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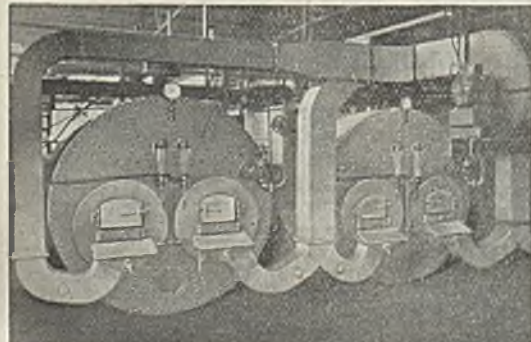
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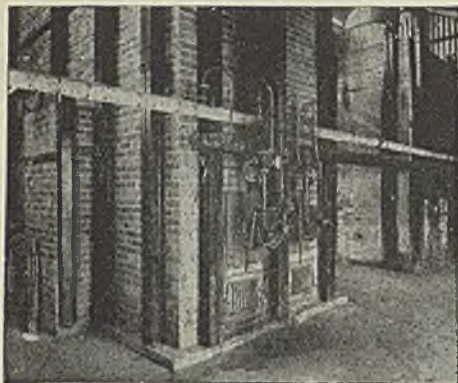
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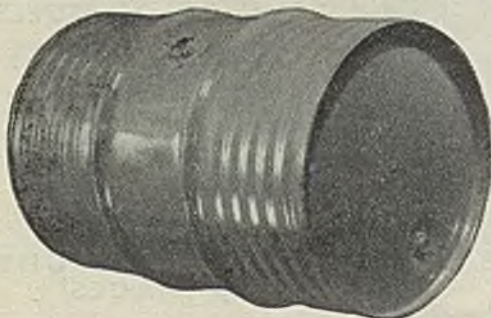
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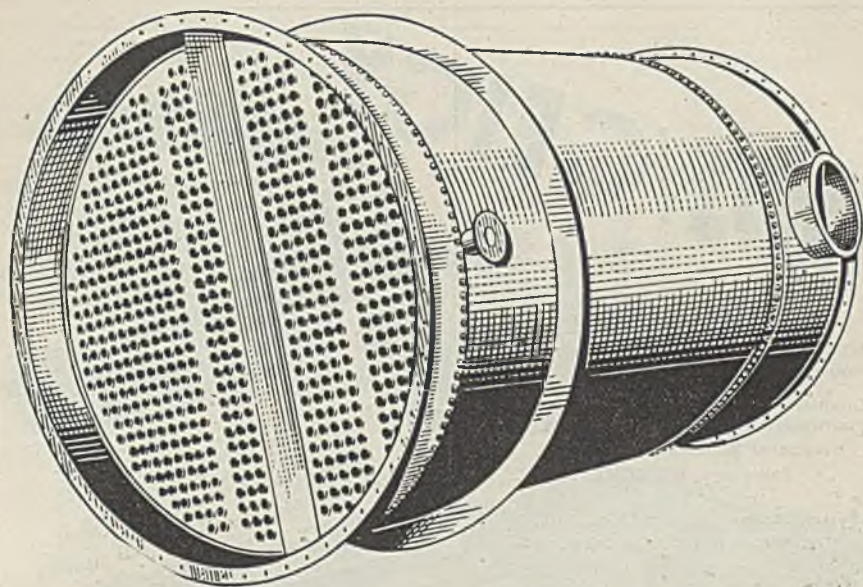
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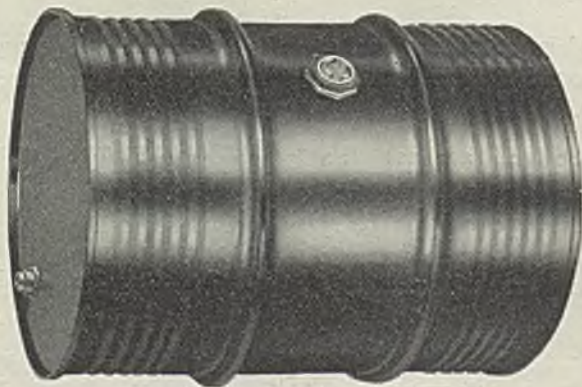
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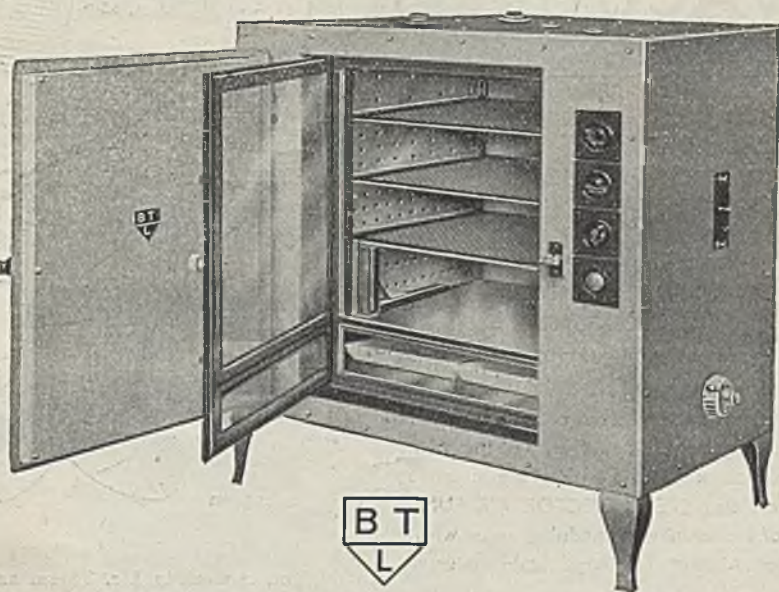
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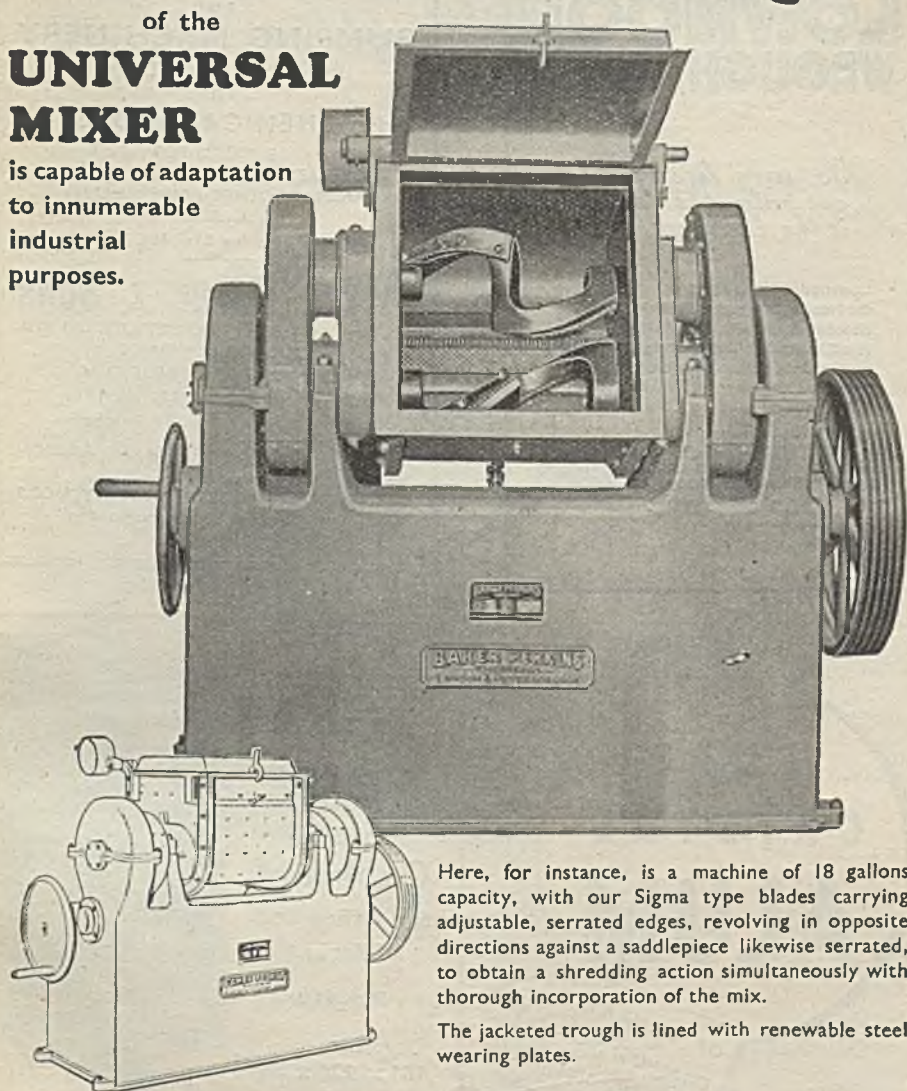
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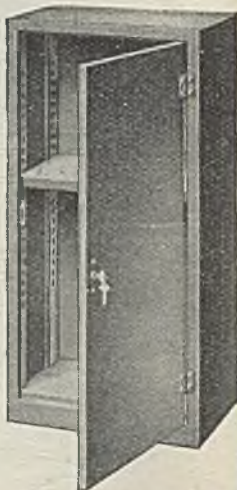
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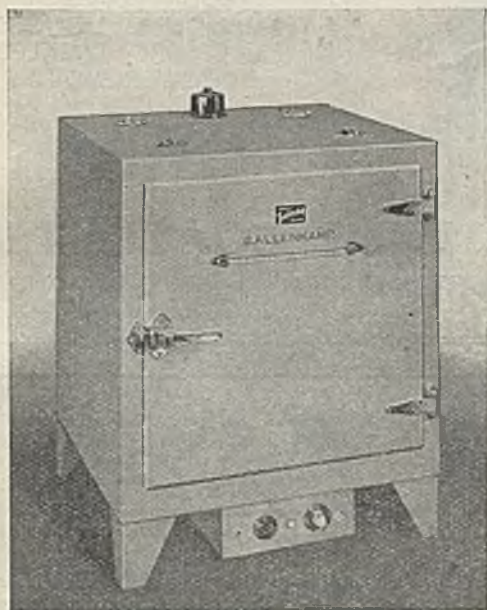
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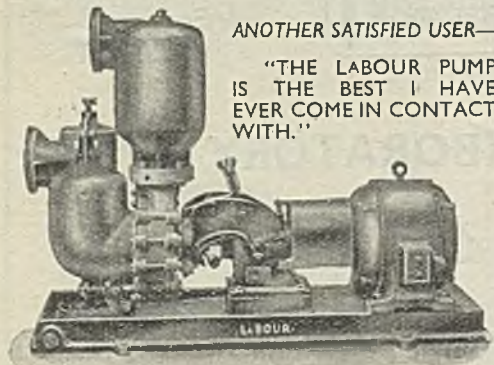
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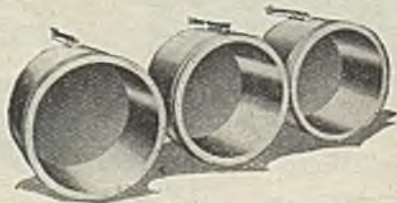
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No. 1372.

October 13, 1945

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Clothing and Chemistry

CLOTHES make the man they say; but more usually it is the man that makes the clothes. This was never so true as when the clothes are made of synthetic material. Is it not strange that although feminine preoccupation with clothes generally transcends that of the male, in the long and interesting scientific history of the development of materials for the production of clothes, there seem to occur no feminine names? Man has been the creator; woman, probably, the originator. We are sure that it was woman who first realised the possibilities of clothing. Some there may be who are like the lady spoken of by Jonathan Swift: "She wears her clothes as if they were thrown on her by a pitchfork." But they are the exceptions; but the lady of the magic lake whom Merlin saw knew better:

"And near him stood the Lady of the Lake,

Who knows a subtler magic than his own—

Clothed in white samite, mystic, wonderful."

A subtler magic indeed, the magic of clothes. Others there be who know the magic of a conscious paucity of integument. Of late, the fashion has arisen of scantier clothing, a fashion which Buchanan must have had in mind when he wrote: ". . . She just wore Enough for modesty—no more."

Some ten years ago a writer of a *Times* third leader summed it all up very neatly: "Wise and learned men say that clothes are a protection—protection, say a very few (and reasonably so seeing how very little protection most women's clothes afford), against heat and cold; protection, say others, against unwanted attentions or spiritual assault,

as by the evil eye; protection against a man's consciousness of himself as a forked radish. But, as innocent St. Maël very soon found in his Isle of Penguins, all these motives become subordinated to one other, which is, by ornament and emphasis, to rouse envy in the wearer's own sex and admiration in the other." Thus it has been from time immemorial. Going back more than a century, we find John Dalton taking the rather typical view of the man of science in a letter he wrote in 1803 when on a visit to London: "I do not know how it happens, but I fancy pretty women look well anyhow."

