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CHEMISTRY & INDUSTRY

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The Chemical Society, the Society of Chemical Industry, the Association of British Chemical Manufacturers, the Institute of Chemistry, the Society of Public Analysts, the Faraday Society, the Institute of Brewing, the Society of Dyers and Colourists, the Society of Glass Technology, the Iron and Steel Institute, the Ceramic Society, the Institution of Gas Engineers, the Society of Leather Trade Chemists, the Royal Photographic Society, the Mineralogical Society, the Biochemical Society, the Oil and Colour Chemists' Association, the Institute of Metals and the Royal Agricultural Society.

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EDITORIAL

Annual Dinner of the A.B.C.M.

THE annual dinner of the Association of British Chemical Manufacturers was held at Grosvenor House, Park Lane, on the 12th inst. This banquet for it deserves such a title—is remarkable because there are no formal speeches and no reporters; the informal remarks by those who do speak are therefore rather less reserved than is sometimes the case and officials normally burdened by a sense of responsibility have been known to allude to matters of policy as they might do at their own dinner-table. On this occasion an exception was made for our distinguished guest Mr C. C. Concannon, the Chief of the Chemistry Division of the United States Department of Commerce, whose *speech is published in our pages this week.* The Association is not merely the link between the manufacturers and the Government in chemical matters; it is an active live body constantly engaged in promoting or resisting changes in policy and procedure. The annual dinner is therefore to a great extent a meeting of manufacturers, Government officials, and others who have as their common objective the prosperity of the country in general and the chemical industry in particular. Nominally our Government is a monarchy; it is commonly believed that the real governing body is Parliament operating by means of a Cabinet; the truth is that the great bulk of governing is done quietly and gently by a very efficient body of civil servants. These frame our legislation and in great measure administer our laws. They do not raise their voices in public but get on with their work as quickly and well as the population of the country allows them. Some years ago we used to enjoy the hospitality of one who knew sundry statesmen including Bismarck; at some gathering Bismarck remarked to our host: "They have compared me with Cavour; it is true that I have helped to unite the German Empire, but I had behind me the German Army which was very good and the German Civil Service which was even better; but Cavour—he made Italy; and he had behind him nothing." We are in this respect at least as fortunate as Germany. Really there is some good luck that favours us even if we do not possess a special British Deity giving us a preference over less favoured nations. Of the three parties to our Government we have a King who, like all the members of the Royal Family, does all that is possible to promote the health, and happiness, and prosperity of his subjects; he is constantly working to that end and his example is followed by his consort and their children. We have a loyal and able Civil Service and, as for our Cabinet, it invariably enjoys the confidence and respect of half the population, sometimes even a larger proportion; if it is a good Cabinet it is because we, the voters, are wise; if it is a foolish Cabinet it is because we are foolish. The Association of British Chemical Manufacturers too has been fortunate, its chairmen and general managers (its kings and civil servants) have been conspicuously successful and have built up an enduring reputation which we believe will long continue.

Industrial Chemistry

We have read with a great deal of pleasure some parts of Prof. Riegel's "Industrial Chemistry," of which a new edition has recently been published, and we hope in time to read with equal pleasure the remaining parts. During the five years that have elapsed since the first edition of this book there has been much progress and it is obvious to anyone who considers the subject that industrial chemistry to-day is very different from industrial chemistry twenty years ago and in some respects American industrial chemistry differs materially from British industrial chemistry. Prof. Riegel has included in his book not merely the chemistry that is the foundation of the chemical industry; he has also included a description of large-scale manufacture with illustrations of modern plant; his account of modern industrial chemistry is very largely elementary chemical engineering in an attractive form. Our acquaintance with the subject is not very extensive, we confess, but we do not remember any other book with so much accurate and up-to-date information about the chemical industry in a form that can be assimilated by those who are not experts. The ordinary heavy chemical industry is described, and fertilizers, cements, pottery, glass,

fuels, fermentation, cellulose, sugar, petroleum, rubber, and so on, and at the end of the book are useful chapters on chemical plant and on the materials used by the chemical engineer including modern steels and ferrous alloys. This book of nearly 800 pages will be a very useful book for the average industrial chemist to have at hand and he will soon learn his way about it and become familiar with its contents. He will learn how manifold have been the efforts of the chemist and the engineer to prevent waste of all kinds, waste of time, waste of power, waste of labour, and waste of materials. It seems that the world has not yet accommodated itself to the new conditions; we have been bred up to regard all these wastes as normal and we have arranged our civilization and our industrial conditions on that footing. Nature is very wasteful and we are always interfering with the methods of nature: we spend immense sums in finding out how to prevent beetles from devouring tropical or native timber, on preventing other insects from devouring or spoiling grain, and potatoes, and leather, and on increasing the yield of sugar beets and other produce. We can and preserve tons of perfectly good fruit and vegetables that twenty years ago would have perished from lack of attention. We employ skilled workmen with modern machinery to keep our houses and our streets clean; our workers work much harder in an hour of work than they did and they turn out very much more in the way of finished goods. Nature is prodigal of life; the weakly and the diseased die off speedily; we try and preserve to the utmost limit the most useless and the least promising of lives. One result of all this departure from the conditions of nature, the conditions under which most of us have grown up, is that we do not quite know what to do. By preventing all the waste we now have a superfluity of almost everything and we cannot use it; we must either adopt an inefficient method of getting copper out of the bowels of the earth or we must get less than can easily be got. Stainless steel that will not corrode, chromium-plated parts of motor cars, wood that resists the furniture beetle, leather that a London policeman cannot wear out, all such things are the curse of modern times. Future generations will be cursed with enduring but useless stuff inherited from the past; we shall have no end of books and magazines that no one will wish to keep at home, unless some great genius, some far-seeing Pasteur, or Faraday, or Nobel, will invent a new synthetic paper guaranteed to remain intact for twenty years and to be completely disintegrated in thirty. A thousand papers a year are read on vitamins, a thousand more on petroleum, a thousand more on scores and hundreds of other chemical topics; how many on leucocytes, and spirogyra, and the metamorphic rocks of the west of Scotland, and on figurate numbers, and vectors, and folk-lore, and psychology, and so on we do not know. Unless we take care the future generations will be smothered with an overburden of heavy material. We think even in those days such a book as Prof. Riegel's* will be valued as a record of what chemical manufacturers were doing in the year 1933.

* Published by The Chemical Catalog Co., Inc., 1933. Price $6.

Alfred Bernhard Nobel, 1833—1896

If ever a chemist led a charmed life it was Nobel, son of a Swedish shipbuilder, the centenary of whose birth falls on October 21. In these modern days anyone who dabbles or experiments with nitroglycerin is either an expert or a fool. Nobel was neither of these; for exact knowledge concerning this dangerous compound was lacking in his days, so that he could not be an expert; while a man who made two millions and a international reputation out of chemical industry could not be convicted of folly. It was rather that Nobel was careful and lucky, meeting with no such accident as befell other workers on those fickle compounds of nitrogen, as Dulong did, for example, in his studies of nitrogen trichloride. The discovery of glyceryl tri nitrate is credited to Sobrero, professor at Turin, but needed a Nobel to search out the means of checking or harnessing the violence with which the molecules of th compound disrupt themselves. The establishment of those prizes bearing his name seems to have distracted attention from the fact that he was essentially a chemi or chemical engineer, and it is as such that we think of him to-day. Two characteristics of a chemist are firstly, a power of observation of small details with th foresight to follow up the first signs of success in experiment; and, secondly, the grit and determination t carry him through when everything seems to go wrong when all previous work seems undone. That Nobel was endowed with the first of these qualities is realized b recalling to memory that day when he patched up h finger with a nitrocellulose collodion, continued workin with his beloved nitroglycerin, and observed the union of the two. And as for determination to carry on i spite of trials and tribulations, Nobel possessed a abundance. The disaster at the Heleneborg works proved fatal to the head chemist and to his brother, besides causing a paralytic stroke to his father. Furthermore his researches on "Nobel's Oil" were hampered considerably by a government prohibition brought int force after so many accidents had been caused b working with it. Not to be outdone, Nobel hired boat in a remote part of the Malarsee and continue his researches alone. Chemical science, like art an literature, has had her admirers working in attic laboratories of sorts being fitted up in these spar rooms: but stranger still is a case of a pursuer of th chemical muse who rigs up a boat in which to practis his devotions. Throughout those years so free fro accident Nobel went from one success to another. H discovery of the first dynamite, of ballistite, of fulm nating caps, and of a gauge for explosion pressures, ar examples of his inventive faculties. Fifteen factorie for the manufacture of explosives were under his contro among them being that establishment at Ardeer whic proved so well equipped for the emergencies of Augus 1914. That his success was financial as well as scientifi was shown by the estate left after his death in 189 more than £1,500,000 being reserved for the Nob Prizes. Chemistry was obviously to the forefron among the subjects in which distinguished work wa to be rewarded, so that it is by Nobel's munificenc that we are able to express our debt to Ramsay, Ruther ford, Aston, and our other great leaders.

RECENT DEVELOPMENTS IN INFRA-RED PHOTOGRAPHY*

By OLAF F. BLOCH, F.I.C., Hon. F.R.P.S.

Photography is a means of recording, and a most convenient means, since it is rapid in operation, permanent in its results, and possesses, in addition, the supreme merit of being impersonal and hence impartial. It is so docile a servant that its universal employment is not surprising.

Now photographic recording is effected by differentiation, and the sensitive materials employed are not only able to differentiate intensities of radiation, but also radiation of varying wave-lengths. This has been made possible by the discoveries of the organic chemists who have built up a large number of dyestuffs, mostly of complicated structure, which are capable of making a photographic emulsion responsive not only to those portions of the visible spectrum to which it is normally insensitive, but also to the invisible infra-red region. The ordinary emulsion already possesses high sensitivity to ultra-violet light, an amount inconveniently large for some purposes.

Visible light occupies an extremely limited portion of the radiation spectrum, the visibility limits being only from about 3900 A° at the violet end to about 7600 A° at the extreme red, and the useful sensitivity of a normal brom-iodo emulsion is from about 3200 A° to about 5400 A°, with a maximum sensitivity at 4000 A°, so that the two sensitivity ranges differ markedly. When we seek to modify the colour response of an emulsion, the usual method of employing the specific dyestuff is to add a solution of it to the emulsion before coating, or, alternatively, it may be used in the form of a dilute solution in which to bathe the photographic plate. For each dyestuff and each emulsion there is usually a relationship between the amount of dye to be used and optimal sensitizing. In whatever manner we effect this optical sensitization, the original spectral sensitivity of the emulsions remains, and indeed often preponderates.

