 a.m. to 4 p.m. Conference on the Prevention of Industrial Accidents.

Company News

Products (Beechams), Ltd., have increased their nominal capital beyond the registered capital of £1000, by the addition of £1,299,000 in £1 shares.

English China Clays, Ltd., are paying 2½ per cent. dividend on ordinary shares for 1945 (against 2 per cent. for 1944), profit having totalled £81,536. (£71,899).

British Emulsifiers, Ltd., announce that trading profit and sundry revenue for 15 months to December 31, 1943, totalled £32,015 (£28,491 for year ended September 30, 1942). A dividend of 12½ per cent. is recommended, leaving a balance of £8655 (£6814).

The Gas Light and Coke Company has declared a final dividend of 2½ per cent. on the ordinary stock, making, with the interim dividend, 5 per cent. for 1945 (same). The balance of net revenue is £1,187,859 (£942,525).

Doulton and Co., Ltd., are paying 10 per cent. dividend, less tax, on ordinary shares for 1945 (5 per cent., less tax, plus 10 per cent. capital bonus, tax free, out of capital reserve). Profit for 1945 was £76,026 (£68,126).

New Companies Registered

Harvey Watson, Ltd. (403,993).—Private company. Capital £2000 in £1 shares. Oil blenders and merchants, drysalters, manufacturers of and dealers in chemical preparations, etc. Directors: N. Hoyle, D. A. Hoyle. Registered office: Stonebridge Works, Colne, Lancs.

G. W. Bolton, Ltd. (404,067).—Private company. Capital £2000 in £1 shares. Manufacturers of and dealers in plastic and moulding materials, rubber, vulcanite and goods made therefrom, gums, cements chemicals, drugs, etc. Subscribers: F. L. S. Pickard (first director); Z. Bondy. Registered office: 15 Wool Exchange, London, E.C.2.

F. J. Hodges, Ltd. (404,164).—Private company. Capital £1000 in £1 shares. Manufacturing, analytical and research chemists and druggists, wholesale and retail dealers in scientific, photographic and optical goods, fertilizers, etc. Directors: A. N. Macintyre, Mrs. B. L. P. Wotherspoon. Registered office: 131 Rushey Green, S.E.6.

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Chemical and Allied Stocks and Shares

STOCK markets have been unsettled by various factors, including political developments, the food situation and doubts about the American loan. British Funds again moved higher on balance, although best prices recorded in the past few days have not been fully held, and the majority of industrial shares were well maintained.

Imperial Chemical have been steady at 40s. 3d., United Molasses moved up to 47s. 4½d., but the units of the Distillers Co. fell back sharply to 117s. 6d. on the grain position. Borax Consolidated deferred remained active up to 50s. on higher dividend hopes, but Imperial Smelting eased to 16s. 4½d., and Goodlass Wall & Lead Industries 10s. ordinary at 27s. 10½d. failed to hold an earlier rise. Amalgamated Metal eased to 19s. 1½d. General Refractories 10s. ordinary shares again changed hands at more than 19s., while the iron and steel section generally remained firm with Dorman Long 27s. 7½d., United Steel 25s. 6d., Tube Investments £6, and Stewarts & Lloyds deferred 57s. 7½d. Thomas & Baldwins have been rather more active around 11s. 6d.; Baldwins (Holdings) were 5s. 10½d., and elsewhere, Ruston & Hornsby were favoured up to 60s. 6d.; while yield considerations and hopes that the forthcoming dividend may be maintained, drew attention to Clarke Chapman at the improved level of 53s. Among recently-introduced shares, G. & J. Weir were firm at 43s., and British Alkaloids 1s. shares were 10s. 9d.

Turner & Newall showed steadiness at 84s. 6d., while hopes of a higher dividend continued to draw attention to British Glues & Chemicals 4s. ordinary, which moved up further to 14s. 4½d., with the participating preference shares 42s. Wall Paper deferred at 42s. 6d. have been well maintained, also British Aluminium at 39s. 1½d., with British Match 45s., and Metal Box 96s. 3d.

B. Laporte held their recent rise to 84s. 4½d., Lawes Chemical 10s. ordinary were 13s. 6d., and Johnson Matthey ordinary shares, which are firmly held and do not change hands frequently, have transferred up to 62s. 6d. Cellon 5s. ordinary were again 27s. British Drug Houses changed hands up to 49s. Burt Boulton were 25s. Monsanto Chemicals 5½ per cent. preference 23s., and Greeff-Chemicals Holdings 5s. ordinary 12s. Levers remained dull at 49s. 6d., and among shares of companies interested in plastics, De La Rue receded to £10; British Industrial Plastics were 6s. 7½d., with Erinoid 13s. 6d., and Catalin 5s. ordinary have been active around 12s. 6d., while Lacrinoid Products 2s. shares were 7s. 3d.

Boots Drug showed firmness at 58s. Sangers were 31s. 6d., and Timothy Whites 46s. 3d., but elsewhere, Griffiths Hughes at 51s. 3d. lost part of an earlier rise. Beechams deferred were 21s. Oil shares turned dull, but Mexican Eagle Oil continued active on the latest developments; after touching 17s. 7½d., however, the price showed a partial reaction to 14s. 7½d. Canadian Eagle Oil were 25s. 3d. after an earlier jump to 27s. 9d.

British Chemical Prices

Market Reports

A STEADY call for contract supplies of leading industrial chemicals has been observed in the London general chemicals market during the past week, and a fair amount of new or replacement business has been done. Demand for soda compounds, both for home and export, has been sustained, and the whole of the potash products section is firm and in strong request. Oxalic acid supplies are finding a ready market and offers of tartaric acid and acetic acid are quickly absorbed. Arsenic is quietly steady and a moderate trade is reported in lead compounds. Quoted rates show little alteration and the general undertone continues firm. Values in nearly all sections of the coal-tar products market remain firm. Demand for both crude and crystal carbolic acid continues strong, while creosote oil is in good request.

MANCHESTER.—Trade in both light and heavy chemical products on the Manchester market during the past week has been on steady lines and in virtually all sections quotations remain on a firm basis, with the tendency in one or two instances towards higher levels. The soda, ammonia and magnesia compounds are meeting with a good demand, and there is a ready outlet for potash chemicals. In the mineral acids, a steady trade is reported. Most of the fertiliser materials are moving satisfactorily to the consuming end, while a fair home and export business in the general run of coal-tar products is being put through.

GLASGOW.—The Scottish heavy chemical trade shows few changes from last week. Prices have an upward tendency, and there appears to be considerable activity in the export market.

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