In the intervening years, the chemist and the physicist have been turned loose on the problem. A whole magic pharmacopœia of dyestuffs, undreamed of by Dalton, has been discovered and applied to the art of costume. The world is much the brighter for that work. But, in addition, scientific men have been let loose on the problem of fibres and textile weaving. Synthetic fibres have helped enormously to widen the range of materials available. Organised research, through such bodies as the British Cotton Industry Research Association, has done immensely valuable work, and has secured results that have been of great advantage to the industries concerned, no less than to the wearers of clothes. An excellent résumé of what has been accomplished was given by Dr. D. C. Clibbens, of the B.C.I.R., in the first Dalton Memorial Lecture at Manchester, a copy of which has just reached us.

The history of science shows that until

observations can be summarised into a general principle, they must be empirical. A great number of observations, sometimes apparently unrelated, are secured by chance experiments and these await correlation before planned research is possible. The progress of research during this earlier period may result in discoveries, but they are discoveries made by chance rather than through reasoning. Dr. Clibbens has shown that during the empirical period in textile research there were discovered three processes all of considerable value—mercerisation, viscose, which led to the enormous viscose rayon industry, and a technically successful crease-resisting treatment for cellulose textiles—none owing anything to modern theory.

Modern theory has shown, as an extension of the original views of Dalton, the cause of the physical properties of textiles explained as a consequence of their molecular constitution. Dr. Clibbens justly maintains that "the chemical theory that started with Dalton's atoms accomplished more in a single century than the observation of chance phenomena had accomplished during many millennia."

Cellulose fibres, according to modern discovery, consist of chain molecules. Thus the cellulose molecule comprises a very large number of simple glucose units combined with one another to form a long thin thread-like or chain-like structure. In native cotton, the length of the molecule is of the order of 1000 times its transverse dimension. It follows from the method of construction of these molecules that they have no single molecular weight, and this Daltonian conception must be replaced by the more complex idea of the distribution of molecular weights round a mean value. A conclusion fundamental to the modern theory of fibre structure is that the presence of long molecules is necessary in a high-strength fibre.

While these discoveries were being made, the study of the X-ray diffraction spectra of fibres showed that the molecules in cellulose fibres are arranged, at least to some extent, in that orderly manner which had hitherto been regarded as a characteristic of crystalline matter. The picture which emerged was that of an assemblage of long-chain molecules arranged in orderly manner, more or less parallel to one another and to the fibre axis. Other dimensions of the unit cell showed that the chain-molecules were packed very closely side by side—so closely as to imply the existence of lateral chemical forces tending to maintain the orderly molecular array.

The mechanical breakage of a fibre does not occur through the rupture of the chain-molecules themselves, *i.e.*, through the breakdown of the main valency chain, but through the slipping of molecules past one another, involving the rupture of the lateral secondary valencies, or hydrogen bonds, that tend to hold the structure together. It can easily be appreciated on grounds of pure probability that the greater the average length of the molecules, the greater will be the average distance of their mutual overlap; the greater therefore will be the number of lateral bonds that must be disrupted in breaking the fibre, and the greater the force necessary to break it. This provides a satisfactory fundamental explanation of the necessity for the presence of long molecules in cellulose fibres of high tensile strength.

Another interesting discovery is that the chemical activity of the fibre depends on the manner in which the molecules are packed. Stretching can produce a considerable effect. The dyeing properties of mercerised cotton yarn appear to vary with their mechanical stress at the time of dyeing. The factors in terms of which textile chemists have attempted to express

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some of the most essential properties of the textile fibres are seen to be the average length of the molecular chains, the extent to which they are ordered in a crystalline lattice, and the forces tending to maintain the lattice structure. The formation of a crystalline lattice can be assisted by mechanical stresses and the forces tending to maintain the lattice structure are determined chiefly by the chemical nature of the groups forming the fringes of the chains. In cellulose molecules, these are hydroxyl groups, which are known to be characterised by a high degree of chemical association; in chain-molecules derived from hydrocarbons, such as those existing in rubber-like substances, the fringes are formed by hydrogen atoms with a low degree of chemical association.

The facts that have been here given illustrate both the profound gap and the close connection that exist between scientific work on clothing materials and the art of wearing them. The human mind is capable of many diverse emotions ranging from the cold consideration of scientific data to the desire to rouse envy which we cited earlier on. And yet withal these emotions are closely related. The great scientific brain cannot work without enthusiasm.

Whether we are textile chemists or manufacturers of textile materials or, as all of us are, wearers of the products of that industry, we have much to be thankful for the work of the textile chemist. There is comfort to be derived from Dr. Clibben's conclusion: "Modern theory has provided a satisfactory fundamental explanation of many of the empirical observations of the textile chemists, a fact that can be expressed alternatively, and with greater justice, by the statement that the work of the textile chemists has contributed in no small measure to the firm foundations of a satisfactory theory of fibre structure. The theoretical chemistry of the 19th century was concerned with the rules for producing new materials with predetermined chemical properties; the chemistry of the long molecules is distinguished by its additional concern with the rules for producing new materials with predetermined mechanical properties. The signposts have been re-erected and we stand at the beginning of a period in which a firm theoretical foundation should permit a planned progress hitherto unknown in the production of clothing materials." Meanwhile, our clothing is very shabby; may we have a little on account?

NOTES AND COMMENTS

Irresistible Science

"AS scientists we hold that no political control, no Government, no laws can arrest the march of science." It was high time that words of this nature should have been publicly uttered, and we are glad to record that they have now been spoken by a chemical engineer of eminence, in the person of Mr. C. S. Garland, on the occasion of a dinner given to Sir Edward Salt, recently chairman of the Parliamentary and Scientific Committee. Mr. Garland's speech followed an appeal by Professor A. V. Hill for complete frankness in dealing with atomic energy. Professor Hill described the prospect of maintaining secrecy, for any length of time, about the atomic bomb as "complete moonshine," and spoke of the "pandemonium of foreign secretaries who

produce their deadlocks" without the presence of anyone with scientific knowledge of the issues involved. He recommended the initiation of vigorous action, if necessary in Parliament, and Mr. Garland urged the free publication of scientific work on atomic energy. Attempts to control one or several materials, he said, would only result in the ultimately successful search for others.

Security Plan Suggested

MEANWHILE, Sir Arthur Salter, speaking at a United Nations Association meeting at Oxford, has recommended a safeguard against misuse of atomic energy. The Security Council, he suggests, should have the right to send its inspectors into any territory, and should be required to destroy any bomb-producing

factories, except possibly within its own territory. In other words, any international police force that there may be must be adequately armed. Here, at all events, is something to work from; and it is noticeable that the pronouncements mentioned have all come from men with either "right-wing" political affiliations, or with none at all.

Murder and/or Suicide

DAILY it becomes increasingly more evident that the German chemical warfare department was preparing plenty of surprises for use against their enemies. It is reported, for example, that a poison campaign was among the schemes for a "last ditch" stand against the Allies. It never came off, as the Allied advance was too rapid; but a secret Nazi paper has been discovered by the United Nations War Crimes Commission giving details of a meeting of chemical experts which discussed means to poison the Allies' invasion forces, combined with plans for providing "suicide tablets" for the Germans themselves as a last resort. Poison was to be injected into food substances, *e.g.*, sausages, and methyl alcohol was to be mixed with alcoholic beverages. The sole success seems to have been the murder of two Allied soldiers by means of doctored liquor. Some idea of the more constructive developments which war-time conditions forced upon German chemical industry are detailed on a later page of this issue. Many of these developments are indeed of such a nature as to be of real use in peace-time industry; and it is no doubt with this fact in mind that the Americans have taken a number of German scientists (on a voluntary basis) back to the United States.

Petroleum Warfare on View

AN exhibition that should be missed by no one who happens to be in the London district is now on view at the Imperial War Museum, Lambeth. Its three rooms are devoted respectively to "Pluto," "Fido," and Flame Warfare, and the exhibits consist mainly of well-selected models and photographs, though there are some "actual" objects to be seen. In the "Pluto" room, sections of the Hais cable and the Hamel steel pipe are displayed, together with an

extremely lucid series of diagrams showing the method of laying either or both under the sea. Particularly ingenious are the copper bursting discs which retain water under pressure in the Hais hollow cables until the line is ready to come into operation. Photographs give a good idea of the colossal size of the "Conun" drums for winding the Hamel pipes, and models amusingly illustrate the camouflage of villas, etc., which hid the pumping stations, etc., on the British shore. The "Fido" exhibition begins with an enlargement of Mr. Churchill's personal message to Mr. Geoffrey Lloyd urging him to get on with some scheme for aerodrome fog-dispersal. Sections and drawings of the three types of burner are shown, with their ingenious vaporising and preheating systems, by which the air temperature was raised along the runways so as to disperse the fog.

Flame in Attack and Defence

PERHAPS the most surprising section of the exhibition is that devoted to flame warfare. Extremely impressive is a large model, which lights up, giving an idea of the literally hot reception which would have met any German invaders who landed on, or even approached, the shores of Britain. Great areas of sea would have been set ablaze by pumping to the surface a mixture of oil and calcium phosphide, the latter igniting on exposure to the air and setting fire to the petroleum. Shore flame barrages, defile traps, and fougasses, formed a fiery defence-in-depth, and to cap all there were the mobile "cockatrices," which could launch a spout of liquid flame 100 or more yards long to combat parachutists or glider-borne troops. On the attacking side are the "Crocodile," the "Wasp" and the one-man "Lifebuoy" flame-throwing devices, all of which are to be seen life-size. A beautifully polished piece of chemical apparatus shows the secret Flame-thrower Fuel—about 70-80 per cent. petrol—in preparation. Development of flame warfare was among the latest of the expedients used to defeat the Germans in this war, yet, as a quotation from an ancient Chinese treatise on the art of war demonstrates, this weapon is among the oldest in martial history.

Methoxone

The New Selective Weedkiller

SINCE about 1930 it has been known that plant growth is controlled in nature by minute amounts of hormones or growth substances. More recently synthetic organic chemicals have been found with similar properties, the most commonly used being α -naphthylacetic acid. Research on the synthesis of plant hormones by the I.C.I. Dyestuffs Division, under the direction of Dr. W. A. Sexton, in conjunction with the Jealott's Hill Research Station, led to the discovery in 1940 that at certain concentrations α -naphthylacetic acid arrested or retarded seed germination and the early growth of some annual weeds without affecting

tation can survive. Others are of the sulphuric acid type which adheres to, and scorches, the foliage of broad-leaved weeds, but runs off or only damages the unimportant outer leaves of cereals and grasses. Methoxone has a distinctive and markedly selective action, which has yet to be fully understood. It is absorbed into the plant structure of the weeds through either the leaves or roots (a factor which minimises the influence of weather conditions and causes serious physiological disturbance. Growth is arrested: the stem and leaves become twisted and contorted; the stem thickens and may split, showing a mass of rootlets; the foliage

The definite line of demarcation between the treated and untreated portions of corn-land effectively demonstrates the efficiency of Agroxone. On the treated portion Agroxone was used at the rate of 2 cwt. per acre.



cereals. Some details of the background of the work were this week reported to the technical Press by Dr. W. G. Templeman, plant physiologist at Jealott's Hill.

Many compounds related to naphthylacetic acid were prepared and finally 4-chloro-2-methylphenoxy-acetic acid, known as methoxone, was found to be outstandingly active. Applied in water solution or in dust at rates as low as 8 oz. per acre, it was found to be effective, under favourable conditions, in killing weeds such as yellow and white charlock, pennygrass, and corn buttercup with no damage or retardation to the cereal crop. In general use, 1 lb. per acre was found to be fully effective when applied in spray form, or 2 lb. per acre in powder.

Methoxone is an entirely new weedkiller in a double sense. It differs from existing weedkillers both in nature and in action. Weedkillers are broadly of two types. The first, such as sodium chlorate and sodium arsenite, sterilise the soil so that no vege-

changes colour; and finally the plant dies. The process is relatively slow: effects may be seen in 12 hours but death may take as long as several weeks. Methoxone has many advantages over the older types of product. It is non-poisonous, non-inflammable, and not unpleasant to handle, and possesses only a slight odour.

The weedkiller may be applied any time from cereal sowing until weeds reach the flowering stage, but is best applied as soon as the cereal is established in order to obtain the maximum benefit from removal of weed competition. It has great promise for use against weeds in pasture and lawns, though much experimental work remains to be done here. It is highly important that methoxone should not be allowed to drift on to root or vegetable crops, or on to garden flowers.