Historical

In 1800 Sir William Herschel, using a delicate thermometer, found that heating effects were at a maximum beyond the visible red of the spectrum, and in 1840 Sir John Herschel painted a paper with a mixture of gum and lamp-black and dipped it when dry into alcohol; when this was exposed to the infra-red region of the spectrum he found that it dried in patches, thus proving the existence of groups of absorption bnes.

Ampère, in 1835, appears to have been the first to have supposed that heat rays were of the same nature as light, differing only in wave-length.

In 1840 Herschel also discovered that if photographic sensitive material which had been exposed to blue light was exposed subsequently to red light, a reversal of the first effect took place. This is known as the Herschel effect and a modification of it, together with diluted methods, has been used by Millochau and others for photographing the spectrum up to 10,000 A°.

Reprinted from the *Journal of the Royal Society of Arts*, with additions.

Another indirect method of infra-red spectrography was employed by Lehman, who got as far as 20,000 A°. This process depends upon the power of infra-red light to destroy phosphorescence. An excited phosphorescent screen when placed in the spectrum has its luminosity diminished or destroyed wherever infra-red lines fall; after exposure such a screen is rapidly placed in intimate contact with an ordinary photographic plate and the effect recorded.

The first calibration of a prism spectroscope in the infra-red was done by Mouton in 1879 employing interference methods. With the introduction of the bolometer by Langley in 1881, quantitative work received a new impetus. Rubens was a prolific worker in this field and by employing wire gratings was able to measure down to 3,240,000 A°, that is, wave-lengths of nearly a third of a millimetre.

Paschen investigated the normal emission spectrum from a black body at various temperatures, and later work has still further increased the sensitiveness of the methods employed.

Vogel was probably the first to employ dyestuffs for optical sensitization; his work is well known and deservedly so, as it gave rise to a method yielding important results.

Other early workers in this field were Becquerel and Ducos du Hauron, who used chlorophyll in order to red-sensitize collodion emulsion; the latter employed it in the three-colour process, of which he may well be said to be the father.

Abney, arguing from the fact that the absorption and sensitizing regions were close together, came to the conclusion that if he could prepare a silver-bromide emulsion absorbing blue light, it should be red-sensitive. He made, in 1880, a collodion emulsion sensitive down to 20,000 A° with its maximum in the neighbourhood of 7600 A°. He also published a map of the infra-red solar spectrum from 7160 A° to 10,000 A°.

Ritz repeated Abney's work in 1906 and claimed to have a similar emulsion in gelatin. Abney is supposed to have photographed a black kettle at the temperature of boiling water, which would mean that his emulsion was able to utilize wave-lengths in the neighbourhood of 30,000 A° to 80,000 A°. In the light of more recent work this appears doubtful, and, so far as can be ascertained, no one has been able to repeat Abney's results.

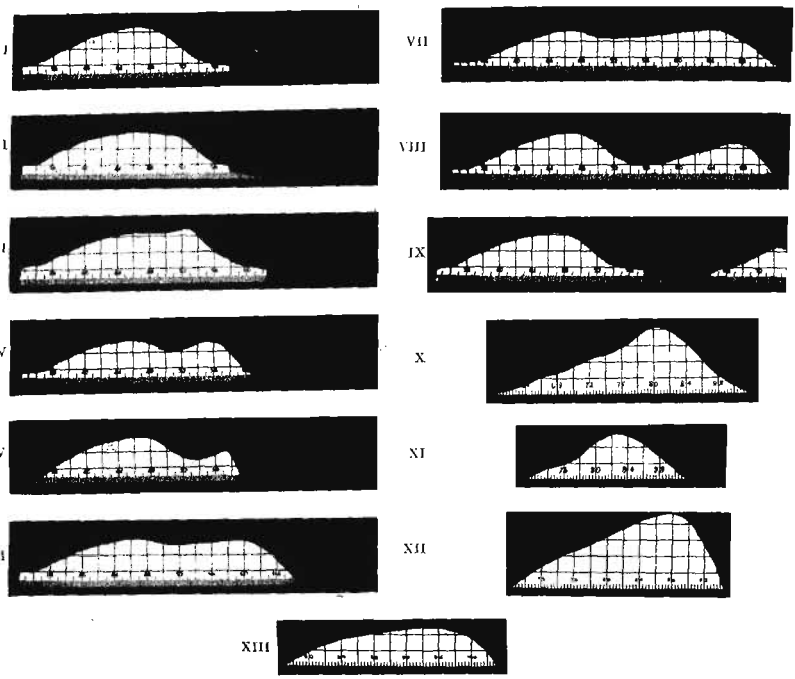
In 1891 Higgs employed Alizarine Blue Bisulphite and prepared plates sensitive to 8400 A°, whilst in 1900 Lehman used the same substance in conjunction with other dyes (*e.g.*, Nigrosine) and produced plates sensitive to 9200 A° and even 10,000 A° with long exposures. The effect of Alizarine Blue Bisulphite is probably of a different type (chemical sensitization), the action in this case being similar to that of a sulphite or a cyanide.

Vogel employed cyanine, one of the first of this important group of dyestuffs, in 1875. In 1904 Miethe and Traube used ethyl red, and about the same time Koenig of the Hoechst Works prepared a set of important sensitizing dyes of the cyanine group (Orthochrome T. etc.). Homolka discovered Pinacyanol in 1906 and Dicyanine was first made in the Hoechst Works at this period; it was the first infra-red sensitizer of this class. Using it, Meggers and McClennan photographed

down to 10,000 A° with long exposures. This dye *normally sensitizes up to 8000 A°, with a maximum at* 7100 A°.

Adams and Haller described Kryptocyanine in 1919. This dye sensitizes at 8000 A° and has its maximum effect at 7500 A° just at the beginning of the infra-red. from 7200 A° to 9100 A°, and has its maximum at 8300 A°, extending to 10,000 A° with long exposures Recently (1932) two new infra-red sensitizers have been synthesized by the Eastman Kodak Laboratory – Mesocyanine, which sensitizes from 6800 A° to 9400 A° maximum at 8800 A°, and Xenocyanine

EXTENSION OF PHOTOGRAPHIC SENSITIVITY BY MEANS OF SYNTHETIC DYESTUFFS



I. *Ordinary emulsion. Silver Brom-Iodide.*
II. *Oxocarbocyanine.*
III. *Thiopseudocyanine.*
IV. *Erythrosine.*
V. *Pseudocyanine.*
VI. *Thiocarbocyanine.*
VII. *Carbocyanine (Sensitol Red).*
VIII. *Thiokryptocyanine.*
IX. *Kryptocyanine.*
X. *Tricarbocyanine.*
XI. *Neocyanine (Red sensitivity only shown).*
XII. *Mesocyanine (Red sensitivity only shown).*
XIII. *Xenocyanine (Red sensitivity only shown).*

It has been much employed in the production of commercial infra-red emulsions.

In 1925 Clark of the Eastman Kodak Co. noticed that a new dye was present in preparations of another dyestuff. This was isolated by Dundon, Schoen, and Briggs in 1926, and called Neocyanine. It functions sensitizing from 7700 A° to 10,300 A°, maximum 9400 A°. The latter dye is very unstable and p containing it rapidly become veiled and useless u they are kept in cold storage.

Recently a new dye has been discovered in the I Research Laboratories; it has the particular mer

mitting the preparation of infra-red emulsions of considerably higher speed and general cleanliness in processing than has hitherto been possible. Its maximum is at 8100 A° and it is effective up to 9000 A°. The preparation of photographic material of far higher speed in the infra-red is responsible for the great revival of interest in the subject and the widening of its practical applications, since work which before was not practicable on account of the prolonged exposures involved, now becomes comparatively easy.

The foregoing diagrams show the gradual extension of the sensitivity of the emulsion by means of synthetic dyestuffs.

Theoretical

A few words must be said on the theory of the process of optical sensitizing.

The Grothüss theory, based upon the idea of depolarizers, and it has found supporters in Bancroft and others. Sheppard has attacked the problem from the point of view of electrostatic attraction, and, later, ideas of intra-molecular electrolysis are introduced, but the evidence is at present slender for any particular theory. Certain facts, however, are known. First, the dye adsorbed to the silver bromide is not firmly attached, since it can be washed out in the cold by employing suitable solvents, which vary in the case of particular dyestuffs. Secondly, although the dye sensitizes in the region of its absorption (always with a slight shift towards the red end of the spectrum), yet the amount of dyestuff necessary to give optimal sensitizing is often so small that its specific absorption must be very slight indeed. Yet it is sufficient to start a train of action similar both qualitatively and quantitatively to that produced by the light to which the silver halide was originally sensitive. In the case of one infra-red emulsion, for instance, the gram-molecular weight relationship between the dye and the silver bromide is in the ratio of 1 : 357,000. Attempts to measure the infra-red absorption of the same emulsion sensitized and not sensitized completely failed to reveal any difference between the two. Thirdly, the effect depends by no means only upon the absorption of light of specific wave-lengths, since dyes of the same chemical class, and possessing the same spectral absorption, vary enormously in their sensitizing power, in some cases possessing none at all. In not a few instances the mere substitution of a dimethyl for a diethyl grouping can produce marked deterioration in this respect. Fourthly, there is no evidence that there is preferential absorption on to the sensitive nuclei of the silver halide grains. It will thus be seen that little is known as yet of the mechanism of the process.

Sources of Infra-Red Light etc.

If we pass an electric current through a filament, molecular oscillation takes place, the wire becomes heated and radiation occurs; whilst the current is small and the temperature low, this radiation is confined to the longer wave-lengths, but as the current is increased and the temperature rises, radiation of shorter wave-lengths is emitted, together with the longer ones. When the filament is at a temperature of 400° C., no visible light of any kind can be seen, but some radiation in the neighbourhood of 9000 A° is now present. Dull redness occurs round about 500° C. Some experiments with an electric flat iron into which a thermoelectric recording thermometer had been inserted are not without interest. It was found that the iron could just be perceived as a grey body by the dark-adapted eye at as low a temperature as 420° C., but at 400° C. nothing whatever was visible. The iron was run at this temperature for 14 hours and the invisible image of it focused on an infra-red plate using the camera lens at an aperture of $f/4 \cdot 5$.

The original negative gives an excellent reproduction of the heat gradient in the iron, and from a measurement of the photographic densities one could interpret the heat distribution in the iron.

Daylight contains ample infra-red light for photographic purposes, especially when the sun is shining, and all high temperature artificial light sources contain more or less, varying with the temperature of the emitter. A convenient source is the ordinary gas-filled electric lamp. It is necessary to use a light filter in conjunction with the lens, which absorbs all the visible light and transmits infra-red light only. With artificial illumination an alternative method may be followed, the illuminant itself being enclosed in a lamp house which is glazed with a filter of the same type as that used in the camera. If high power illuminants are used the heat becomes very great and it has been found advisable to install a small fan blowing a current of air through the lamp houses if these are to be kept running for any length of time. One of the infra-red light filters in common use transmits from about 7300 A° onwards; this filter therefore passes the extreme visible red.

Dyestuffs in general do not possess sharply bounded absorption bands; in consequence, attempts to restrict still further the red transmission by increasing the dye concentration would so greatly increase the absorption of the infra-red itself that exposures would be unduly prolonged when such a light filter was employed. The exposure depends, as with all other photographic material, on the intensity of the illuminant, the character of the objects to be photographed, their distance from the camera, and so forth.

A certain number of dyes when in solution transmit infra-red light freely, as does also a solution of iodine in carbon disulphide, certain glasses containing oxides of iron and manganese etc. and these can serve as light filters.

Lenses do not all behave alike in their covering power, or in the distance of the image plane from the nodal point. Lee has shown that, theoretically, the image plane should be about 1/200 of the focal length further away from the lens than for white light, but some lenses show practically no difference. Recently two English firms have placed upon the market lenses which cover well and whose infra-red and visual foci are alike.

As most infra-red plates possess very feeble green sensitivity, a fairly bright yellow-green safelight containing a substance which absorbs the infra-red can be employed, and handling and processing are thus rendered easy.

A few words should be mentioned about materials. So substances which are transparent to infra-red adiation must be employed in the construction of the amera or dark slides, or if used must either be of such thickness that they no longer transmit the radiation rith reasonable exposures, or they must be backed up rith material which is opaque.

The Uses of Infra-Red Photography

It should be clearly understood that the matters liscussed in the following sections refer only to that ortion of infra-red radiation to which the photographic naterial used was sensitive, namely: from about 7500 A° o 8600 A°.

Distance and aerial photography.—The air is seldom eally clear in England because a considerable amount of water vapour is usually present: consequently, long listance vision is rare. It is well known that the shorter wave-lengths comprising the blue and violet constituents of light are more readily scattered by small particles than the longer wave-lengths constituting red light, and infra-red light is scattered even less. This principle has been adopted in the orange and yellow filters employed for motor-car headlights, but it is doubtful if these are generally sufficiently red to be of great practical value. The use of infra-red photographic material thus enables one to employ a greater proportion of the direct image-bearing light, and it becomes possible to take distance photographs in hazy weather and even to secure images of objects which are invisible to the eye because they are lost in the prevailing haze or mist. One of the earliest of these photographs, taken in 1924, is due to Dr. Wright of the Lick Observatory and shows the Sierra Nevada mountains at a distance of 150 miles. More recently, Stevens has taken an aerial photograph from a height of 23,000 ft. in what must have been an extremely clear atmosphere, showing Mount Shasta, at a distance of no less than 331 miles, whilst another photograph taken from the air, also by Stevens, shows the haze of the pampas against the Andes Mountains at a distance of 310 miles in such a way as to demonstrate the earth's curvature. There is as yet no exact information about the effect of varying atmospheric conditions on this class of work, and fuller knowledge is necessary regarding the action of variation of the dimensions of the water particles which constitute mist or haze, and also in what direction the additional presence of carbon particles constituting fog modifies the transmission of infra-red light.

The method has found some application in press photography, a notable instance being the photograph of the Cenotaph taken on Armistice Day which appeared in several newspapers. The weather was foggy, but the infra-red photographs are remarkably clear, giving a view up Whitehall to Trafalgar Square with an almost complete absence of mist. Little is known about the infra-red content of daylight, but it has been found that the time necessary to secure correct exposures can vary without any change which can be appreciated by the eye. By the kindness of Dr. G. B. Harrison I am able to show photoelectric cell records of the visible and infra-red content of daylight taken simultaneously during three days. These were made by means of two cells, one of which gives approximately visual daylight response, whilst the other possesses high infra-red sensitivity: the cell aperture of the latter was covered with an infra-red filter.

The galvanometer mirror movements are recorded on two revolving drums covered with sensitive paper. It will be seen that whilst an increase in the amount of visible daylight is sometimes accompanied by increased infra-red content, at other times there is no proportionality between the two.

Recent records have been taken continuously with the two photoelectric cells enclosed in an integrating sphere, and placed on the roof of a building. An interesting and curious feature of the result is the more rapid increase in infra-red radiation which takes place not long after sunrise, independently of the brightness of the day, that is, whether it is clear sky or cloudy.

Aerial photography presents a useful field for work and, though the photographic material at present

Ordinary plate

Infra-red plate

Newlands Corner

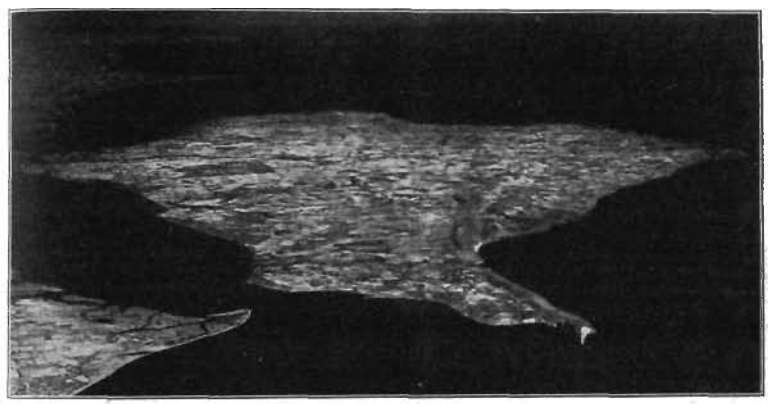
available is somewhat slow, interesting results have been obtained under favourable conditions. The combined study of photographs taken on ordinary or panchromatic plates and those taken on infra-red plates promises to be serviceable, since each photograph reveals details which are lacking on the other.

Foliage.—It is well known that when foliage is photographed by the infra-red process it is always rendered darker in the negative and lighter in the print than is normal. Indeed, when the sun is shining it photographs so dark that the prints have somewhat the appearance of a snow scene in winter. This is because chlorophyll both reflects and transmits, but does not absorb, that portion of the infra-red light to which the plates used are sensitive, and it seems reasonable to suppose that it rejects this radiation because absorption of it would not be beneficial to the foliage; leaves, therefore, will have nothing to do with it and for this reason it possibly is not quite so cool in the shade of a tree on a hot day as it ought to be!

Flowers and fruit exhibit the same phenomenon and probably for the same reasons.

The absorption spectrum of an alcohol extract of chlorophyll shows complete transmission from 6800 A° inwards.

Fabrics etc.—The treatment of fabrics with dyestuffs can produce big differences in their behaviour to infra-red light. Some coloured fabrics, though dyed with dark or black dyestuffs, reflect infra-red light strongly and might be cooler to wear in warm weather than those dyed fabrics which absorb it, but we have no proof of this. Little appears to be known about this, and the effect of variations in the method of dyeing, in the mordants used, or in the after-treatment of the dyed material, has yet to be investigated. The after-treatment is certainly of importance. Two samples of cotton were dyed with Chlorazol Steel Blue 6BS and one was after-treated with copper sulphate and potassium bichromate; in the same way, after-treatment with formaldehyde can produce marked changes. The former shows slight and the latter very strong infra-red absorption. In such cases the photographic method of differentiation might conceivably be an aid to analysis and classification. Messrs. Imperial Chemical Industries were kind enough to supply a large number of specimens of dyed fabrics; these have been examined, and the following list of specimens of cotton, wool, and silk dyed



Isle of Wight from the air, 18,000 *ft.*

to a deep colour and showing relatively strong infra-red *reflection*, is of interest:

WOOL, COTTON AND SILK DYED TO A DEEP COLOUR AND SHOWING RELATIVELY STRONG INFRA-RED REFLECTION

Chlorazol Black JHS	Chlorazol Blue BS
,, ,, BHS	,, Fast Blue 2BNS
,, Dark Black BS	,, Drab RHS
,, Steel Black 6BS	,, Brown PBS
CR ,, Black D	,, Azurine GS
CR ,, ,, A2BN	Coomassie Navy Blue GS
,, Burl Black RMW	,, Green TS
,, Black ES	Lissamine Violet 10BS
,, ,, SDS	,, ,, 6BNS
,, Fast Black BKS	,, Navy AN
,, Black PBS	,, Dark Green M
,, ,, LFS	Solway Blue RS
,, Dark Green PLS	Naphthalene Black 12BS
CR ,, Fast Green	,, ,, L
,, Green GS	,, ,, ESN
,, ,, BNS	,, ,, PR
,, Blue 2RS	,, ,, BD
,, Dark Blue BS	,, ,, AW
,, *Fast Blue FFRS*	,, ,, *ESNC*
,, Blue 3BS	,, Fast Black NN
,, ,, RWS	Acronol Indigo Blue AS
	Caledon Olive RS paste

Very little in the way of definite conclusion is at present possible, but it appears as though the sulphur

colours, on the whole, reflect but little infra-red. No general relationship appears to exist between the infra-red reflection and the visual colour.

A number of oils, varnishes, gums, and adhesives have been tested and all of them were found to be quite transparent. When these are applied to paper they render it more translucent to visible light, and the effect as regards infra-red radiation is similar. The materials which have been examined are: rape, sperm, castor and linseed oils, paraffin wax, vaseline, cellulose varnishes, indiarubber, seccotine, and among the gums, arabic, mastic, tragacanth, and benzoin. Other substances transmitting infra-red light are melted sulphur, selenium, orpiment, and realgar in thin layers. Asphaltum is more opaque.

Various materials.—It will be of interest and practical value to deal with the absorptive and transmissive properties of some common materials.

Wood.—Woods vary greatly in this respect, but in thicknesses of $\frac{1}{8}$ in. the majority of woods examined proved to be transparent, and a table of these with exposure details is appended.

Name of wood	Exposure	Photographic effect	Behaviour (qualitative) towards infra-red light
Siberian Pine	1 sec. at 6 ft. from 500-watt lamp	Considerable	Transmit freely
Balsa Wood		,,	
Yellow Deal		,,	
Sycamore		Some	
Boxwood		,,	
Beech		Slight	
Yellow Pine		Considerable	
Tasmanian Oak	5 sec. at 6 ft. from 500-watt lamp	,,	Some transmission
Cedron (Nigerian)		,,	
Gurjan		Some	
Agba (Nigerian)		,,	
Mahoborn		Slight	
Indian Teak		Considerable	
Honduras Mahogany	400 sec. at 6 ft. from 500-watt lamp	,,	Almost opaque
Jarrah (Australian)		Some	
Silky Oak (Australian)		,,	
English Oak		Slight	
Padouk (Andaman)		,,	
Australian Walnut	2,000 sec. at 2 ft. from 500-watt lamp (= 18,000 sec. at 6 ft.)	,,	Opaque
African Walnut		,,	
Blackbean (Australian)		None	
American Walnut		,,	
Indian Silver Grey		,,	
Iroko Teak (Nigerian)		,,	
Ebony		,,	

All the above specimens were $\frac{1}{8}$ in. thick

It has long been known that ebonite in thin sheet is easily penetrable and vulcanized fibre resembles it. Paper and cardboard come under the same category and are unsafe, but black paper, such as that employed for packing photographic material, is far more opaque. Since carbon black is the substance generally employed in the pigmentation of this paper, it was tested by painting lamp black on to a white paper and, as expected, was found to absorb infra-red light strongly. Celluloid and bakelite are very transparent, thicknesses of $\frac{1}{8}$ in. of these materials, without any loading, transmitting infra-red light freely. Ebonite and vulcanized fibre, in thicknesses of not less than 1 mm. and 2 mm. respectively, are reasonably safe.