Practical details of field results were supplied by Dr. E. Holmes, head of the technical department, Plant Protection, Ltd.,

Walding, Kent. By last autumn, he said, experimental work with methoxone was so promising as to justify extensive field trials. Accordingly, in spring this year, with the co-operation of scientists of the Agricultural Research Council, arrangements were made to distribute considerable quantities to every War Agricultural Executive Committee. These authorities carried out widespread trials, the results of which are now being collated. In addition, Plant Protection, Ltd., laid down controlled experiments at 111 centres throughout England, Wales and Scotland. The complete series of experiments was the largest ever undertaken in Britain on an agricultural problem. In all, over 1000 centres involving a total of some 13,000 acres were under treatment.

Dusts were chosen for all the above experiments, since far more farmers are equipped to apply dusts than sprays. These were of five different strengths of methoxone, all strengths being employed in each trial.

Types of Weed Attacked

Of 50 weeds recorded in these experiments, 20 important ones appeared in many of the treated areas. Observations were made in relation to time of application, weather, soil and other conditions. Analysis shows that results may be broadly classified as follows:—

<i>Killed Outright</i>	<i>Seriously Affected</i>
Yellow Charlock	Corn Marigold
White Charlock	Fat Hen
Corn Buttercup	Speedwell
Creeping Buttercup	Chickweed
Pennycress	Poppy
	Sow Thistle
<i>Affected</i>	<i>Unaffected</i>
Bindweed	Bladder Campion
Spurrey	Coltsfoot
Thistles	Cleavers
Mayweed	
<i>Polygonum</i> spp.	
Dock	

It must be emphasised that the weeds "killed outright" are the most important among cereal crops. Of those which were not killed outright, many were so reduced in growth that they ceased to be serious competitors with the crop. Throughout the trials no damage whatever was caused to wheat or oats, though in 4 out of 63 trials with barley, slight malformation of barley heads was observed. This phenomenon is still under investigation. In one single experiment, methoxone proved completely effective against hoary cress (peppercress), a weed that has proved singularly resistant to other forms of attack.

Some idea of the remarkable activity of the weedkiller and the rapidity of its application may be gauged from the fact that when employing sprays, 1 lb. of methoxone was used with 10 gallons of water, and that,

using 20 gallons of methoxone solution in 180 gallons of water, 18 acres of corn-land were treated in 65 minutes.

Methoxone itself is far too powerful to be dealt with by means of ordinary agricultural appliances. This was explained by Mr. Chieveley, managing director of Plant Protection, Ltd., who also called attention to the fact that the discovery of this selective weed-killer was an entirely British affair, and one of a series of advances in agricultural science that had put this country far ahead of others in that branch of industrial chemistry. Its development was, moreover, a fine example of co-operation with farmers. As a result of the work done, it seems probable that more continuous corn-growing may be possible as well as a great cutting down of acreage under "cleaning crops" and bare fallow, leading, perhaps, to an extra million tons per annum of food for man and beast.

Agroxone

To farmers, methoxone will be sold in a form specially suitable for use on the land, and will be marketed as "Agroxone." The initial cost will not exceed 30s. per acre, and this figure is likely to be lowered. Preparation for the market is well in hand and enough material will be ready for distribution for spring use. In view of the fact that few farmers have spraying appliances, Agroxone will be supplied mainly in powder form, and can be applied with the ordinary fertiliser drill. The standard rate is 2 cwt. per acre. Liquid Agroxone will also be available in more limited quantity for spraying machinery, and to begin with will mainly be allotted to contractors. A new form of sprayer is being developed which will deal with the comparatively small quantities of liquid which are all that need be used.

KOREAN CHEMICALS

In Korea, coal production reached 2,300,000 tons in 1936 and has probably been doubled by 1944. Oil has not been found, though some synthetic oil is being produced from lignite. Electricity output exceeds 2,000,000 kW. Among manufacturing industries, the first place was occupied, in 1938, by the chemical industry which, in terms of gross value of output, accounted for 31 per cent. of the total, while the metal industry accounted for 8 per cent. Production of ammonium sulphate is carried out in a plant with a yearly capacity of 500,000 tons, using cheap electric power.

No recent figures are available for the metal and machinery industry, but steel production has been put as high as 2,000,000 tons. There is a substantial aluminium and magnesium output.

The German Chemical Industry

Some War-Time Developments

DATA concerning the German chemical industry's recent activities, collected by the Industrial Intelligence Staff of the U.S. Chemical Warfare Service are reported upon in a long article in *Chem. Eng. News* (1945, 23, 1576). The following is a summary of some of the most interesting features.

The Importance of Acetylene

Over and above the now well-known development of the Bergius and Fischer-Tropsch processes, and the attention given to polymers (plastics, rubber substitutes, and fibres), one of the most striking features of German war-time chemical economy was the extensive use of acetylene, which, because of the lack of short-chain hydrocarbons obtainable by cracking petroleum, occupied a position of abnormal importance. A large number of products and processes were developed to relieve shortages or for lack of an alternative route to the desired material.

While most acetylene was still made by the calcium carbide route, a large plant, at Hüls, successfully operated the arc process. The raw material was waste gas from hydrogenation, natural gas, or coke-oven gas residues. Its success was due largely to the discovery that acetylene can be safely handled under pressure by observing certain precautions, and that water can be used as the recovery solvent by taking advantage of the fact that the pressure solubility characteristics of acetylene are almost identical with those of carbon dioxide. A power consumption of 4.3 to 4.8 kWh per lb. of pure acetylene was attained at this plant.

While many of the reactions employed had been disclosed in patents and other literature, the extent to which their use had developed is of distinct interest. Butadiene, for example, was made from acetylene, either *via* the acetaldehyde-aldol route, or *via* the formaldehyde-acetylene (butynediol) route to conserve acetylene. Even ethylene and ethyl alcohol were made from acetylene, and synthetic lubricating oil was produced by polymerising the ethylene.

By working out safe conditions for handling acetylene under pressure, the I. G. Farben was able to raise the vinylation reaction to a status comparable to sulphonation or nitration, working without accidents at pressures up to 20 atmospheres and temperatures up to 200°C. The alkali alcoholate catalysts disclosed in I.G. patents were used to make vinyl ethers of the alcohols containing up to 18 carbon atoms, the products being then converted into polymers for use in various fields. This type of catalyst also served to produce vinyl amines,

such as vinyl carbazole, and could, in general, be used for the vinylation of any organic compound containing active hydrogen. For making ring-substituted phenols, the catalyst used was a zinc (or cadmium) salt of an organic acid. By this procedure vinyl isobutyl phenol (Koresin) was produced.

A third catalyst of major importance was copper (or silver) acetylide. By proper preparation on a support and by proper control of operating conditions, this temperamental compound was brought under control. Using this catalyst, the triple bond of acetylene remains and addition takes place at one or both carbon atoms.

A fourth catalyst was nickel carbonyl, which could be used to introduce the CO group into the molecule. Thus, acrylic acid could be produced from acetylene, water, and CO, or, starting with alcohol instead of water, ethyl acrylate was manufactured. Using the same catalyst, CO was added to tetrahydrofuran to give adipic acid.

By using a modification of the copper acetylide catalyst (addition of alkali chloride) in aqueous hydrochloric acid solution, acrylonitrile was produced on a large scale by the direct addition of hydrocyanic acid to acetylene. With mercuric chloride catalyst, vinyl chloride was produced, and with zinc acetate, vinyl acetate.

Surface-Active Chemicals

One of the most important discoveries made was the fact that the addition of cellulose glycolic acid sodium salt to synthetic detergents increases their effectiveness to fully the equivalent of that of soap. The amount required was about 25 per cent. of the amount of synthetic detergent.

The production of synthetic detergents was greatly expanded, reaching 75,000,000 lb. per year. Besides the I.G. types, the Igepons and Igepals, the two synthetic American types, alkyl benzene sulphonates and aliphatic sulphonates, were produced in large quantities. The fatty acid (and consequent soap) shortage was largely relieved by substituting the synthetics or incorporating them in the soaps made of necessity from synthetic fatty acids.

The older emulsifying agents were of the long-chain aryl polyglycol ether type. Later there was introduced the Emulphor STH and STX type, made by condensing a long-chain aliphatic sulphone chloride (Mersol) with ammonia and then with chloroacetic acid. This was favoured for drawing oil emulsions, as it conferred extreme pressure-lubricant properties and gave very smooth

surfaces while at the same time possessing anti-rust characteristics. Later, because of shortages, dodecyl xylene sulphate was also sold under the same name.

Demulsifying agents were of three types—alkyl aryl polyglycol ethers, derivatives (amides) of hydroxyoleic acid sulphate ester, and the sulphate of di-(ethyl hexyl)-maleate. These were each very specific for certain types of petroleum.

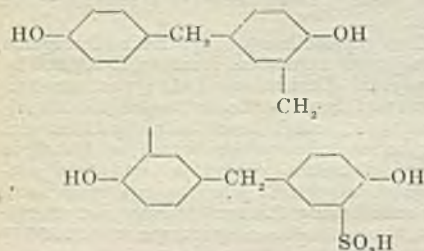
Water resistance of cellulose fibres was attained by treating with hexamethylene diisocyanate or by using an emulsion of paraffin wax containing zirconium oxychloride (Persistol, said to be resistant to washing) or aluminium acetate (not fast to washing). A claim was made that treatment with di-(hydroxymethyl)-phenols produced permanent water repellence.

Textile-finishing materials, wetting agents, dyeing assistants, lubricants, printing assistants, etc., were marketed in large numbers. Most of these were based on combinations of the Igepon-Igepal-Alipals or a composition containing selected vinyl ethers. By suitable combinations of these ingredients and natural or synthetic oils most of the various members of the wide range of textile assistants were produced.

Tanning Agents

An interesting group of synthetic tanning agents known as Tanigans had been developed. Tanigan A was produced by condensing together 4,4'-dioxydiphenyl sulphone, the alkaline waste liquors from cellulose treating plants, and formaldehyde. A complicated resin resulted which in solution formed a good tanning bath.

Tanigan Extra B was produced by condensing phenol with formaldehyde in the presence of sulphuric acid to form 4,4'-dihydroxydiphenylmethane. This was partially sulphated and then condensed with further quantities of formaldehyde to form:



Tanigan Extra E was a mixture of Tanigan Extra B and the product formed by condensing 4,4'-dihydroxydiphenylmethane with the alkaline waste liquors from cellulose treating.

Rocket Propulsion Chemicals

A number of chemical systems were studied for use in the propulsion of rockets.

Selection of the chemicals was made very largely on the ground of availability rather than desirability. Each system had two main constituents, an oxidising agent and a fuel. The constituents reacted chemically in a combustion chamber at 30 to 40 atm. The products of combustion drove the rocket by passing out through a jet.

Oxidizers and Fuels

The principal oxidising agents considered were 98 to 100 per cent. nitric acid (which was found to be too corrosive), 98 to 100 per cent. nitric acid with 5 to 10 per cent. strong sulphuric acid added, liquid oxygen (which was difficult to handle), 80 to 85 per cent. hydrogen peroxide with or without sodium or calcium permanganate, and ammonium nitrate.

The principal fuels considered were methanol, ethanol, hydrazine hydrate, hydrazine hydrate plus methanol, 57 per cent. *m*-xylidine plus 47 per cent. triethylamine, 8-hydroxyquinoline, furfuryl alcohol, vinyl ethyl ether, gasoline, diesel oil, Optol (a hydrogenated lignite tar fraction), and Ergol (a mixture of Optol, tetrahydrofuran, furfuryl alcohol, and aniline).

A few monofuel systems were also studied but never fully developed. These included 65 to 85 per cent. methyl nitrate in methanol, ammonium nitrate plus ammonia, ammonia and nitrous oxide, and tetranitromethane plus a solution of 8-hydroxyquinoline in 80 to 85 per cent. hydrogen peroxide.

Most of the rockets actually used were propelled either by a combination of liquid oxygen and methanol or ethanol, or by mixed acid (5 to 10 per cent. H_2SO_4 plus 95 to 90 per cent. HNO_3) with an oxidisable substance. In the case of the V-2 rocket, the starting cycle was in three steps. First, permanganate reacted with hydrogen peroxide, giving superheated steam which drove a turbine connected to the pumps. The pumps delivered hydrogen peroxide and hydrazine hydrate in methanol solution to the combustion chamber, where an instantaneous, strongly exothermic, reaction occurred. When the reaction chamber became hot enough, the permanganate and peroxide shut off automatically and the rocket drive was taken over by the liquid oxygen-alcohol combination. This system was also used, in principle, in experimental torpedoes and was engine-tested for the high-speed propulsion of submarines.

In connection with the rocket programme, the most important of the chemicals produced on a large scale for the first time was concentrated hydrogen peroxide. The usual 30 to 35 per cent. commercial solutions made by the potassium persulphate, ammonium persulphate, and persulphuric acid processes were brought up to 82 to 85 per cent. strength by vacuum concen-

tration in two stages. In the first, the solution was vaporized continuously from a retort maintained at 73 per cent. concentration and the vapours, after passing through a separator, were fractionally condensed in a scrubbing tower as a 65 per cent. product. This product was then fed into a second retort which was maintained at 80 to 85 per cent. The vapours were again fractionally condensed and the condensate was returned to the retort, from which the finished product overflowed. If especially pure solution was required, the product was drawn off the bottom of the scrubber. The acidity was adjusted with phosphoric acid. The product was of very high purity and stability. One plant had a capacity of 500 metric tons per month; a second plant had a capacity of 1200 tons; and a third plant was under construction with a projected capacity of 2100 tons.

Two non-electrolytic processes were being investigated because of the shortage of platinum and stainless steel. One was based on the passage of H_2 plus O_2 through a silent electrical discharge. The other was based on the reduction of 2-ethyl anthraquinone to 2-ethyl hydroanthraquinone by H_2 , followed by oxidation to 2-ethyl anthraquinone and H_2O_2 . Pilot plants have been operated on both processes and a large plant was under construction in spite of explosion hazards encountered in the pilot plant.

Insecticides

DDT was widely manufactured in Germany and a number of variations were developed, such as difluorodiphenyltrichloroethane, known as Gix, and phenylchlorophenyltrichloroethane. The former was more easily emulsified and was claimed to be more effective than DDT though much more expensive. No other variations of the DDT molecule appeared advantageous.

An entirely new approach was taken in the development of "Lauseto neu" which is *o*-chloromethyl-4-chlorophenyl sulphone, said to be more active than DDT on the body louse and on bedbugs, but less so on flies. A mixture of the analogous *o*-chloromethyl phenyl sulphone and 3,4-dichlorobenzyl alcohol was even more active against bedbugs. Another new compound for uses similar to DDT is Lucex, which is not as effective as DDT but is cheaper, and is made by chlorinating the side chain of ethyl chlorobenzene.

For aphids the hexaethyl ester of tetraphosphoric acid, "Bladan," was more effective than nicotine though suffering from instability in aqueous solution. "Nirosans," the active principle of which is tetranitrocarbazole, was used for control of insects and fungi on vines with and without addition of copper compounds. For similar purposes sprays based on 1-sulphocyno-2,4-di-

nitrobenzene were used. Pentachloronitrobenzene and 1, 2, 4-trichloro-3,5-dinitrobenzene were employed as soil disinfectants and the former was also used to disinfect wheat seed. Many variants of the ordinary copper and arsenic insecticides were in common production.

While diethyl phthalate was largely used as a mosquito repellent, a new compound, trichloroacetyl chloroethylamide, was being tested. It appears to be effective against mosquitoes other than the anophelino (which is the malaria carrier) and superior to the phthalates.

The problem of replacing thallium in rat-poisons became acute. "Castrix" was made from acetoacetic ester and urea followed by chlorination and amination. It is very toxic to mice but low in toxicity for domestic animals. A new compound, *p*-dimethylaminophenyl diazo sodium sulphonate, was under development.

Continued development of the Eulan moth repellants resulted in Eulan NK, triphenyl-3,4-dichlorophenyl phosphonium chloride, particularly resistant in textiles to washing, and Eulan AL, 3,4-dichlorophenyl N-methyl sulphonamide which was produced in large quantities.

Solvents

In the field of solvents, in addition to the halogenated ethylene derivatives manufactured from acetylene, other interesting developments were uncovered—for example, hexyl alcohols were produced from acetaldehyde and butyraldehyde by alkali condensation followed by hydrogenation. Methyl pentane diol and triol were produced in considerable tonnage by converting acetone to diacetone alcohol and hydrogenating. These latter products found uses as solvents for lacquers.

Sodium amalgam drawn from the mercury cell for chlorine manufacture was reacted with sodium polysulphide (made from one-quarter of the sodium sulphide produced) to give a very pure sodium sulphide, while the mercury was returned to the cell for re-use thus:



The use of substituted carbazoles as insecticide ingredients led to the development of some novel methods of synthesis.

The use of hydrazine hydrate as a rocket fuel, as mentioned above, resulted in translating the usual laboratory synthesis of oxidising ammonia with sodium hypochlorite to a large full-sized industry. The synthesis of caffeine by the Traube synthesis, which starts with urea and sodium cyanoacetate to form diamino uracil, followed by reaction with excess formic acid and exhaustive methylation, was also reduced to industrial practice.

Fluorescence Test for Uranium*

Interfering Elements Largely Eliminated

by CLAUDE W. SILL and H. E. PETERSON†

IN the course of a series of investigations on vanadium deposits in the western United States, the Bureau of Mines collected many hundreds of samples for chemical analysis. As uranium is often associated with these vanadium minerals, they were also analysed for uranium, which was found to be absent in a large percentage of the samples. Since the usual methods for determining uranium are laborious and time-consuming, it is desirable to have some simple qualitative test that can be applied prior to a quantitative analysis to determine whether uranium is present or absent and thus save the time and expense of applying the quantitative analysis to the large proportion of samples containing no uranium. To be acceptable, the test should be specific for uranium, sensitive enough to detect small amounts of uranium, and simple enough to make it worthwhile to apply. Available methods for detecting uranium lacked one or more of the desired characteristics. Eventually, however, a method was worked out that satisfied all the requirements. This method is probably more specific and sensitive than the usual qualitative methods for uranium, and its simplicity and speed of application make it ideal for testing samples.

U.V. Light Effect

It has been known for many years that hexavalent uranium salts fluoresce under the influence of ultra-violet light. It has also been known that solutions of uranium salts fluoresce under the proper conditions, although this fluorescence is usually described as being relatively weak.¹ Fluorescence tests for uranium, therefore, have usually been made by bead tests.¹ However, under certain conditions, the intensity of fluorescence in aqueous solution is strong enough to find practical application in the analytical chemistry of uranium. The test described in this paper is the result of investigations carried out employing ultra-violet light for detecting uranium in aqueous solution. It is based on the greenish-yellow fluorescence produced when a solution containing hexavalent uranium is exposed to short-wave ultra-violet radiation. It was found that aqueous solutions of uranium are much more responsive to short-wave than to long-wave ultra-violet light. Dement and Duke² report this to be true also for uranium minerals and compounds.

The test described is sensitive enough to indicate amounts of uranium that would ordinarily be detected in the most precise chemical methods,³ but not so sensitive as to give positive tests with traces of uranium. This is a highly desirable feature, since all samples should be eliminated that do not contain determinable amounts of uranium. However, the method can easily be made to detect smaller amounts by proper selection of sample size and concentration. The test is highly specific and extremely simple in application. Moreover, it uses up none of the sample, so that if uranium is present the solution examined may be carried on through the quantitative determination. The method was developed to precede a volumetric determination, using a 3 gr. sample of low-grade ore in which the separated uranium is determined by titration with 0.025 N $K_2Cr_2O_7$. Since its development, the test has been used on hundreds of samples of various kinds and has been found satisfactory in all cases.

Procedure and Apparatus

Weigh 3 gr. of the low-grade ore into a 400-ml. beaker, and dissolve with HCl, HNO₃, and HF if necessary. Add 15 ml. of H₂SO₄, and take down to fumes of SO₃. Any dark coloration due to organic material is removed by dropwise addition of HClO₄ to the fuming solution. Fume off most of the free H₂SO₄, and cool. Dilute with water to 100 ml., and heat until all soluble salts are in solution. Filter, using a little paper pulp if necessary to give a clear filtrate, and dilute to 150-200 ml.

The fluorescence test is conducted in a dark room. The eyes of the analyst should be protected by plain, colourless glasses if he is to be exposed frequently or for periods of time longer than 15 minutes. 400-ml. Pyrex beakers, chosen for their low fluorescence, are used as containers for the solutions. Place the clear solution on a dark, non-reflecting surface, with the ultra-violet lamp on the open top of the beaker. In the presence of substances that absorb the radiation appreciably, which is the usual case, the uranium fluorescence will be noted as a bright greenish-yellow line immediately below the meniscus (Fig. 1), if the eyes are at the same level as the meniscus and the solution is viewed at right-angles to the incident beam. If the eyes are lower, it will be seen that the entire under-surface of the solution is greenish-yellow. This line, although narrow, is nevertheless easily seen, owing to the

* Reprinted from Bureau of Mines Information Circular 7337.

† Of the Bureau of Mines Intermountain Experiment Station, Salt Lake City, Utah.

marked contrast with the body of the solution. In solutions that contain no substances that absorb this radiation appreciably, as, for example, water to which a very small amount of uranium has been added, the fluorescence is distributed more or less throughout the solution (Fig. 2) and is of a more greenish colour than the line described above. As the uranium content is increased, the absorption of ultra-violet light is increased, resulting in less penetration of the light and a corresponding narrowing of the fluorescent band (Fig. 3).



Fig. 1.



Fig. 2.



Fig. 3.

With large amounts of uranium, the absorption is so strong that the ultra-violet light does not get much past the surface, and the absorption again appears as a line just below the meniscus. The contrast between the brilliant fluorescent line and the rest of the solution makes a decision as to the presence or absence of uranium very simple.

Since certain substances desensitize and inhibit the fluorescence of uranium solutions, the following corroborating test should always be applied to establish definitely the presence or absence of uranium. Test the solution under light as described. If no fluorescence is noted, uranium is not present, provided no inhibiting agent is present. Then add approximately 0.025 *N* solution of UO_2SO_4 dropwise to the solution under test, stirring the solution and testing for fluorescence after each few drops. If the fluorescence shows up after the addition of a few drops, the conditions for fluorescence were favourable, and since no fluorescence was noted before the uranium was added it is fairly certain that the original uranium content was not greater than the amount added.

Should the fluorescence fail to appear after several drops have been added, or if it should appear only very faintly after

the addition of a fairly large amount of the uranium solution, it may be assumed either that some inhibiting agent is present or that the ultra-violet light is being absorbed too completely (ultra-violet light is absorbed partly by pure water). The appropriate separations must then be made to eliminate this difficulty before the test can be applied successfully. On the usual ores that are likely to contain uranium, such difficulties are rarely encountered, since the method of preparing the sample will eliminate most of the possible inter-

fering substances. Samples containing large amounts of iron may offer some difficulty, especially if large samples are taken to detect small amounts of uranium, owing to high absorption of the light. In any event, the presence of any interference will be noticed if this test is applied and the analyst can then take the proper steps to eliminate the difficulty.

Interfering Elements

There are several ions that inhibit the fluorescence of uranium solutions and at certain concentrations completely destroy it. Einecke and Harms¹ studied the effect of various ions on the fluorescence of uranium solutions, using a quartz mercury-vapour lamp emitting long-wave ultra-violet rays of 3500 Å. Although their conditions were different, the results they obtained are very similar to those obtained with short-wave ultra-violet light. The following ions were tested during this investigation and were found to have inhibiting properties: I^- , Br^- , SCN^- , $\text{Cr}_2\text{O}_7^{2-}$, $\text{Fe}(\text{CN})_6^{3-}$, AsO_3^{3-} , S^{2-} , Cl^- , HCOO^- , NO_2^- , $\text{S}_2\text{O}_3^{2-}$, Ag^+ , VO^{2+} , Fe^{2+} , Tl^+ , Tl^{+++} , MoO_4^{2-} .

The following ions have been tested and do not affect appreciably, if at all, the

fluorescence of uranyl solutions: Na^+ , K^+ , Li^+ , NH_4^+ , Ca^{++} , Zn^{++} , Mg^{++} , Mn^{++} , Al^{+++} , Fe^{+++} , Cu^{++} , Cr^{+++} , Ni^{++} , Hg^{++} , Bi^{+++} , Cb^{++++} , Ta^{++++} , Ti^{++++} , Cd^{++} , Be^{++} , Sn^{++++} , ClO_3^- , BrO_3^- , IO_3^- , SO_3^{--} , SO_4^{--} , PO_4^{--} , AsO_4^{--} , Ac^- , VO_3^- , $\text{Fe}(\text{CN})_6^{--}$, $\text{B}_4\text{O}_7^{--}$, tartrate, citrate, and oxalate. The fluoride ion is quite remarkable in that, when present in moderate amounts, it causes a very pronounced increase in the intensity of the fluorescence. This fact may be of use where greater sensitivity is desired. Too large amounts of fluoride, however, result in complete destruction of the fluorescence. Also, certain cations, such as Li^+ , Cd^{++} , and Be^{++} , enhance the fluorescence, although to a smaller degree than F^- .