Leather, such as is used in camera bellows construction, is transparent, unless it contains, as dyestuff or loading material, some substance rendering it opaque. The metals are opaque. The practical points that emerge are the necessity for the use of metal dark slides and the use of leather backed up with a material opaque to infra-red for the camera bellows.

Analysis of documents.—The usual method of procedure in dealing with erasures, blacking out, over-writing, and supposed forgeries, is the photography of these in ultra-violet light. Recently the infra-red method has been applied with success in certain cases. Bendikson, in 1932, photographed pages from a copy of "Theodore de Bry's Voyages" which is in the Huntington Library: these pages had been obliterated in black ink by the Inquisition Censor 300 years ago. The results show that the defacing ink is sufficiently transparent to infra-red radiation to permit of the successful photography of the underlying invisible printing. Many factors may affect the result. The character of the paper or parchment, the composition of the original ink used, the composition of the ink employed for erasure or over-writing, and the nature of the faded inks, which, in turn, depend upon their original composition. If the fluorescence of the paper or the ink in ultra-violet light are of the same order and if their reflective and absorptive properties in infra-red light are also alike in degree, no useful results can be expected.

A number of fragments of leather, used for writing, are in the possession of the British Museum. These are covered with hieratic script almost entirely illegible and date from about 1200 B.C., a period when the hieratic writing was passing into the hieroglyphic. These pieces of leather were frequently used more than once, the first writing being erased before the second took place. When photographed by infra-red light the photographs were successful in revealing writing so that the documents were decipherable.

Portraiture.—The taking of a photographic portrait in apparent darkness proved somewhat of a sensation, and it was the examination of these pictures that directed attention to the notable differences in the variously-dyed clothing. In general, infra-red portraits are far from flattering. In some cases they reveal hair beneath the skin of clean-shaven males, probably owing to pigmentation differences; in other cases the entire features of the sitter appear to be modified, never to advantage. In one instance of a photograph of a negro, changed racial characteristics were observed, and it is therefore possible that the process might find occasional use in ethnological studies.

A large number of studies have been made of different races of the world, chiefly those with pigmented skins. The differences are not inconsiderable and need ethnological analysis. In general, the white and yellow races do not afford such striking differences as the darkly-pigmented races, but exceptions occur, and some types of hair beneath the skin appear in the infra-red photograph, greatly altering the appearance of the sitter. An interesting point is that the eyes are dark with light-skinned people in infra-red photographs and frequently lighter for the black races.

Scientific applications

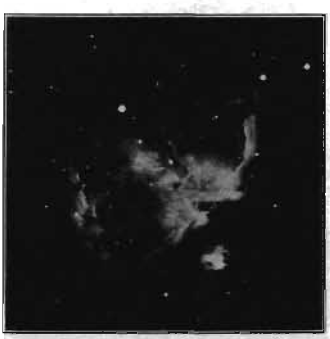
(*a*) *Spectroscopy.*—The uses are obvious and need not be dealt with here at any length. If in any spectral region photographic material can be prepared which is sensitive to that region, it can be employed by any of the usual photographic methods.

(*b*) *Astronomy.*—Considerable use has been made of the infra-red method. Prof. Wright of the Lick Observatory has taken photograph of Mars and the ordinary photograph shows the planet larger in size than the infra-red picture. It is thought that this increased image size is due to scatter of the shorter wave-lengths of the Martian atmosphere in a manner similar to that which occurs in the terrestrial atmosphere. For the same reason (diminished scatter in the infra-red) the infra-red photograph reveals markings on the surface which are not visible on the ordinary plate. Trumpler, also of the Lick Observatory, has photographed the Orion nebula in this manner, and has been able to obtain images of many faint stars invisible in the usual photograph. This is because the general light of the nebula, which is chiefly in the visible

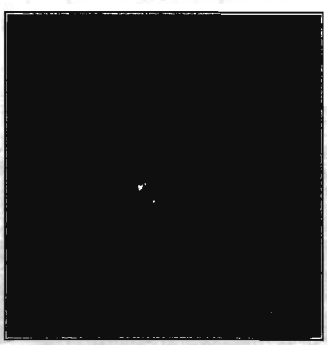
Panchromatic plate

Infra-red plate

Leather 1200 *B.C.*



Ordinary plate



Infra-red plate

Nebula in Orion

spectrum, blackens the photographic plate during the long exposures necessary, but with an infra-red filter such stars as radiate any infra-red are able to be recorded whilst the effect of the general scattered light is greatly reduced. Quite recently (1932) the infra-red spectrum of Venus has been photographed at the Lick Observatory.

Spectrum of Venus

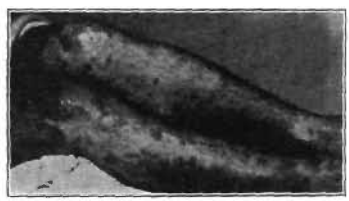
This shows the carbon dioxide bands in the atmosphere of Venus at 7820 A° and 7883 A°, which do not exist in the solar spectrum. The spectrum of Venus, apart from this, is that of sunlight reflected from the clouds in its atmosphere.

(c) *Microscopy.*—In working by transmitted light the spectral colour of the specimen, the method of preparation, and the stains used (if any) all affect the results obtainable. In those cases where the specimen is opaque, or nearly so, to visible light, but more or le transparent to infra-red, useful results may be expecte and some of the work which has been done is not witho

Orthochromatic plate

Infra-red plate

Lupus



Orthochromatic plate

Infra-red plate

Eczema

promise. The photomicrographs show exterior detail as well as interior structure. Focusing and exposure present no special difficulties.

(*d*) *Medical.*—As a consequence of the peculiar results obtained in portraiture, it was considered that the photography of cases of skin complaint and of those suffering from such infectious and other diseases as produced markings on or beneath the skin should prove of considerable interest. Insufficient work has been done to make any considered statement about this, but the results so far have not been very promising. Some recent pathological work, however, has provided interesting results. Experiments upon flesh penetration have also been made, but scatter of the light has hitherto prevented any considerable degree of success.

Prof. Haxthausen of the Rigs Hospital, Copenhagen, has done a good deal of work in infra-red photography with cases of eczema, lupus, and the like. Infra-red radiation has the power of penetrating a short distance below the skin, and the photographs are able to reveal the venous circulation if this is not too deeply seated. In the case of eczema the exterior eczematic appearance of the skin is not seen in the infra-red photograph, while the varicose veins which usually accompany this condition are clearly rendered. With regard to lupus cases under treatment by ultra-violet radiation, the whole of the skin is generally covered with scab, and from the appearance it is impossible to see how clearance is going on, but the infra-red photograph ignores the scabs to a considerable extent and reveals the healed areas underneath.

(*e*) *Engineering.*—Infra-red photography has been employed to demonstrate the presence of carbonaceous matter in lubricating oils which have been used in internal-combustion engines. The efficacy or otherwise of chemical treatment of these oils with a view to preventing carbonaceous deposit has thus been made more easy to judge. (R. O. King, *Engineering*, August 25, 1933.)

Conclusion

We have seen from this discussion that a highly-specialized process such as this can have unsuspected applications, and that a knowledge of its powers and possibilities may not be without value in the course of technical work or scientific investigation.

CHROMIUM-PLATING

A NEW PORTABLE EQUIPMENT FOR THE ELECTRO-DEPOSITION OF METALS

With the rapid advances in methods and styles of plating which recent years have witnessed, it is perhaps inevitable that many attempts would be made to produce a method whereby plating may be accomplished by means other than the vat. Efforts in this direction have previously concerned themselves with the application to metal of a fluid preparation in that a mixture of chemical solutions is applied to a metal, whereupon the reaction is that a film of metal is deposited upon the surface. In many cases these preparations, notably for silver-plating, have been marketed but are not satisfactory for industrial use owing to initial cost, thinness of metallic layer and, most important, lack of durability due to want of adhesion between the surface metal and the plating.

More recently a method of deposition by a spraying process has been advocated, but it does not seem that any of these methods can surpass or even equal the deposits given by a first-class vat plater. Some years ago there appeared on the market a portable electro-plater for copper, nickel, and silver. It operated very efficiently from batteries, but naturally suffered from those defects which this means of electrical power supply induces, *i.e.*, inconstancy of current and limited working life. Since that time, however, a vast amount of research has enabled the patentee to adapt the process for use on the ordinary lighting mains, and to produce the some-what startling ability to chromium-plate by means of this portable equipment.

In these days of chromium-plate mania, the many advantages of a proved portable method of plating leap to the fore, and since it is possible to plate items *in situ*, the enormous field of shop-fronts and window fittings, cinemas, and car fittings etc. is obvious. But the equipment, by its ability to deposit any platable metal, has application in many and varied industrial fields. Particularly is this so in the chemical and food industries, where vats and jars have periodically to be replated.

In this respect may be cited a firm of food manufacturers who have, for certain of their products, batteries of steam jacketed vats, each some 4 ft. in diameter, all of which it is necessary to dismantle and send away for re-nickelling. This has to be done twice yearly and the cost of dismantling, plating, re-assembling, and testing amounts to £7 10s. per vat, a total of £15 yearly, and there are over 250 such vats. The main inconvenience (apart from cost) is that a number of the vats are out of use during the plating period. With the Portable Plater, it is possible to re-nickel the vats without dismantling, and to have the plating done overnight or during the week-end. Operating costs are considerably lower for the actual plating, a provedly durable deposit of nickel given, and, crowning advantage, the vat is out of action for a matter of hours only. This is but one aspect of the use of this process, some technical details of which follow. The illustration conveys a good idea of the noteworthy compactness and mobility of the Chromium Portable Plater. In operation the electrical equipment is connected to a suitable current supply (from either power or lighting main), the plating lead plugged in and the spade anode connected to the plug. The surface of the work to be plated having been prepared (with the portable buffer if needed) and cleaned with the special grease-free and grease-removing polish, the cathode clip is placed in contact with the work, the set switched on and the bulb of the plating spade having been filled with electrolyte from the stock jar it is passed smoothly and steadily over the work. The result is a perfect deposition of the metal plated, a deposition, moreover, which is so "bonded" or "merged" to the metal base that peeling or stripping cannot occur.