Precautions with Tin Ions

Sn^{++++} does not interfere with the fluorescence. However, it may cause interference through the deposition of solid salts if the acidity is not high enough. Solid $\text{Sn}(\text{SO}_4)_2$ has a strong, golden-brown fluorescence and if allowed to precipitate will give the effect of a fluorescence in solution. In testing for uranium in the presence of Sn, the solution should be acidified strongly enough to prevent precipitation of basic tin salts.

It should be noted that visible colour does not necessarily indicate absorption of ultra-violet light. Moderate amounts of Cu^{++} , Ni^{++} , and Cr^{+++} are without great effect, and Co^{++} can be tolerated in somewhat smaller degree. However, the latter ion is undesirable, due to a masking effect of its colour. Moderate amounts of HVO_3 do not interfere seriously, even when tested in solutions of low acidity (pH 5) where its visible colour is most intense. To detect small amounts of uranium in the presence of very large amounts of HVO_3 , however, the examination should be made very carefully, since HVO_3 , like Fe^{+++} , absorbs light so strongly that large amounts may result in a very thin fluorescent line. Amounts of KMnO_4 that give visibly transparent solutions will not interfere, but with larger amounts the solution rapidly becomes opaque to the ultra-violet radiation. Although $\text{Cr}_2\text{O}_7^{--}$ has some inhibiting properties, it does not seem to interfere seriously in small amounts.

Of the above-mentioned interfering substances, MnO_4^- , $\text{Cr}_2\text{O}_7^{--}$, MoO_4^{--} , Ti^{+++} and Ag^+ should survive the initial treatment with fuming H_2SO_4 and HClO_4 . The presence of the first two in amounts sufficient to produce interference is easily detected by their colour. Their interference is easily eliminated by reduction, since neither Mn^{++} nor Cr^{+++} ions interfere, even in fairly large amounts. An excess of reductant may interfere, however, either because of its own inhibiting properties

(Fe^{++}), or by forming an inhibiting substance; e.g., vanadium, which is so often associated with uranium, may be reduced to the blue VO^{++} . The most satisfactory method has been to reduce with H_2O_2 and eliminate the excess H_2O_2 by boiling. The boiling also ensures complete reduction of the $\text{Cr}_2\text{O}_7^{--}$ and destroys the reddish-brown HVO_3 , which is formed in the presence of vanadium and which interferes if present in large amounts. Small amounts of either MnO_4^- or $\text{Cr}_2\text{O}_7^{--}$, however, may be more conveniently reduced with a little FeSO_4 , and the excess FeSO_4 oxidised by addition of KMnO_4 to a faint permanent pink. This slight excess of KMnO_4 does no harm. This method is inadvisable on other than small amounts, since it tends to increase the concentration of Fe^{+++} , which absorbs the ultra-violet light strongly. Small amounts of MnO_4^- may be reduced conveniently by slow, dropwise addition of NaNO_2 ; a small excess of NaNO_2 is not objectionable, and too great an excess can be destroyed by the addition of a small amount of urea. In samples containing incompletely decomposed organic matter, the HVO_3 may have become reduced. In such a case, the vanadium should be reoxidised with KMnO_4 , and the excess destroyed with NaNO_2 as described above.

If the test indicates that excessive amounts of either Fe^{+++} or the more highly-coloured ions are present, a separation must be made before the test can be applied successfully. A satisfactory separation may be made as follows: solid Na_2CO_3 is added to the acid solution until neutral, and then an excess of 1 to 2 gm. is added. The solution is boiled for about 15 minutes and filtered hot. The filtrate is acidified, boiled to expel CO_2 , and the test applied.

The separations of Ag^+ , Ti^{+++} , and MoO_4^{--} have not been found sufficiently complete to prevent some interference from these sources. However, these ions are so rarely encountered in uranium ores that more complete removal has not been investigated.

Discussion

This test has been applied to other problems besides the one for which it was originally developed. It has been used to detect uranium in columbium-tantalum ores after decomposing the ore by pyrosulphate fusion and leaching with dilute H_2SO_4 . It has been most helpful in checking separations employed in the conventional quantitative schemes of analysis. For instance, the precipitation of uranium as $\text{UO}_2\text{NH}_4\text{PO}_4$ from buffered acetate solution has not produced entirely satisfactory results. Examination of the filtrate from this separation almost always shows the presence of variable amounts of uranium. These amounts are usually small and may be un-

important in the usual macro-determinations, but for semimicro work on low-grade materials they may cause quite serious error. The loss occurs in the analysis of actual ore samples, although there is no difficulty in separating uranium completely from pure solutions of uranium. A Na_2CO_3 separation is used to remove iron before the precipitation of the uranium, and it may be that incomplete precipitation is caused by failure to eliminate CO_2 completely. Further work is being done on

this point. Other applications have been found in studying the amount of uranium occluded by $\text{Fe}(\text{OH})_3$ and the retention of $\text{UO}_2\text{NH}_4\text{PO}_4$ in the pores of filter paper.

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The Technologist To-day

O.C.C.A. Discussion on Post-War Problems

A PLEASANTLY unconventional address was delivered by Mr. R. J. Ledwith, B.Sc., A.R.I.C., at a meeting of the London section of the Oil and Colour Chemists' Association, held at Manson House, Portland Place, London, W.1, on September 21. His subject was "The Paint Technologist To-day," but a great deal of what he said was applicable to other technologists in all branches of industry in which chemistry plays a part. As he said, modern industries cannot flourish without help from scientific and technical workers, and the paint industry is no exception.

Paint technologists, he said, practised the science of the industrial arts, or the art of industrial science. They had a little chemistry and physics, and a dash of mathematics. They tried to develop imagination and craftsmanship, and a good deal of commonsense. In the paint industry, he urged that their relations with other departments, particularly production and sales, were important. Many of them had close contact with the men who operated the mills, mixers, and kettles. Not only was that of great value in giving them appreciation of the practical aspects of production, but they also gained the experience of working with the factory staff and getting to know them. Let them develop those contacts and help to destroy the popular fallacy that scientists were unapproachable and inhuman beings, whose work tended to destroy civilisation rather than to develop it.

Working with Sales Staff

Close co-operation with the sales staff was also of the greatest value. It fostered the team spirit, which led to efficiency by the pleasantest route. He believed that the strict segregation of industrial chemists was unwise. Regular meetings of sales and laboratory staffs should be held, so that the former might appreciate technical developments. A measure of technical knowledge in the sales department was highly desir-

able, otherwise the laboratory might be inundated with trifling queries. The senior technical staff should have opportunities for meeting consumers of their company's products; thereby they might gain a broader understanding, not merely of application problems, but also of human relationships.

Discussing the value of association membership, Mr. Ledwith pointed out that many paint technologists were members, not only of the O.C.C.A., but also of one or more other scientific societies, and thereby took part in the corporate life of the chemical profession. It seemed that there was much to be said for a unified body, possibly a British Chemical Society, which would embrace divisions of paint and varnish chemistry, agricultural chemistry, biochemistry, and so on. However, with a sturdy individualism worthy of the ancient Greek city-states, our scientific societies resolutely refused to sacrifice their identities. He personally saw no particular value in isolation for its own sake, and although members might receive little technical benefit from such a merger, yet the economic and professional status of chemists might be greatly enhanced by it. If that be admitted, it would seem logical for the central chemical organisation to be linked with other technical bodies; and the Association of Scientific Workers came to mind. There was no question that the A.Sc.W. tended to achieve improved economic conditions for chemists; some felt that the prestige of the profession would suffer in the process, but he was by no means convinced of that. Anyway, prestige buttered no parsnips!

They could always increase their reputation and influence by broadening and strengthening their relationships with colleagues in other departments, with customers, competitors, and the fellow next door. It was not done by holding a decorous meeting of the "Triglyceride and Chromophor Chemists' Association," and deciding un-animously that chemists were what the

R.A.F. calls VIP's. They could increase their prestige by being more versatile, more humanitarian, by being scientific without being pedantic. In brief, let them try to be good citizens as well as good paint technologists. If they could do that, there would be more chemists on boards of directors, on local Councils and in Parliament; and scientific methods would be applied as never before to advance the welfare of humanity.

A Lively Discussion

In the animated discussion which followed, Dr. R. F. Bowles had a few words to say about research work. His opinion was that the technologist in general was far too easily satisfied and complacent about what research he did. The glorious excuse for not doing things which ought to be done was that the laboratories were understaffed and there was not time; but he felt certain that it was not impossible in any individual case to carry on a certain amount of research, using the term in the broader sense, not restricted to academic work. Everyone could carry on a tiny little trickle of research work which would eventually bear fruit; even if they did not complete the work they would retain their self-respect as scientists and technologists, they would keep their minds broad and would be fitted to train juniors in a proper scientific atmosphere. It was always possible to spare a few minutes each day, or at least a few minutes each week. That was one way in which to make their contributions to co-operative investigation work.

Other members discussed the relative advantages of a university course in chemistry or in physics, it being generally agreed that the chemistry course was nowadays the broader in outlook. Mr. N. A. Bennett and Dr. S. H. Bell stressed the point that wartime influences had tended to concentrate the attention of physicists on to electronics; some chemists even had been obliged to become physicists despite themselves. As Dr. Bell said, what the paint and allied industries wanted (and this applies to many other industries as well) was physical chemists or chemical physicists.

Service Technologists

A number of speakers expressed concern about the training of young technologists returning from the Forces, Mr. H. A. Idle insisting that evening classes were not sufficient to bring them up-to-date. Mr. D. H. Hewitt remarked on the importance of keeping in touch with Service men by means of technical correspondence, and Mr. L. F. Dennington emphasised the value of holding informal meetings for men returned from the Forces. Mr. A. J. Goodfellow urged that such men should be given plenty

of time off by management in order to attend classes during the day instead of cramming in the evening. The chairman agreed that without this concession only the most exceptional men could regain lost ground. Reference was made by Mr. C. N. Auty to the American scheme, whereby the State saw that men who had been taken away from their work by the State were able to complete their training under proper conditions.

The chairman suggested that members who were willing to assist in providing lectures for returning Service men should get into touch with Mr. Campbell, chairman of the Association's Technical Education Committee.

TRADE WITH THE NETHERLANDS

Following the Financial Agreements with the Netherlands, and the lifting of Trading with the Enemy restrictions on current trade (see THE CHEMICAL AGE, September 22), the Netherlands Government is now prepared to consider the issue of import licences to private traders for the import of goods into Holland. A certain number of goods will; however, on representations made by H.M. Government, continue to be procured by the Netherland Office for Relief and Rehabilitation.

Exporters are advised that for administrative reasons the issue of import licences by the Netherlands authorities is likely to begin gradually, and there may be some delays at first. Orders at present in course of negotiation for supply through the Netherlands Office for Relief and Rehabilitation will continue to be handled by them, while fresh demands originating in Holland will, so far as possible, and as the Netherlands Government determines, be handled by private trade.

U.K. exporters wishing to sell goods to traders in Holland should advise their customers to apply to the Dutch authorities for an import licence and they should themselves apply to the Export Licensing Department of the Board of Trade, 4 Fenchurch Avenue, London, E.C.3, in the normal way if the goods are subject to export licensing. Similarly, the Import Licensing Department, 1-6 Tavistock Square, London, W.C.1, is prepared to consider applications for licences to import from Holland goods which do not come under an Open General Licence.

Application for shipping space for exports to the Netherlands should be made to the Netherlands Office for Relief and Rehabilitation, Marine Forwarding Department, Stratton House, Stratton Street, London, W.1.

Chemical Progress in South Africa

Raw Materials Required

CHEMICAL manufacturers in South Africa, as elsewhere, hope that import controls will soon be lifted. Although this will mean that in many cases oversea exporters will be able to land increasing quantities of competitive lines in the Union, this is not a source of concern to the local chemical industry, which has been built up to its present state largely without the aid of protection. The absence of control should facilitate the import of raw materials. It was recently pointed out in Johannesburg in an address to the Transvaal Chemical Manufacturers' Association that the development of South African chemical industries had been continuous and progressive in the past few years. On the basis of plant and equipment, the chemical industries ranked fourth in importance in the Union, coming after heat, light and power; metals; and food. They ranked third in gross value of output, coming after food and metals, and sixth in employment. This development was not due to artificial stimulus, but to diligent research and hard work.

Research Plan

A chemical engineer, Mr. J. E. Worsdale, manager of the Cape Portland Cement Company, stressing the vital need of research in the chemical industry, has suggested a plan of action. He said that the American statistical method of linking research with the value added in the course of manufacture was a logical one. A suitable level for industrial research expenditure in South Africa would be one per cent. of value added in manufacture which, with the present industrial activity, would mean £1,200,000 a year. This sum would pay the services of 750 professionally trained workers and 750 workers of a lower grade.