The efficiency of the process is fully certified by such authorities as the National Physical Laboratory, Sheffield Testing Works, and the Faraday House Testing Laboratories, and their findings have been verified by the tests of industrial users.

Since the bulb reservoir of the plating pad contains the chemical solution actually being used, there is no fear of the electrolyte becoming unbalanced and differing in density. These solutions are made under the supervision of a competent analyst and are suitably tested before being issued.

The speed at which a metal is deposited, and the quality and durability of the resultant deposit depend on the current density, or number of amperes per square foot of anode. For example, 10 amperes on 4 sq. ft. equal a current density of 2½ amperes per sq. ft. It is therefore an advantage to have as high a current density as possible since the higher the current density the more rapid and better the deposit. However, the current density cannot be raised indefinitely in the bath, since burning of the metal takes place, unless there is a corrective introduced. The usual means is an agitation of the electrolytic solution; by this means platers using the vat process have been able to some degree to increase the current densities, but these in comparison with the new process are very low.

With the Portable Plater much higher current densities are possible than by the bath method; so that the rate of deposition is greatly increased. The U.S. Bureau of Standards issued a table in which it is shown that the vat process necessitates one hour for the deposition of 0·0005 in. of nickel and 0·0002 in. of chromium at 100 amperes per sq. ft., whereas the new process deposits 0·0005 in. of nickel and 0·0002 in. chromium in five minutes. These claims are substantiated by authoritative tests which have been carried out by research and Government laboratories.

Until now the plating of metals electro-chemically has been confined to the workshop and the hands of the experts. With the Portable Plater no special technical knowledge is needed. Unskilled men are efficient after only a day or two of routine training which is given, if needed, by the company. Simplicity of operation is a keynote of the process. Copper, nickel, cadmium, chromium, and silver are electro-deposited with equal facility by the Portable Plater, and the deposits are so "merged" to the metal base that peeling and stripping cannot occur—thus the plated surface is good for years of service and will stand heat and bending tests of a severe nature. Additionally, there is absolute freedom from irksome working regulations, special ventilation, etc.

The apparatus is approved by leading industrial manufacturers, chemical works, scientific instrument makers, etc., and the easy mobility of the equipment enables it to be moved to various parts of a building, and the ability to plate *in situ* results in enormous saving of time and labour. Further, it is the only known means for the plating of those fixtures which are too large for the bath, or which it is impossible or inexpedient to dismantle.

The outstanding advantage of the Chromium Portable Plater and its process may be stated as follows: it is not necessary to lay-out a factory and instal expensive plant in order to do plating. There is freedom from troublesome regulations, and operators are free from the dangers attached to bath-plating methods. The plating deposit is more dense than the bath deposit. It is less liable to corrosion. Metal after plating can be bent without danger of peeling or flaking. There is practically no porosity; and there is an actual bond or merger between the plating and the metal base. Where work is done *in situ* the saving of costs is enormous. The process is practically foolproof and does not require experts to work it.

Fullest details, copies of certificates etc., and appointments for practical demonstrations will be given by the producers of the process, The Chromium Portable Plater Sales Co., 169, Hampstead Road, London, N.W.1.

NATIONAL INDUSTRIAL RECOVERY IN AMERICA

The annual dinner of the Association of British emical Manufacturers was held on Thursday, October at Grosvenor House, Park Lane, London, W. E. F. Armstrong, F.R.S. was in the chair, and C. C. Concannon, the chief of the Chemistry Division the United States Department of Commerce, spoke national indnstrial recovery in America. He said:

The first question which naturally arises in a situation this kind is "What is it all about?" Why did ngress pass the National Industrial Recovery Act, own as N.I.R.A., and why has President Roosevelt up the National Recovery Administration, known as R.A., under the direction of General Hugh Johnson? ese apparently simple questions are not so easily swered. We Americans are all acutely conscious that have had a depression, that bad times are with us, l we know that we are faced with a critical situation in life of our country affecting our social structure and well-being of every one.

Several years ago economists, sociologists, students of blic affairs, and those who were following developnts throughout the world were beginning to realize it something fundamental was wrong with the scheme things. There was a *grievous maladjustment*, with oduction far outrunning in its development our thods and means of distribution. The Machine Age l arrived at a critical period in its evolution, and id development of power and machinery brought out over-expansion, over-investment, and overoduction in many lines. The rapid advance of science played an important part in this distortion of nomic relationships, and we have had inter-commodity npetition as well as inter-industry competition ching ruinous proportions. "Profitless prosperity" s a statement frequently heard but seldom underod, and it was not until America's unemployed workers ched millions that the gravity of the situation forced to undertake measures that might be adopted only a time of national emergency.

There are two very definite goals to be attained. The t is the relief of unemployment. That is our greatest d at the moment, and all emphasis is to be placed on putting men back to work before anything else is lertaken. The second goal to be attained is to ate some sort of economic structure whereby business be permanently improved and the conditions which e brought us to this period of economic crisis shall remedied once and for all. Without purchasing er there can be no market for the products of the n or of the factory, and until there is real purchasing er on the part of our farmers, workers in industry, citizens throughout the land, there can be no sperity. Real prosperity cannot be attained so t as productive capacity greatly exceeds, as it now s, purchasing capacity. This condition, which has n in effect for the past several years, gradually oming more acute, spells depression, and it is to come this that the N.R.A. has been set up.

nd now let me briefly review a series of events ing up to the present situation. After numerous attempts, thoughtfully planned and seriously undertaken, were initiated, it became increasingly evident that expedience and temporizing would not avail, and the people of America at the last election issued their *mandate that something must be done*. The old *laissez-faire* policy must go. One of the well-organized programmes of the past designed to remedy the situation, particularly with regard to unemployment, was the "Share-the-Work" movement. This movement was just what its title signifies, and had some success, but it was everywhere evident that brand-new theories of social organization were necessary.

Probably the first definite step forward was a Bill introduced in Congress by Senator Black of Alabama. This measure was known as the "Thirty-Hour-Work-Week" Bill. It limited the hours of labour to thirty hours per week. The obvious result of this proposed legislation would have been the end of all unemployment, but there were many other factors involved, and this simple but arbitrary limitation of hours of labour to thirty a week, though it passed the Senate, failed of final enactment and did not become law. The Black Bill, however, served an extremely useful purpose *because it focussed attention actively upon the problem*, and events then began to happen in rapid succession. Secretary of Labor Perkins came forward with suggestions to make the Bill more flexible so that different conditions in varying industries could be taken care of, and it is quite likely that the idea of government control of business came into active being at about that time. At any rate the administration took the matter *up in vigorous fashion and various proposals were made* by Senator Wagner of New York which eventuated in the National Industrial Recovery Act.

President Roosevelt signed the National Industrial Recovery Act making it law on June 16. Title I—that is the first part of the law—has to do with re-employment and industry, and is carried on by the N.R.A. Title II of the law was designed to bring relief through a vast progress of public works. *As originally designed* it was expected that all industries would file codes covering maximum hours of labour, minimum wages, and other features having to do with business ethics, with emphasis on elimination of cut-throat competition. The textile, coal, steel, petroleum, and automobile industries as great employers of labour were of primary importance and codes of fair practice for these industries have been put through the N.R.A. mill, have been finally approved by the President, and are now the law of the land regulating the specific industries involved. *Many industrial codes are in the process of formulation.* Up to the time of my departure from Washington a month ago, more than 4000 national and local codes had been received of which 1000 were of national scope. As can be imagined the task of reviewing these and of putting them to the various tests of fitness set up by the N.R.A. is enormous. To speed up matters and to take care of unorganized small employers a blanket code was promulgated. Thus *the President's Re-employment* Agreement, known as P.R.A., whose symbol is the Blue Eagle, was brought into being.

Because I think it will be of interest to you, let me quote the declaration of policy of the National Industrial

Recovery Code: "A national emergency productive of widespread unemployment and disorganization of *industry, which burdens interstate and foreign commerce*, affects the public welfare and undermines the *standards of living of the American people*, is hereby declared to exist. It is hereby declared to be the policy of Congress to remove obstructions to the free flow of interstate and foreign commerce which tend to diminish the amount thereof; and to provide for the general welfare by promoting the organization of industry for the purpose of co-operative action among trade groups, *to induce and maintain united action of labor and* management under adequate governmental sanction and supervision, to eliminate unfair competitive practices, to promote the fullest possible utilization of the present productive capacity of industries, to avoid undue restriction of production (except as may be temporarily required), to increase the consumption of industrial and agricultural products by increasing purchasing power, to reduce and relieve unemployment, to improve *standards of labor, and otherwise to rehabilitate industry* and to conserve natural resources."

Of interest to you may be that part of the foregoing which refers to foreign commerce and in this connexion I think it will be appropriate to quote from a recent N.R.A. statement announcing the establishment of an import division. "Under the provisions of the National Recovery Act, *any labor or trade organization which* has complied with the terms of the act may complain to the President that articles are being imported to the detriment of the competitive position of similar domestic articles. The President is empowered to have an immediate investigation made, and may, after such investigation, require the payment of fees or may restrict the importation of such articles. As a general matter, it was announced, the industry making the *complaint will be expected to make a prima facie case* before their request will be forwarded to the President and requests for relief may be made only after a code has been approved." I merely quote the foregoing because I consider it to be significant and it is something that has been generally overlooked.

There is naturally great interest in the success of the American recovery progress, including agricultural and public works programmes, together with the N.R.A. *To properly appraise the situation is not easy.* There are those who say that the undertaking has failed, but that is in my estimation the superficial reaction. It is true that the programme has fallen short of what was promised in the beginning, but too much should not be expected too quickly. We have been passing through the first phase of our effort, *i.e.*, mobilizing public opinion under the Blue Eagle, and we are now in the second phase in which we are endeavouring to *set up industrial codes, the magnitude of the task being* such as to almost stagger the imagination. The third and the most important phase of the N.R.A., *i.e.*, enforcement and economic planning, is yet to come.

It is a fact that more men are working owing to the efforts of the N.R.A. and if the entire undertaking accomplishes nothing more than the abolition of child labour and the improvement of labour conditions we may feel that our efforts have not been unsuccessful. "

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

The Annual Chemical Dinner will be held this year on Tuesday, November 28, in the Hotel Great Central, Marylebone Road, London, N.W.1, when Lord Leverhulme will act as Chairman. The tickets are 12s. 6d. and cover the cost of the dance which follows the dinner. *Particulars and application forms* will be circulated shortly to all members. In the meantime the dates should be reserved.