In order to purchase additional plant with which to increase the output of their factory at Roodepoort, Anglo-Alpha Cement recently increased their capital from £1,000,000 to £1,500,000 by the creation of 2,000,000 additional 5s. shares. Of these 1,087,742 were issued at 6s. per share, the balance being held in reserve. It is expected that shipments of the new plant will commence shortly and that the extensions will be completed early in 1946.

Before the war a considerable range of British polishes for various purposes were imported by the Union, and a number of retailers are hoping that in the near future they will again be able to stock such lines. British polish, however, is likely to meet with more competition in South Africa, mainly from the branch factories which famous British manufacturing firms have established in the Union, and also from the

purely South African companies which have been developed during the war. The South African factories are now producing not only floor and furniture polish, but also liquid metal polishes for chromium, silver, and other metals, and also various sorts of powders for cleaning windows, etc. Other recently established firms are producing quick-drying lacquers, thinners, varnishes, and stencil inks.

The Drug Trade

The pharmaceutical side of the chemical industry has also undergone considerable development during the war, but in many cases it has been found less expensive to import drugs and preparations rather than to continue their manufacture in the Union. South African production of penicillin is now virtually at an end, as most requirements can now be obtained from America. On the other hand new companies that began the production of patent medicines, household remedies, and herbs and medicines for the native market are hoping to extend production. Many of these factories also produce dyes, perfumes, soapless shampoos, and white shoe cleaners. It cannot be said that in every case these products are of equal quality to those formerly imported, and it is likely that where the quality of the South African product is not all it should be, it will fail to meet overseas competition, for the South African consumer only seems to prefer the local product when it can be compared favourably with that imported.

Recently, a report was issued in South Africa stressing the need to make greater use of discarded hides and hoofs for the production of glue and gelatine, and also possibly neatsfoot oil for tanning. In a few local factories all this waste matter is used, but in others it is either discarded or not taken from the abattoirs. The shortage of bonemeal in South Africa is still acute, as a very low percentage of bones is reaching the fertiliser factories. The prevailing shortage of glue and gelatine might also be relieved if more oddments of hide reached the factories. Several new glue and gelatine factories have been established and if they can obtain the raw materials it is possible for them to provide the bulk of the needs of this market, but the main problem is how to keep the factories supplied with sufficient raw materials.

Dehydration, canning and other forms of food processing have undergone great development during the war. In fact, the industry is now so large that pressing problems may have to be solved in the near future.

Reconverting British Industry

Board of Trade Service

DURING the six months that have passed since the Location of Industry Planning Room was transferred from the Ministry of Production to the Board of Trade building at Millbank, Westminster, it has been visited by the representatives of more than 400 firms contemplating new factory building or the acquisition of space in Government-owned factories or on trading estates, states the *Board of Trade Journal*.

To undertake the duties laid upon it under the Distribution of Industry Act, 1945, the Board of Trade must be in full possession of all the facts about industrial location. A first step was taken in 1943, when a series of comprehensive reports was made by the Board of Trade, covering more than 100 different localities. The next step was made in the summer of 1944, after the publication of the White Paper on "Employment Policy." This was the compilation of statistical data about the industrial structure and the trend of employment and unemployment in every part of the U.K. While the Distribution of Industry Act provides for special measures, including financial assistance, to be taken for the Development Areas, it is highly important for the industrial well-being of the country that the Government should be informed about every locality.

The Board of Trade therefore took over the Location of Industry Planning Room, established early in 1943 by the Ministry of Production, to inform the Supply Departments of the most suitable areas for setting up new capacity for munitions production. It provides detailed information, readily available, about all factors that have a bearing on the location of new factories, and a central service to industrialists.

Industrial Information

As far as possible, the information is presented in the form of a panorama of maps and charts showing the degree of unemployment in each local office area of the Ministry of Labour in the immediate pre-war years and the current labour supply situation.

Particular attention is paid to the Development Areas, and four large-scale maps show the boundaries of each, indicating the sites of the Government-owned factories, the position of the trading estates, both existing and proposed, and the factory building schemes in progress or approved. Pamphlets explain facilities for leasing factories in the Development areas, either on the trading estates, or on individual outside sites selected by prospective tenants.

As the Board of Trade is responsible for the disposal of Government-owned factory

and storage premises, full details, including lay-out and plans, of all premises becoming available for disposal are centralized in the Planning Room.

Information in card-index form is maintained about gas, water, and electricity supplies, transport facilities, and drainage for each locality in the country. Another card-index lists geographically the name, address, type of industry and size of every factory employing 100 or more workpeople. Maps indicate railways, roads, and canals, and the areas of the electricity supply undertakings. Reference books include a collection of industrial guides and handbooks issued by local authorities. This information is available in duplicate, and tabulated statistics in the regional offices of the Board of Trade. With this as a basis, more detailed information about local industrial facilities is being built up in each region to supplement the work of the Planning Room in London.

Fuel Efficiency

New Bulletins from the Ministry

COMBINING power generation with heat supply for process and space heating is a subject which should be approached from two directions: one purely technical and the other economic. The difficulty has been to obtain a comprehensive and reliable guide to both sides of the subject and the many questions involved. The greatest need has been for a review of the main principles which would be readily understood by those in authority who might not be quite at home with the more intricate technical considerations. A publication of that nature is now available and we commend it to the notice of every managing executive and engineer at plants where electric power and heat are required on any scale. It is one of the latest Fuel Efficiency Bulletins (No. 40) issued by the Ministry of Fuel and Power.

There are a number of ways of recovering and using waste heat from furnace flue gases. But whether, and to what extent, it might be possible to recover the heat depends on economic factors and on technical considerations. The answer is influenced by such things as the size of the installation, the cost of the heat recovered in relation to the cost of other sources of supply, and the possible uses to which the heat might be put. Another new bulletin (No. 42) from the Ministry of Fuel and Power goes very thoroughly into the whole question and we recommend all furnace owners and users to study it. The bulletin provides specialist knowledge on this very important subject of recovering waste heat from flue gases and is a further valuable aid to fuel economy and a higher standard of efficiency of fuel usage.

Belgian Chemical Exhibition

A Comprehensive Programme

From a Special Correspondent

AT the official opening of the Belgian National Exhibition of the Chemical Industries, which was held at Charleroi from September 12 to 21 (see THE CHEMICAL AGE, September 15), M. Solvay, president of the honorary committee of the exhibition, gave an address on "The Situation and Role of the Belgian Chemical Industry." He pointed out that, during the five years of war, Belgium's chemical plants, as far as they had not been destroyed, had become worn-out and obsolete, and now needed almost complete replacement. In the meantime, an entire new chemical industry had grown up abroad, based very largely on coal, and while Belgium had all the assets—coal, electric power, skilled workers, and enterprise—it would need very great efforts to recapture a satisfactory place in world markets and conquer the unemployment that the war had left.

Metallurgical Chemistry

In addition to the usual exhibition stands provided by leading Belgian chemical firms, a series of papers were read by chemical engineers, under the general chairmanship of M. A. R. Mathis, professor at the Special School of Technical Engineers at Charleroi.

Each day of the exhibition was devoted to a specific branch of the chemical industry. The first day was devoted to the iron and steel and coking industries, and papers were read by M. J. Bosquet, joint chief engineer of the Union Chimique Belge and professor at the Free University of Brussels, on "The Use of Silica in Batteries of Coke Ovens," and by M. A. Lefèvre, an engineer of the Central Administration of the Soc. Solvay and a professor at the Mons Polytechnic, on "Soda and the Iron and Steel Industry." On the second day, dedicated to the memory of Dr. L. H. Baekeland, and devoted to the metallic construction and electrical industries, papers were read by M. J. Barbier, chief service engineer of the Plastics Division of the Soc. Belge de l'Azote et des Produits Chimiques du Marly, on "Plastic Building Materials," by M. M. Ledocq, chief service engineer of the A.C.E.C., on "Salt Baths and the Thermal Treatment of Alloys," and M. Scohy, director of the chemical laboratory of the Soc. Internationale d'Electricité, on "An Experimental Study of the Corrosion of Boiler Plates." The third day was devoted to the chemical industries proper, when papers were read by M. P. Colbach, sales manager of the Refractory Products Division of the Union Chimique Belge, and M. A. Debecq,

managing director of the S. A. des Produits Chimiques d'Auvelais and president of the executive committee of the exhibition. M. Colbach spoke on "The Use of Anti-acid Refractory Materials," while M. Debecq gave a well-documented survey of the Belgian chemical industry.

The chemical side of mining took up the fourth day, when M. P. Ferrero, research director of the Société Carbochimique et Carbonisation Centrale, read a paper on "Some Aspects of the Chemical Exploitation of Coal." On Saturday M. R. Arzens, president of the Association of Technicians of the Paint and Allied Industries, spoke on "Painting in Reconstruction," while M. L. Lemal, professor at the Industrial and Professional Institute of Charleroi-Nord, lectured on "The Chemistry of Hydrocarbon Semi-liquids in Road Maintenance."

The chemical aspects of the textile, paper, and hides and skins industry, were covered in the Monday session, when a paper was read on "The Belgian Industry of Cellulosic Short Fibres," by Dr. L. Delange, director of the S.A. Fabelta. A "Survey of the Dye Industry," was given by M. Ferrero, in place of M. C. Vandendries. M. E. Briehard, technical director of the Union des Verrieres Mécaniques Belges, spoke on "Scientific Research and the Glass Industry," and Mme. Lacomte, chief chemist of the Enamels Division of the Usines L. Lecomte et Fils, on "The Problem of the Adhesion of Enamels to Sheet Metals."

Agriculture and Food

On the following day, devoted to agriculture, three papers were read, one by M. Charliers, service director of the Union Chimique and vice-president of the General Bureau of Belgian Superphosphate Manufacturers, on "The Belgian Superphosphate Industry," another by M. Sauvage, agricultural research director of the S.A. Belge de l'Azote et des Produits Chimiques du Marly, on "The Role of the Agricultural Stations of the Fertiliser Industry," and the third, by M. Tilemans, on "Phytopharmacy in the Chemical Industry." The closing day of the exhibition was allotted to the food industries, when papers were read by M. A. Desoer, chief engineer of the Soc. Solvay, on "The Sterilisation of Water by Hypochlorous Acid in the Food Industries," and by M. M. H. Van Laer, director of the National Institute of the Fermentation Industries, on "Crossing Factors in Yeast Production."

New Control Orders

Rubber and GR-S

THE Control of Rubber (No. 25) Order, 1945 (S. R. & O. 1945, No. 1228), issued on October 5, frees from control under Ministry of Supply Orders gutta percha, balata, and new "GR-S" synthetic rubber. Improvement in supplies makes it possible to relax restrictions, but the Ministry of Supply remains the sole importer and distributor of "GR-S." Reasonable quantities may now be released for incorporation in goods for the export market, but until greater capacity becomes available, it will not be possible to extend the range of articles which can be made for the home market to any considerable extent. The position in respect of waste and reclaimed rubber is not affected.

Mercury

The Minister of Supply has made the Control of Mercury (No. 11) Order (S. R. & O., 1945, No. 1229), which revokes the Control of Mercury (Nos. 5 to 10) Orders and provides reduced maximum prices for mercury metal and mercurials.

The Order came into force on October 8, and from that date licences are no longer necessary for the production, use and consumption, and acquisition and disposal, of mercury sulphide red (vermilion).

Export Control Relaxed

Appended is a list of the chemicals released from export control under the Export of Goods No. 7 Order (*see p. 297*), held over owing to lack of space. An asterisk denotes that the item has been deleted in part only or otherwise modified.

Acetaldehyde; acetals; acetanilide; acetic acid and anhydride; acetone and methyl acetone; adonitol; alanine; amidopyrine; 2-aminopyridine and its salts; mono-ammonium phosphate; amyl acetate; amyl alcohol; amyl salicylate; amylocaine and its salts; aniline (aniline oil) and its salts; anilines, alkylated, and their salts, arsenious chloride.

Benzaldehyde; benzidine and its salts; benzoic acid, etc.; benzoyl chloride; benzyl chloride; bromine; butyl acetate; butyl alcohol; butyric acid.

Cadmium mass; cadmium sulphide; caffeine and sodium benzoate; caffeine and sodium iodide; caffeine and sodium salicylate; calabar beans; calcium acetate; calcium arsenate; calcium carbide; carbromal; carrageen moss; cellobiose; cellulose acetate; *cellulose nitrate (nitro-cellulose), etc.; chloroacetic acid; chlorobenzene; *chlornitrobenzene; cinchophen; *coal tar products: benzol and benzene, coumarone and its liquid polymers, high-boiling tar acids, indene and its liquid polymers, naphthas solvent and heavy.

quinoline and its salts, styrene and its liquid polymers, toluol and toluene, xylool and xylene; *cobalt compounds; copper sulphate; cyclohexanol; cystine.