MEMBERS ELECTED

Adcock, Cecil Milton, Grenehurst Park, Capel, Surrey. Chemist.

Bage, William Reginald, c/o Messrs. Cranfield Bros., Ltd., Dock Roller Mills, Ipswich, Suffolk. Cereal chemist.

Barratt, Sydney, Messrs. Albright & Wilson, Ltd., Oldbury, Birmingham. Research chemist.

Burrage, Leslie J., "Waverley," 252, Perth Road, Ilford, Essex. Research chemist.

Carter, Dr. John Stanley, 26, St. John's Road, Golders Green, N.W.11. Inspector of alkali, etc., works.

Cooper, Jack Herbert, Frank Cooper, Ltd., Victoria Works, Oxford. Analytical chemist.

Correia, Charles Albert, 14, Broad Street, Georgetown, Demerara, British Guiana. Wine manufacturer and farmer.

Cowen, William, College of Technology, Manchester 1. Lecturer.

Coward, John Nelson, Lakeland House, Coniston, Lancashire. Scholar.

Elmore, A. Stanley, "Threefields," Boxmoor, Herts. Engineer.

Farrant, James Clifford, 11, Southampton Row, London, W. Engineer.

Gardner, Roy, 41, Dowling Street, Dunedin, New Zealand. Analytical and consulting chemist.

Green, G. Colman, Thomson Bros (Birkenhead), Ltd., New Chester Road, Birkenhead. Glue and gelatine manufacturers.

Heim, Siegfried, Tower House, Trinity Square, E.C.3. *Chemical merchant.*

Hirst, Fred, Research Station, Campden, Glos. Director, *research station.*

Humberstone, Harry William, c/o Shell-Mex & B.P., Ltd., Jarrow-on-Tyne, Durham. Installation manager.

Jorgensen, Holger, Dansk Gærings-Industri, Ltd., 12, Snaregade, Copenhagen, Denmark. Chemical engineer.

Keys, O. Hilton, 35, Mersey Street, Island Bay, Wellington, S.2. Analytical chemist.

Lee, Clarence O., c/o Freeport Sulphur Co., 122, E.42nd Street, New York, N.Y., U.S.A. Mining engineer.

Lee, Herman, 81, Whitchurch Gardens, Edgware, Middlesex. Analytical chemist.

Lewin, J. Upton, 46, Alicia Avenue, Kenton, Middlesex. Analytical chemist.

Mason, Cecil (*restoration*), 145, Rose Street, Beckenham, Christchurch, New Zealand. Chemist.

McDowell, Richard Henry, c/o Messrs. H. P. Bulmer & Co., Ltd., Cider Makers, Hereford. Works chemist.

Potter, Col. C. K., Little Lever, near Bolton. Chemical manufacturer.

Rawstron, Frank C., 54, Astley Road, Handsworth, Birmingham. Chemist.

Rosenthal, Alfred, 3, Riffel Road, Willesden Green, N.W.2. Colloid chemist.
Shuler, Millard King, 42, Rue Royale, Brussels, Belgium. Mining engineer.
Slater, *William Kershaw*, Dartington Hall, Ltd., Totnes, South Devon. Managing director.
Spencer, Wilfrid Devonshire, 152, Princes Road, Liverpool 8. Chemist.
Stegeman, Richard Alan, 509, South Fourth Street, Champaign, Illinois, U.S.A. Scholar.
Thomas, *Brynmor, Agricultural Department, Armstrong* College, Newcastle-on-Tyne. Analytical chemist.
Turabull, R. H., Messrs. J. R. Hutchison, Ltd., P.O. Box 2280, Calcutta, India. Merchant and chemist.
Van Dillen, Proefstation West-Java, Buitenzorg, Java. Chemical engineer.
Villalba, A. M. *Barriga (restoration)*, Laboratorio de Quimica, Apartado 1005, Bogota, Colombia, South America.
Wattleworth, Douglas R., Windsor Lodge, Moresby, Whitehaven. Chemical engineer.
White, Lawrence Aubrey, Eynsford, Hawks Hill, *Fetcham, Leatherhead. Consulting* engineer.

Associate Members

Drake, J. V., "Alixon," Woodstock Road, Barnsley, Yorkshire. Chemist.
Howell, William James R., British Vegetable Parchment Mills, Ltd., *Northfleet, Kent. Analytical* chemist.
Munday, Charles Walter, "Sherbrook," East Runton, Cromer. Student.
Walker, Edward Neil, Rock House, 98, St. Paul's Road, Smethwick, Staffs. Chemist.

LONDON SECTION

A large number of members attended the first meeting of the session of the London Section held at Burlington House on October 9, with Dr. J. J. Fox presiding. The first part of the meeting was devoted to a paper by A. B. P. Page and O. F. Lubatti on "The Application of Fumigants to Ships and Warehouses." This paper appeared in the Transactions of the JOURNAL, October 6, 1933. Dr. Page remarked on many points of interest in the paper, and a number of slides was used to show how the work was carried out and the significance of the results.

A paper on "Tung Oil: Chemical Studies and Specifications" was then read by Dr. L. A. Jordan, and an interesting discussion followed. The paper will be published subsequently in the Transactions.

CHEMICAL ENGINEERING GROUP

There was a large attendance at the first meeting of the session of the Chemical Engineering Group at Burlington House on Thursday, October 12, when Mr. George Cadbury gave an interesting lecture, illustrated by lantern slides and a film, on "The Canning of Fruits and Vegetables." Mr. W. A. S. Calder, chairman of the Group, presided.

Mr. Cadbury gave a general survey of the canning industry and drew attention to the outstanding economic, chemical, and engineering problems with which it was faced. Whereas the output of cans of fruit and vegetables in 1927 in this country was estimated at 7,840,000, the figure for 1932 was 50,000,000. In the same period the imports of canned fruits and vegetables had increased in volume by 15%, but the value has decreased by 10%. It was interesting to note a consumption in this country of 2¼d. per head per week, as compared with 7d. in the United States. At the same time, owing to over-stimulation and consequently over-production, coupled with the phenomenal fall in prices of imported canned goods both from the Dominions and from other countries in spite of tariffs, the further erection of *canning plant and machinery in this country was unlikely* and inadvisable during the next two years.

The automatic can-making machinery now in use in this country was largely imported from America, although British firms had made considerable improvements in it. At the same time it was recognized that although the canning industry here had only been in existence for 7 or 8 years it had had the benefit of 25 years' experience in the United States. One of the greatest problems facing canners here, however, was to know how far it paid to put down elaborate plant for such a short season, 3 to 4 months, as we have in this country. With this factor in mind it was suggested that the advance of canning machinery must necessarily be slow if it was elaborate and expensive in the first case. It was regarded as essential that the machines should be simple to operate, not liable to jamb, and had to be put up at a low first cost so as not to involve heavy overheads during the 8 or 9 dead months of the year. In the absence of products which could be manufactured during the dead season, difficulties of an economic nature would continue to be encountered, and it was hinted that some form of rationalization of the industry would be necessary.

Mr. Cadbury spoke of the need for accurate scientific control from the time of the planting of seed to the finished product, and the National Mark Committee was working with this end in view. For that reason it was regarded as essential that growing should be on the large scale and that the small-holder would have little or no place in the canning industry because of the difficulty of applying scientific control to his operations.

All tin used was lacquered with a double coating of a special lacquer which, it was stated in the discussion, consisted of pure fossil gums, refined oils, and diluents, the degree of success depending upon the skill with which the mixture was made. In the case of vegetables a special sulphur-resisting lacquer containing zinc was used, which did not discolour with the presence of sulphur compounds. The lacquering was to prevent the reaction between fruit acids and the metal, and the valuable work done at Campden in this and other directions was fully acknowledged.

One of the problems that had faced canners had been that of providing a continuous-pressure cooker for vegetables. Machines had been devised in both this country and America that by means of transfer valves received the sealed cans, transferred them to the interior of the machine, cooked and delivered them over another transfer valve into the pressure cooler and thence by a further transfer valve to the open air. These machines were very ingenious, but it was considered very doubtful how far they were a paying proposition owing to

the very short time during which they could be utilized. A new type of pressure cooker and cooler had been developed which was vertical and was said to be much favoured as it occupied little space, consumed less steam, used less labour, and ensured exact uniformity in processing and cooling. The machine was fed by a rotary valve so that the cans entered and left the cooker and cooler through steam-tight valves. The cans were carried upright through the machine so that no shaking of the product occurred and as a result of the continuous movement it was possible to use a shorter period for processing, thus improving colour whilst at the same time effecting perfect sterility.

Another source of difficulty with canned vegetables was what was known as "flat sours." This arose from a type of thermophilic bacteria which had the curious property of being active only at temperatures round about 130° F. The origin of the germ was difficult to trace, but it was generally found in sugars which had come from an infected sugar factory. It was difficult to remove from the plant, as steaming, unless extremely effective, was generally of very little use, the only method of dealing with it being an abundance of washing with cold water. It was only when the can was opened that the effect of this bacteria was seen, in that the contents had become mushy and sour.

The importance of maintaining intact the film of lacquer was emphasized and for that reason the system of stamping lids by impressing code marks upon them had been given up as it had been found that the lacquer inevitably cracked at the edges of these code marks and gave rise to points where corrosion took place allowing air to enter and deteriorate the contents of the can.

A large number of members and visitors took part in the discussion. Dr. W. Cullen emphasized that the development in the canning industry had not been due to the initiative of the farmers but to the tinplate manufacturers. He asked for details of the lacquer used (given above) and suggested that small-holdings might be developed in conjunction with the canning industry, a point which subsequent speakers and Mr. Cadbury did not subscribe to. Some references to the purchase of tinned goods which did not conform to the description on the labels led to replies by representatives of British Canners, Ltd., that the efforts at standardization now being made by the National Mark Committee were gradually eliminating the bad work which had been done by the inefficient canners who were the first to operate in the early days of the industry. It was emphasized that British canners were now building up a reputation upon which the public could rely.

Dr. S. G. Barker referred to a machine he had seen operating in Germany which made up containers from a special form of paper for such foodstuffs as butter and jams, and asked whether something similar could be adopted for fruits and vegetables and so overcome the troubles encountered with tinplate. This paper, he said, withstood heat and acid but not alkali.

Mr. A. Samson speaking on the question of stamping lids said there was really no danger of damaging the enamel if the work was carried out in an efficient manner. He had seen stamping to a depth of two or three inches without damaging the enamel. The chemical problems in the canning industry however were more important than the engineering ones because the greatest progress so far had been made on the engineering side. Without the double seaming machine, for instance, there might be no canning industry at all. Many problems remained to be solved in regard to heat penetration, head space *in vacuo*, temperature, etc., but these were not so difficult as the chemical problems to be dealt with.