Diacetone alcohol; 4:4' diamidinodiphenoxypentane; 4:4' diamidinodiphenoxypentane; 4:4' diamidinostilbene; diethanolamine and its salts, etc.; diethyl diphenyl urea (carbamite or centralite); dimethyl diphenyl urea (carbamite or centralite); dimethylaminoethanol and its salts; divinyl ether.

Ergotamine and its salts; ergotamine and its salts; erythritol; ether (sulphuric); ethyl alcohol; ethyl cyanacetate; ethylene dibromide; ethylene dichloride (dichloroethane).

Formaldehyde.

Gall nuts; gentian and its extracts; glycogen.

II-acid (amino naphthol di-sulphonic acid); hamamelis leaves; hexamine and its salts.

Ichthammol; inositol; *insecticides, *fungicides, *weedkillers, etc.; isopropyl acetate; isopropyl alcohol.

Lactic acid, etc.; lactide; licorice root and its extracts; litmus and its preparations.

Mannose; melezitose; melibiose; methyl acetate; methyl alcohol (including wood spirit); methylated spirit.

Naphtha, wood; naphthalenes, chlorinated; naphthols; naphthylamines and their salts; neoarsphenamine; neoalarsine; nitranilines and their salts; nitrobenzene (oil of mirbane); *nitrophenol; *nitro-toluene.

Oestradiol and its esters; oestrone and its esters; organic thiocyanates, etc.; ouabain; oxalic acid.

*Para-chlor-meta-xylene and preparations thereof; paraformaldehyde; parathyroid; phenazone and its salts; phenolphthalein; phloroglucinol; *picric acid; potassium chlorate; potassium guaiacolsulphonate; potassium perchlorate; potassium permanganate; pregnenolone (anhydrohydroxyprogesterone); propyl alcohol, normal; pyrethrum flower and extracts.

Quassia; quinolinic anhydride.

Resorcinol; rhamnose; rubber accelerators, anti-oxidants and vulcanisers.

Salol; salt; seilla (squill), etc.; sodium arsenate; sodium di-hydrogen phosphate (acid sodium phosphate); storax; strontium nitrate; strontium oxalate; strophanthin; strophanthus; *sulphanilamide and its derivatives; sulphanilic acid; sulphapyridine.

Tannic acid; terpeneol; thiourea and its salts; tin compounds; toluidine and its salts; toluidine blue; trehalose; triacetin; *trinitrophenol; trioxymethylene; tryparsamide; tryptophane; tyrosine.

Urease; valerian.

Witchhazel, distilled, etc.; xylose.

Zinc oxide, etc.

Personal Notes

MR. E. BROWN has been appointed a director of Eno Proprietaries, Ltd.

DR. N. L. ANFILOGOFF, who recently joined Berry Wiggins & Co., Ltd., has now been appointed a director of that company.

MR. H. L. WYNEKEN has been appointed secretary and chief accountant of Edgar Allen & Co., Ltd.

MR. F. R. KING, buying manager for Coal Carbonisation Products, I.C.I., Ltd., has been elected to the National Council of the Purchasing Officers' Association.

DR. D. C. PEPPER, a graduate of London University, who has been doing research work in Cambridge, has been appointed Lecturer in Chemistry at Dublin University.

MR. B. G. FAGAN, M.Sc., F.R.I.C., Dublin City Analyst, is to lecture on "Leaves from the Note-Book of a Public Analyst" to the Royal Dublin Society.

DR. ARTHUR C. COPE, last year's winner of the American Chemical Society's award for pure chemistry, has been selected as head of the department of chemistry at the Massachusetts Institute of Technology.

The Minister of Supply has agreed to release MR. C. T. BROCKBANK from his post as Controller of Abrasives, Graphite and Asbestos. Communications should now be addressed to the Abrasive, Graphite and Asbestos Section, Raw Materials Department, Glentworth Street, N.W.1. Mr. Brockbank will continue to act as adviser to the Ministry on abrasives.

SIR FREDERICK C. STEWART, of Cove, chairman of Kelvin, Bottonley and Baird, Ltd., and of Thermotank, Ltd., Glasgow, has presented £10,000 to the Commonweal fund of the Trades House of Glasgow. He gave £10,000 in 1942 to the University engineering department to assist in development work, and latterly gave £10,000 to the Glasgow Citizen's Theatre.

Obituary

MR. GEORGE GRANT, of Swansea, aged 53, manager of the Landore Chemical Co., Ltd., was found dead recently in an arm-chair at his home. Near him was a beaker containing crystals which smelt strongly of cyanide. Last week the Swansea Borough Coroner recorded that Mr. Grant died from prussic acid poisoning administered while the balance of his mind was disturbed. In February this year, Mr. Grant had been fined for supplying basic slag, otherwise than by authorisation of a permit, at a price exceeding the statutory maximum.

SIR DAVID MILNE-WATSON, D.L., LL.D., whose death on October 3 was recorded briefly last week, was born in Edinburgh in 1869, where he took the degrees of M.A.

and LL.D. After further studies at Marburg, Paris, and Oxford, he was called to the bar in 1896 and a year later began his lifelong association with The Gas Light and Coke Company. He filled the posts of assistant general manager, general manager, managing director, and in 1918 he became the company's eleventh Governor. He was knighted in 1927, and became a baronet ten



Sir
David
Milne-
Watson.

years later. He served for 25 years as chairman of the National Joint Industrial Council for the Gas Industry and, among his other offices, was chairman of the National Benzole Association, president of the Road Tar Association, and chairman of the British Sulphate of Ammonia Federation. During the 1914-18 war, he was a member of the Ministry of Food Committee on ammonia sulphate distribution, and of the Ministry of Munitions Departmental Committee on the position of the fertiliser trades. He became president of the Gas Research Board at its formation in 1939, and was a honorary member of the Institution of Gas Engineers, whose Birmingham Gold Medal he held. Sir David was a member of the World Power Conference, and represented the Government at the Berlin Fuel Conference in 1930, and on the committee in Stockholm in 1933. He is survived by two sons and a daughter.

DR. A. WAHL, a well-known French chemist, is reported to have been murdered at the Auschwitz camp during the German occupation of France.

MR. HAROLD EDWIN MUSSETT, who died at Purley, Surrey, on October 1, aged 62, had been chairman and managing director (for 22 years) of Shawinigan, Ltd., and chairman of the Acetic Acid Syndicate. Mr. Mussett had been associated with Shawinigan for practically the whole of his business career, and was an active and esteemed member of various trade committees. He had frequently visited the U.S. and Canada on behalf of his firm.

General News

The Soap Makers' and Fat Splitters' Federation announces that the Ministry of Food has agreed to increases in the selling prices of split fatty acids by £1 10s. per ton, and of distilled fatty acids by £2 per ton. These are operative from October 1.

Among the sums so far recorded as having been invested in savings during Widnes's Thanksgiving Week are: £15,000 (I.C.I. Staff Pension Fund); £10,000 (High Speed Steel Alloys, Ltd.); £5000 (Orr's Zinc White, Ltd.); £1000 each (Thomas Bolton & Sons, Ltd.; Widnes Foundry & Engineering Co., Ltd.).

The concentrations of piperine required for an effective insecticide were wrongly given in a recent issue of *Chem. Eng. News* and were so quoted by us (August 18, p. 159). The correct figures are: 0.20 per cent. piperine with 0.10 per cent. pyrethrins, not 20 per cent. piperine and 10 per cent. pyrethrins.

The recently-formed Society of British Paint Manufacturers has appointed Mr. C. G. Heywood, chairman of Pinchin, Johnson & Co., Ltd., as chairman, and Mr. Norman Hadfield, vice-chairman and managing director of Hadfields (Merton), Ltd., as vice-president. A secretary has been appointed, but his name has not yet been revealed, and the Society's permanent offices are not yet in occupation.

Experts from Allied European countries visited I.C.I.'s Agricultural Research Station, Jealott's Hill, on October 12. The visit has been arranged at the request of the Economic Emergency Committee of Europe to demonstrate the great advances made during the war by British chemists in connection with agriculture. The visitors were shown the latest results of British research on fungicides, insecticides, and on the first selective weed-killer, Methoxone. The newest machinery for the application of protective dusts and sprays will also be demonstrated.

One person was killed and 54 were injured when an explosion shook the chemical factory of May & Baker at Dagenham on October 5. The explosion took place in a room where the famous M and B 693 tablets were being made. An employee said that about 50 people were in the room when suddenly there was a tremendous explosion followed by a blinding glare and huge pillars of pink and black smoke billowed up. The cause of the explosion, which was heard for miles around, is not yet known, but an official stated that it may have been started by a cylinder of oxygen.

From Week to Week

Foreign News

Sulphur production has been taken up during the war in Baluchistan to meet domestic requirements.

Monacrin (5-aminoacridine hydrochloride) is being manufactured commercially in Australia, and supplies are already being exported. The product is frequently combined with penicillin or sulphonamides.

The commercial section of the U.S. Embassy in Lisbon is showing great interest in beryllium deposits in Portugal. Prospectors have been told that beryllium may be as useful as uranium in the release of atomic energy. Various types of beryllium have been collected and sent to the U.S. for testing and analysis.

The Vacuum Oil Pty., Ltd., is proposing to erect a refinery for the production of lubricating oils and bitumen. The project, which was under development at the outbreak of war, had to be temporarily shelved, but has now received the endorsement of the Secondary Industries Commission. Its annual capacity will be 4,000,000 gallons.

The incorporation of DDT and 666 in well washes, and the effect of lime on DDT, when incorporated in lime wash, are discussed in an article in the *Indian Journal of Scientific and Industrial Research* (1945, 4, 78). The article is based on experiments undertaken at the request of the Food Department of the Government of India at the Cawnpore Ordnance Laboratories.

In order that the United States may benefit fully from German progress in science and technology, a number of carefully-selected scientists and technologists are being taken to America on a voluntary basis. They have been chosen from those fields where German progress has been of significant importance and in which they have played a dominant part. Throughout their stay in the United States these German experts will be under the supervision of the War Department.

Technical information collected from secret records of the German oil industry by the U.S. Petroleum Administration shows that German laboratory techniques had been developed to a high degree. For instance, the Germans had developed a better method of olefine determination than the one now commonly used in the United States. This will save several hours in processes used daily in almost every refinery. Since 1938, they had been using a method of quantitative nitrogen analysis that, in certain phases of refining operations, is superior to the American.

New companies recently registered in Belgium include Anciens Etablissements A. Lamotte et Cie., Ans (1,000,000 fr. capital), manufacturers of and dealers in chemical products, and Applications Phytopharmaceutiques et Vétérinaires, Brussels (2,000,000 fr. capital), manufacturers of and dealers in veterinary medicines.

Large-scale production of formaldehyde on the Pacific Coast will begin with the construction of a new plant at Springfield, Oreg., by the Casein Co. of America. Expected to be in operation before the end of 1945, the new plant will produce 1,000,000 lb. of formaldehyde monthly as well as synthetic resin for the plywood industry.

The oil refinery at Martigues, in Southern France, has been put into working order and will now work continuously, at least until the end of the year, since crude oil from the Iraq has been received again since July. The oil refinery at Gonfreville-l'Orcher, near Le Havre, also owned by a subsidiary of the Compagnie Française des Pétroles, is to resume operations within the next few months.

In the Soviet Union, iodine, bromine, and chlorine are being obtained from a species of red algae, *Phyllophora nervosa*, which is found in abundance in the Black Sea. Water containing the chopped weed is electrolysed at increasing voltages, iodine being obtained at the lowest, bromine at a higher voltage, and chlorine at the highest. A concentrated solution, after further electrolysis, yields mannite and alginates.

Spain's tin industry is reported to have made progress during the war, chiefly through the increased mining and prospecting for wolfram. Salamanca, the chief wolfram area, is now a regular tin supplier, while the mine in Montejo de Torines is stated to be Spain's richest occurrence. As regards lead, the historical fields, such as Linares, La Carolina and Cordoba, have been exhausted. In future, production will have to take place in the little-explored central part of the country, the development of which would require a considerable capital outlay.

In Canada, 955 establishments operated in the chemical and allied industries last year, distributed as follows: 318 in Quebec, 489 in Ontario, 61 in British Columbia, 39 in Manitoba, 17 in Alberta, 14 in Nova Scotia, 9 in Saskatchewan, 7 in New Brunswick and 1 in Prince Edward Island. The works in Quebec accounted for 50 per cent. of the production, and those in Ontario for 42 per cent. The average employment in all works was 81,895, including about 39,000 in shell-filling and small arms ammunition, and salaries and wages for the year totalled \$135,700,000.

The conference just concluded in Paris between the representatives of the F.B.I. and of the French National Organisations of Industry, under the chairmanship of M. Pierre Fournier, has agreed to ask the Governments of France and of the United Kingdom for the complete removal of every obstacle which at present interferes with the visits of business men between the two countries.