Major H. J. W. Bliss inquired as to the need for sugar solutions in canning fruits and inquired if, as in bottling, the process could be carried out with water only. He also asked why iron, perhaps treated with an anti-rust composition, could not be used instead of tinplate.

Major L. J. Barley suggested that the possibility of quick freezing of fruit might enable it to be stored for a sufficient period to allow of the canning factory operations being extended over a much longer period. Mr. K. D. Brough said it would be possible to keep fruit subjected to quick freezing only for a matter of ten days or a fortnight and the large amount of storage necessary would not justify the process. Speaking of the use of lacquer he said this was mainly for the purpose of preserving the colour of the foodstuffs because the acid reaction between the food and the unlacquered tinplate gave rise to nascent hydrogen which broke down the colour.

Mr. Cadbury in the course of his reply to the discussion said he could not imagine paper containers for fruit and vegetables withstanding the punishment they would receive in the cooking and subsequent processes. Cellulose had been tried but was not yet successful although it had advantages in the form of lids for display purposes only. Other metals than tinplate had been tried but none of them had been really satisfactory. As to the use of water instead of syrup, he pointed out that bottling was only a sterilizing process and that the fruit has to be cooked before it could be served. If water were used in canning, the fruit would sink to the bottom and the result would not be at all satisfactory.

PLASTICS GROUP

The first meeting of the 1933—34 session was held at Burlington House on October 11, with Mr. H. V. Potter in the chair. A paper on "Optical Measurements of Stress in Transparent Bodies" was given by Prof. E. G. Coker, F.R.S., Dean of the Faculty of Engineering, University College, London. In the course of his paper Prof. Coker said:

Although engineers working with steel and other metals use both their elastic and plastic properties, yet nearly all their researches on the properties of materials under load relate to their elastic condition, mainly, no doubt, owing to the fact that practically all machines and structures are designed so that the members shall never be stressed beyond the elastic limits of the materials employed. Even so, the intricacies of the elastic stress distributions, encountered under the practical needs of construction, are so formidable that there is constant need for experimental research to meet new conditions, and generally very difficult ones, arising from modern demands.

Among the practical methods employed during the ast 30 years photo-elastic investigation has now taken n assured place, for the simple reason that not only an stresses be seen in transparent bodies, but they an also be measured in plane models of engineering hape. It would take too much time to develop the arious proofs that such models show the same stress ntensities as arise in their metal counterparts. It is, n fact, hardly necessary to do this as the evidence s to be found in various scientific papers and is also eveloped very fully in a recent book on "Photo-lasticity" by Prof. Filon and the lecturer.

It is therefore more profitable to spend the time in xplaining the salient features of this experimental nethod. If, for example, a simple tension or com-ression member is loaded and viewed in a beam of olarized light, it can be seen, as autochroic lantern lides showed, that each load is associated with a definite olour on the projected image, and thus registers the ntensity of stress in the member. These simple effects an be applied at once to a variety of practical uses, s, for example, to find the squeeze exerted on a short-ompression member held between the jaws of a vice vhen a given load is applied at the handle. Again, eams with holes and notches cut in them and loaded n various ways show intricate stress distributions, all f which are easily measured with great accuracy, although they defy all the efforts of mathematical nalysis.

The simplicity of photo-elastic experiment in all such ases arises from the fact that it is now possible to neasure the stress in a plane model at any and every oint by purely experimental observations which merely nvolve the reading of linear or circular scales on the arious instruments devised especially for these observ-tions, as described in the lecture. This kind of xperimental research has an extremely wide rauge of pplications, as was shown by the elastic stresses bserved in cog-wheels, thick cylinders, and built-up ailway wheels when under load. In the extensive field f machine-tool operation photo-elastic experiment has lso revealed some interesting features of the behaviour f cutting tools, described here by reference to turning, planing, and milling operations on transparent materials hich become plastic under the action of the tool and how these stresses by brilliant colours on the work and lso on the shavings removed.

Some further explorations in the plastic field were lso described by reference to over-stressed notched embers and eye bolts. The lecture concluded with a rief description of the present position of research ork on the stresses in transparent plastic materials nder load. A large number of very interesting slides as used by Prof. Coker to illustrate his remarks, and embers had the opportunity after the lecture of xamining many of the transparent models used by the cturer in his investigations.

BIOCHEMICAL SOCIETY

The 157th meeting of the Biochemical Society was eld on Saturday, October 14, in the Chemical Lecture heatre, University College, Nottingham, by kind per-ission of the Principal, following a visit paid by the Society to the works and research laboratories of Messrs. Boots, Ltd., Nottingham.

The following papers were read:

"The Determination of Minute Traces of Bismuth in Animal Tissues," by G. F. Hall and A. D. Powell. A number of the available colour reactions for the detection of minute traces of bismuth are discussed and criticised. The iodobismuthous acid method, involving extraction into ethyl acetate, in which solvent the complex iodide yields a characteristic red colour, is described, and the conditions necessary for estimation of amounts of the order of 5 micrograms are given, with particular reference to treatment of animal tissues. The test recommended is as follows:

A suitable amount of the organic matter is submitted to wet oxidation, using sulphuric and nitric acids. The acidity of the residue is adjusted, an aliquot containing from 5 to 10 micrograms of Bi is diluted to 5 c.c., and a controlled amount of potassium iodide is added (0·1 g. to 0·2 g.). If oxidising substances (*e.g.*, ferric iron) are present, hypophosphorous acid is first added to *prevent development of free iodine. The solution is* shaken with 2 c.c. of ethyl acetate and the red colour matched against control tests in a suitable comparator.

"The Chemotherapy of Derivatives of Harmine and Harmaline, Part 2," by C. E. Coulthard. Members of a homologous series of *O*-alkyl derivatives of harmol, prepared as described by Coulthard, Levene, and Pyman (Biochem. J., 1933, **27**, 727—739) have been tested *in vitro* for amœbicidal efficiency against *Entamœba histolytica* in comparison with emetine hy the method of Laidlaw, Dobell, and Bishop (Parasitology, 1928, **20**, 207). The peak of activity was found at *O*-*n*-nonyl harmol. It has been confirmed that the amœbicidal value of emetine varies with the conditions of the experiment, and it has consequently been necessary to carry out the comparison of the relative activities of emetine and *O*-*n*-nonyl harmol under a variety of conditions.

"The Metabolic Products of *Byssochlamys fulva* Olliver and Smith," by G. Smith. *Byssochlamys fulva* Olliver and Smith (J. Bot., 1933, **171**, 196), a fungus causing spoilage of processed fruits, has been grown on Czapek-Dox solution, containing glucose as the sole source of carbon, and its metabolic products examined. At 24° the sugar is completely consumed in 56 days. The main product is mannitol, the amount being approximately 30% of the original glucose. Addition of mineral acid to the metabolism solution gives a precipitate, the chief constituent of which is a new mould product "byssochlamic acid," $C_{15}H_{20}O_6$, colourless prisms, m.p. 163° $[\alpha]_{5461}$ in $CHCl_3$ solution = +127°. The substance titrates as a tetrabasic acid, with addition of two molecules of H_2O, giving salts $C_{15}H_{20}O_8R_4$. The free acid $C_{15}H_{24}O_8$ has not been obtained. At temperatures above 24° growth is more rapid but the yield of byssochlamic acid is less and is practically nil at 37°. The sodium salt of the new acid is toxic to mice. Injection of 25 mg. was fatal in 24 hours, whilst the least dose used, 6·25 mg., killed all the animals tested in less than 6 days.

"The Metabolic Products of *Penicillium Charlesii* G. Smith," by P. W. Clutterbuck, H. Raistrick,

G. Smith, and M. Stacey. "The metabolic products of a *new species, P. Charlesii G. Smith* (*Trans. Mycolog. Soc.*, 933, **18**, 90) when grown at 24° on Czapek-Dox or on aulin Thom medium, in which the only carbohydrate resent is glucose, have been investigated. The products olated consist of two new polysaccharides and six itherto undescribed optically active organic acids. he polysaccharides are a polygalactose $[\alpha]_{5790}$ −84° nd a polymannose $[\alpha]_{5790}$ + 51° which on hydrolysis ve as the sole hydrolytic products respectively *galactose and d-mannose. The six acids are as* llows: (*a*) $C_9H_{10}O_4$, m.p. 132°, $[\alpha]_{5461}$ (free acid in ater) + 84°, Na salt + 71·5°, monobasic, gives on ydrolysis 1 molecule butyrolactone, 1 molecule acetoin nd 1 molecule CO_2: (*b*) $C_9H_{12}O_7$, m.p. 123°, $[\alpha]_{5461}$ ree acid in water) + 60°, disodium salt + 54°, dibasic:) $C_{10}H_{10}O_6$, m.p. 176°, $[\alpha]_{5461}$ (free acid in water) 160°, disodium salt − 147°, dibasic, gives on hydrosis 1 molecule butyrolactone, 1 molecule acetoin and *molecules* CO_2: (*d*) $C_{10}H_{12}O_6$, *m.p.* 181°, $[\alpha]_{5461}$ (*free* id in water) − 160°, disodium salt − 150°, dibasic:) an acid (? $C_{13}H_{18}O_6$), m.p. 171°, $[\alpha]_{5461}$ (free acid in cohol) − 53° (rapidly falling), disodium salt + 46°, basic: (*f*) an acid (? $C_8H_{10}O_3$), m.p. 171°, $[\alpha]_{5461}$ (free id in alcohol) + 28°, sodium salt + 85°, monobasic. he sodium salts of the acids (*e*) and (*f*) are differentiated ; giving with $AgNO_3$ in the cold a silver mirror and heavy precipitate with $HgCl_2$, the acid (*e*) is charac*rised by the intensity of the* $FeCl_3$ *colour* and by a olour reaction with uranium acetate, the acid (*b*) by characteristic Cu salt (blue needles), the acid (*d*) by a avy brown precipitate with $FeCl_3$ and an immediate avy precipitate with neutral lead acetate and the acid) *by a characteristic Cu salt (green nodules). The acids* so show *considerable differences in solubility in solvents.*

"The Colour and Vitamin-*A* Activity of Butter as ffected by the Breed of the Cow," by S. K. Kon and . G. Booth. The Vitamin-*A* activities of Shorthorn id Guernsey butters *have been compared in biological* id colorimetric tests. The butters were produced by ows kept at the National Institute for Research in airying under identical conditions of feeding and anagement and were collected in May and early June hen all the cows were out at pasture, the animals being ept in the same field and receiving the same mixture concentrates.