The Government of Madras has sanctioned temporarily for one year a demonstrator and a skilled assistant for the establishment of a peripatetic demonstration party, to train villagers in the method of preparing caustic soda from alkaline earth deposits. Demonstrations will be held in selected places and the demonstrator will assist in the survey of unexplored tracts and in carrying out any laboratory work connected with the deposits and their treatment.

Forthcoming Events

October 15. Association of Austrian Engineers, Chemists and Scientific Workers in Great Britain. Austrian Centre, 69 Green-croft Gardens, London, N.W.6, 7.30 p.m. Dr. F. Eirich: "Modern Views on Colloid Science (with special reference to the ultra-centrifuge)."

October 16. Hull Chemical and Engineering Society. Regal Room, Regal Cinema, Ferensway, Hull, 7.30 p.m. Mr. E. H. Brittain: "The Origin and Development of Patents."

October 17. Society of Public Analysts. Inaugural meeting of Biological Methods Group. Chemical Society's Rooms, Burlington House, London, W.1, 6.45 p.m. Mr. A. L. Bacharach: "Biological Assay and Chemical Analysis."

October 17. Institute of Fuel. Royal Geographical Society, Kensington Gore, London, S.W.7, 6 p.m. Professor C. H. Lander: "The Importance of Team Work in the Acquisition of Knowledge as Contrasted with Individual Research" (Melchett Lecture).

October 17. Society of Chemical Industry (Food Group). Rooms of the Chemical Society, Burlington House, Piccadilly, London, W.1, 2.30 p.m. Mr. D. W. Stenart: "The Nitrogen Content of Apple Juices and its importance in Cider Making," and Mr. E. Ball: "The Raw Materials for Cider Making."

October 18. Institute of Fuel (East Midlands Section). Victoria Station Hotel, Nottingham, 3 p.m. Discussion: "The Reid Report." Opener: Mr. H. Watson-Smith.

October 18. Oil and Colour Chemists' Association (London Section). Royal Insti-

tution, Albemarle Street, W.1, 6.30 p.m. Professor E. N. da Costa Andrade: "Viscosity and Plasticity" (second lecture).

October 19. The Institute of Physics (Scottish Branch) and Industrial Radiology Group. Rooms of the Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow, 6.30 p.m. Mr. E. Thomas: "The Radiography of Welds in High-Pressure Steam Pipes."

October 19. Institution of Chemical Engineers, Institute of Physics and Chemical Engineering Group (S.C.I.). Royal Institution, Albemarle Street, London, W.1, 10 a.m.-4.15 p.m. Joint conference: "Instruments for the Automatic Controlling and Recording of Chemical and Other Processes."

October 19. National Smoke Abatement Society. Caxton Hall, Westminster, S.W.1, 10 a.m. Conference on Improved Fuel-Burning Appliances for New Houses. Chairman, Dr. E. W. Smith, C.B.E.; opener of conference, Alderman C. W. Key, M.P., Parliamentary Secretary, Ministry of Health; opener of discussion, Mr. E. H. Keeling, M.C., M.P.

October 20. Society of Public Analysts (Physical Methods Group and North of England Section). Engineers' Club, Albert Square, Manchester. 1.30 p.m. Four short papers on "Polarographic Analysis."

October 20. Royal Institute of Chemistry (London and S.E. Counties Section). London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1, 2.30 p.m. Discussion: "The Publicity of Science, with special reference to Chemistry."

October 23. Society of Chemical Industry (Yorkshire Section) and **Leeds University Chemical Society.** Chemistry Lecture Theatre, Leeds University, Woodhouse Lane, 6.30 p.m. Mr. G. Roche Lynch: "Some Medico-Legal Experiences."

Company News

Pinchin Johnson & Co., Ltd., is again paying an interim ordinary dividend of $\frac{2}{3}$ per cent.

Carbo-Lime, Ltd., Newcastle-on-Tyne, have increased their nominal capital beyond the registered capital of £100 by the addition of £3900.

Bentley, Maudesley & Co., Ltd., manufacturing chemists, Dewsbury, have increased their nominal capital beyond the registered capital of £100 by the addition of £900 in £1 shares.

Anglo-Iranian Oil Co., Ltd., reports a gross profit, for 1944, of £8,441,999 (£8,446,303). Net profit totals £5,677,142 (£5,639,122). The ordinary dividend is 20 per cent. (same).

Commercial Intelligence

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

Mortgages and Charges

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

ANTISEPTIC PRODUCTS, LTD., Maidstone. (M., 13/10/45.) September 17, debenture, to Anglo-Federal Banking Corporation, Ltd., securing all moneys due or to become due to the bank; general charge. *£1100. March 31, 1944.

FLUORSPAR, LTD., Oswestry, miners. (M., 13/10/45.) September 19, series of debentures securing not more than £20,000 and bonus of £35 per cent., present issue £12,000; general charge. *Nil. December 31, 1944.

Satisfactions

W. F. METCALF, LTD., Southport, chemical manufacturers. (M.S., 13/10/45.) Satisfaction September 24, of debenture registered June 15, 1940.

STEWARTS & LLOYDS, LTD. (incorporated in Scotland). (M.S., 13/10/45.) Satisfaction September 25, of debenture stock registered February 8, 1934, to the extent of £17,500.

New Companies Registered

Walter & Co. (London), Ltd. (399,121).—Private company. Capital, £500 in £1 shares. To acquire the business of scientific glassware manufacturers carried on by F. R. Walter and others at 2 Melville Avenue, N.W.6. Directors: F. R. Walter; E. H. Moore; P. J. Mason, research chemist. Registered office: 2 Melville Road, London, N.W.10.

Chemical and Allied Stocks and Shares

FOLLOWING the reassembly of Parliament, stock markets have continued to show a waiting attitude pending new developments in international affairs and the Government's policy. Bank of England stock remained firm on views as to the basis of compensation for stockholders, and other prospective nationalisation groups were generally firm, with home rails showing

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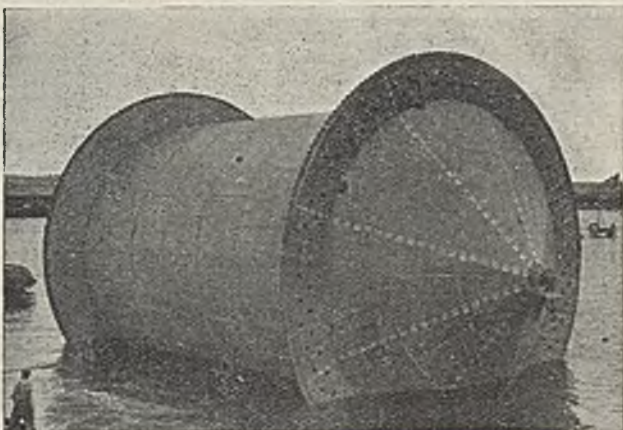
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a further rally, while colliery shares and those of electric supply companies moved moderately higher. British Funds strengthened further, accompanied by revived talk of the possibility of a forthcoming new Government loan. On the other hand, European Bonds remained reactionary, further declines of up to a point being recorded. Financial results and dividend announcements continue to show the effect of the transition. On the other hand, industrial shares remain firmly held, reflecting confidence that, when labour and material supplies are materially improved, profits in many cases are likely to show an upward trend. Moreover, there are continued hopes that E.P.T. will be reduced or abolished next year, opening up the way for improved dividends. The view persists that the forthcoming interim Budget cannot be expected to bring any important changes in taxation.

Shares of chemical and kindred companies continued firm generally, with Imperial Chemical at 39s. 6d., while B. Laporte remained held firmly and quoted around 87s. Fisons were 55s., with the units of the Distillers Co. changing hands at 115s. 9d., and Metal Box shares favoured up to 91s. 3d. United Glass Bottle strengthened to 70s. 9d., accompanied by hopes of a somewhat less conservative dividend. Forster's Glass 10s. shares were 40s. 7½d., and, elsewhere, Canning Town Glass 5s. shares changed hands around 9s. 9d. Firmness at 85s. was shown in British Oxygen, and General Refractories 10s. shares received more attention, improving to 17s. 1½d. Lever & Unilever further rallied to 51s. 9d. in anticipation of the full results and hopeful views as to the final decision regarding the dividend guarantee of Lever N.V., the Dutch company.

British Celanese have been active, but after a further rise to 35s. eased to 34s. 6d. Iron & steels firmed up, Babcock & Wilcox to 57s., Colvilles to 24s. 3d.—the last named being favoured on yield considerations—while Stewarts & Lloyds deferred were 54s. 7½d., and United Steel hardened to 24s. 3d., pending the results. Hadfields 10s. shares, after an earlier reaction, rallied to 30s. 9d., and Weardale Steel deferred shares moved up to 32s. 3d. Textiles generally became dull, reflecting uncertainty pending further development of Government policy.

Qualcast 5s. shares moved up to 47s. 6d. on the chairman's recent reference to the policy of distributing a small bonus each year. Triplex Glass 10s. units eased to 39s. 1½d. following the cautious remarks at the annual meeting. In other directions, Turner & Newall at 81s. 3d. lost part of their recent rise. De La Rue strengthened to £11 3/16, British Industrial Plastics 2s. shares were active around 6s. 9d., and Erinoid 5s. shares steady at 11s. 6d. on the unchanged 10 per cent. dividend. Amalgamated Metal shares further strengthened

to 19s. 6d., and Birmid Industries moved up to 95s. 6d. United Molasses eased to 41s. 6d. British Plaster Board were little changed at 35s. 3d. British Drug Houses rose further to 40s. Awaiting the results, Burt Boulton were steady at 26s. British Glues & Chemicals 4s. ordinary rose further to 13s. Blythe Colour 4s. shares were 22s., and Greeff Chemicals 5s. ordinary 9s. Oils were less active, Shell being 82s. 6d., Trinidad Leascholds 92s. 6d., while Anglo-Iranian at 113s. 9d. were unaffected by the full results.

British Chemical Prices

Market Reports

REPORTS from makers and distributors show that the position of the London general chemicals market with regard to supplies and prices is steady. The pressure for deliveries against contracts is well maintained and a fair amount of fresh inquiry is reported, although actual new business has not been extensive. In the soda products section, offers of chlorate, bichromate and prussiate of soda are scarce, and quotations are strong, while firm prices are ruling for soda ash, Glauber salt and salt cake. In the potash section, supplies of yellow prussiate of potash are limited, and there is a ready market for caustic potash, permanganate of potash, and bichromate of potash. In other directions, formaldehyde is a good market, and a steady demand is reported for white powdered arsenic, alum lump, and all grades of glycerine. The market for coal-tar products remains steady, with a fair amount of inquiry for export.

MANCHESTER.—Traders in chemical products on the Manchester market during the past week have had little cause for complaint regarding the rate at which the leading industrial chemicals are being taken up against contracts by users in Lancashire and Cheshire and the West Riding of Yorkshire. Fresh inquiry from home consumers for the soda products and other principal "heavies" has been moderately active, while new business has been arranged on overseas account. Among the fertilisers there is a steady demand for basic slag and lime, while a fair trade is reported in sulphate of ammonia and superphosphates. Except in one or two sections, not a great deal of new business is offering at the moment in tar products.

GLASGOW.—In the Scottish heavy chemical trade during the past week there has been an improvement in the home market, business being very much more active. Prices generally remain firm, but where altered are rather dearer. The export position remains unchanged.

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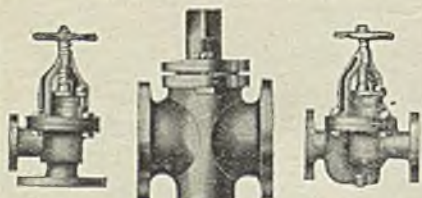
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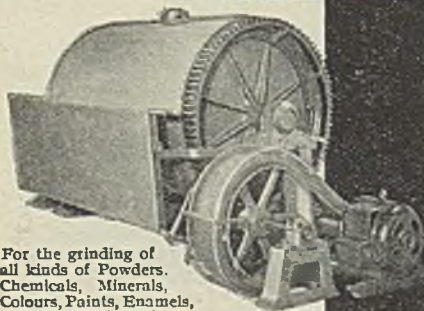
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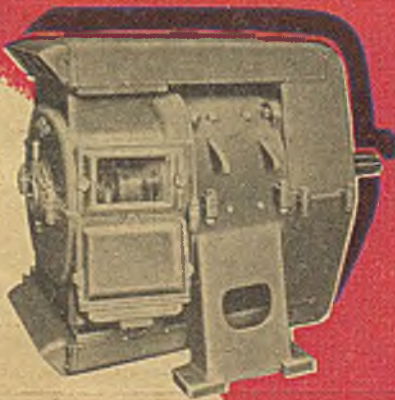
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