Though the feeding of the cows was identical the differ-ce in coloration of the butters was, as expected, most arked, and when measured in the Lovibond Tinto-eter the Guernsey butter was found to be three times highly coloured as the Shorthorn. On the other nd the butters were found to be identical in Vitamin-*A* tivity when assayed at two levels on groups of 12 rats r Dr. Coward's technique. Both were found to contain ther more than 50 International units of Vitamin-*A* r g. While our experiments were in progress a recent aper by the American workers Wilbur, Hilton, and auge (*J. Dairy Sci.* 1933, **16**, 153) *came to our notice,* ese workers found no difference in the Vitamin-*A* ntent of Guernsey and Ayrshire butters. Our findings the case of Guernsey and Shorthorn butters are in mplete agreement with their observations.

When the $SbCl_3$ *test was applied to the non-saponifiable residue from the two butters it was found that the Guernsey butter gave actually lower values than the* Shorthorn, notwithstanding the fact that carotene gives a blue colour with $SbCl_3$ and that the contribution from this source would be in the case of the Guernsey *butter three times as great as from the Shorthorn butter.*

The following Lovibond values were found:

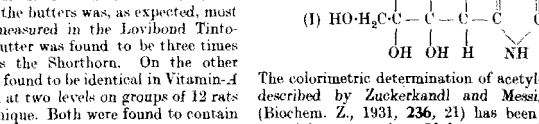
Guernsey butter: 53 yellow units and 52 blue units per g.

Shorthorn butter: 18 yellow units and 70 blue units *per g.*

These results suggest a definite difference in the ability to convert yellow carotene to colourless Vitamin-*A* in these two breeds of cattle.

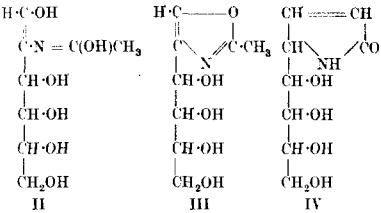
From a practical point of view the following conclusion might be reached; namely, that the *yellow colour of* butter-fat is a good guide to the Vitamin-*A* activity of a butter made solely from the milk of any one breed, but is valueless when butters of different breeds of cattle *are compared or where the butter had been artificially* coloured or had been blended.

"Colorimetric Methods for the Estimation of Glucosamine and Acetyl-*N*-glucosamine," by L. A. Elson and W. T. J. Morgan. A colorimetric method for the *estimation of glucosamine and chondrosamine which* depends on the colour that develops when pyrroles are condensed with *p*-dimethylaminobenzaldehyde has been studied. The conversion of glucosamine (0·75—3 mg.) into the pyrrole derivative (I) α′-methyl-β′-acetyl-α-*glucopyrrole* (*cf. Pauly and Ludwig*, 1922, *Z. physiol. Chem.*, **121**, 176) is accomplished by heating the glucosamine solution at 100° for 15 minutes with an alkaline solution of acetylacetone. Alcohol and 1 c.c. of *an alcoholic solution of p-dimethylaminobenzaldehyde* (*1·0%*) containing *50%* hydrochloric acid are *added* to make up to a volume of 10 c.c. The intense red colour which develops reaches its maximum intensity after 15 minutes and shows no fading over a period of several *hours. The colorimetric comparison is reliable only* when the intensities of the tints of the unknown solution and the standard solution differ by not more than 25%. Equal amounts of glucosamine and chondrosamine give rise to colours identical in tint and intensity. *The accuracy of the estimations is not affected by the* presence of other sugars or amino-acids.



The colorimetric determination of acetyl-*N*-glucosamine *described by Zuckerkandl and Messiner-Klebermass* (Biochem. Z., 1931, **236**, 21) has been found to give unsatisfactory results. If, however, their reagents and technique are modified, reproducible figures can be obtained. The acetyl-*N*-glucosamine (0·75—2·0 mg.) *in a volume of 1 c.c. is treated with 1 c.c. of alcoholic* 0·1*N* KOH for 2 minutes at 100°. *p*-Dimethylaminobenzaldehyde (1%) in glacial acetic acid containing 5% of concentrated HCl is added and the volume made up *to 10 c.c. with glacial acetic acid. An intense reddish-*purple colour develops and reaches its maximum intensity

in 40 minutes; the colour is stable for at least 30 minutes. The method can be used for the determination of acetyl-*N*-chondrosamine. Evidence has been obtained that acetyl-*N*-glucosamine, on warming with alcoholic KOH, reacts in the enolic form (II) which passes over with loss of water into a gluco-oxazole (III) and not, as suggested by Zuckerkandl and Messiner-Klebermass, into a gluco-pyrrole (IV). Authentic specimens of 2 : 4 di-substituted oxazoles when treated with *p*-dimethylaminobenzaldehyde give rise to colours closely resembling those produced by glucosamine derivatives.



II III IV

CORRESPONDENCE

JUBILEE CELEBRATIONS OF THE SOCIETY OF DYERS AND COLOURISTS

SIR,—One of the great features of next year's Jubilee Celebrations of The Society of Dyers and Colourists is to be the publication of a volume dealing with the history, progress, and present position of every phase of the dyeing, dyestuff, and textile printing industries. The contributors are of international repute, and the volume will certainly prove to be a world's landmark in the history and literature of the tinctorial arts and industries.

It is determined to make the celebrations next Whitsuntide the greatest event in the dyeing world, and this volume unique in its complete survey of our knowledge of dyeing, textile printing, and dyestuff manufacture.

There is doubtless much valuable matter which is in danger of being irretrievably lost and which closely affects our knowledge of dyeing and dyestuffs, and also concerning the history of the Society of Dyers and Colourists, with its branches in every main centre of dyeing industry in Britain, and its members in all parts of the world.

It will be of great value if these things can be brought to the notice of the above Society whether these matters be ancient or modern, British or foreign.

I am, Sir, etc.,
GEO. G. HOPKINSON,
Honorary Secretary,
The Society of Dyers and Colourists

32, Piccadilly,
Bradford
Oct. 12, 1933

TRANSPORT AND FIRE HAZARDS OF LIQUEFIED GASES

SIR,

A propos of the article in your issue of Oct. 6 on fire hazards from the use of liquefied gases, though not directly connected with this subject it has occurred to me that many of those responsible for plants making use of liquid chlorine may not be acquainted with the following method of treatment for workmen and others suffering from inhalation of this gas.

I have used this method several years ago when running a bleach liquor from liquid chlorine plant in a large British paper mill. In those days control valves were not so efficient as nowadays, and leakage occurred occasionally in localities where ventilation was imperfect. I found that the most effective way of treating the patients was to cause them to inhale through a face mask a mixture of air containing about 5% or so of CO_2. The proportion is not very important. The sufferer from chlorine gassing is usually unable to breathe without spasms of coughing. Whilst inhaling the CO_2 mixture he is able to breathe regularly and very deeply. The tendency to coughing rapidly disappears, and the lungs are well ventilated and washed quite free of the last traces of the gas. At the same time the irritant mucus is readily removed, and the benefits remain to a great extent after the treatment is discontinued. The treatment was an enormous improvement on such methods as drinking brandy, cold tea, brine, or the inhalation of ammonia.

At that time our breathing apparatus was crude, but nowadays Messrs. Sparklets, Ltd. of Upper Edmonton London, N.18, are turning out a very convenient and cheap CO_2 resuscitator of a handy size for such emergencies.

I am, Sir, &c.,
JAS. H. BELL

Auchtermuchty,
Fife
Oct. 16, 1933

ROADS

SIR,—In the interests of his fellows may a mere pedestrian point out that there is another side to the question. If you have the least regard for them you will not go out in your best clothes, and to be sure of reaching your destination you will fix on a hospital or a mortuary.

I am, Sir, etc.,
JAMES S. MANN

Essex
Oct. 13, 1933

PERSONAL AND OTHER ITEMS

Many members of the London Section will mourn the death of Mr. E. Theodore Brewis which occurred at his home in Leytonstone on Friday last, October 13, after a short illness. Mr. Brewis was one of the now fast dwindling body of original members of the Society in the activities of which he took a prominent interest. He was a regular attendant at meetings of the London Section and contributed on many occasions to the discussions of the papers. His death leaves vacancies on the committees of the London Section and of the Chemical Club. He was educated at the Royal College of Science for Ireland under Sir W. N. Hartley and after serving a period each with Hamilton Long & Co., Dublin Sugar Refinery, Southall Bros. & Barclay, he joined the staff of Stafford Allen & Sons, Ltd., manufacturers of drugs and fine chemicals, where he finally occupied the

position of chief chemist. He was elected a Fellow of the Institute of Chemistry in 1888. The funeral took place at the Crematorium, Manor Park, on Tuesday last, when the Society and the London Section were represented by Mr. H. J. Pooley, Mr. E. Hinks, Mr. H. A. Steel and and other members.

The Leverhulme Chemistry Prize of the Liverpool Section of the Society has been awarded to Mr. T. G. Green of St. Helens. The Section has awarded its Senior Prize to Mr. D. N. Grindley and its Junior Prize to Mr. C. E. Ryder.

Major F. A. Freeth, F.R.S., joint research manager of Imperial Chemical Industries, Ltd., has been elected president of the British Cast Iron Research Association.

The Council of the Royal College of Surgeons of England at a meeting recently admitted Dr. F. G. Banting, the discoverer of insulin, to an honorary Fellowship of the College.

We regret to record the death recently in Australia of Mr. E. W. Knox, of the Colonial Sugar Refining Co. of Sydney, N.S.W. Mr. Knox joined the Society as long ago as 1886.

Prof. A. Robertson has been appointed to the Chair of Organic Chemistry at the University of Liverpool in succession to Prof. Heilbron.

We regret to learn of the death on October 10 of Mr. Sinclair Pearn, chairman and managing director of Frank Pearn & Co. Ltd., engineers, of West Gorton, Manchester. Mr. Pearn, with his brother, Mr. Frank Pearn, founded the firm in 1870, and it was one the earliest advertisers in the Society's JOURNAL.

Dr. George Tate, who is well known to many Merseyside chemists, has retired from the position of lecturer of chemistry at Birkenhead Technical College, a post he has held for more than forty years.

Gifts to Glasgow

At a recent meeting of the Court of Glasgow University it was announced that £20,000 had been given by Miss M. D. Rankin of Greenock to provide a fund for medical research. The fund is to be available for any research into the origin and treatment of disease, and the donor wishes cancer research to receive special consideration. The University has also received a bequest of £8000 by the late Miss B. Aitken Gray for the endowment of a travelling bursary in engineering.

A Forty-Hour Week Experiment at Billingham

Imperial Chemical Industries, Ltd. has decided to introduce a new system in its Billingham works by which about 15% of the employees will have a 40-hour working week. It has been found necessary to change certain shops at Billingham from ordinary day work to shift-work, and the workers concerned have elected to use a four eight-hour shift system instead of the usual three-shift system, thereby giving employment to more men. Payment for shift-work is paid at a higher rate than day-work, and the workers concerned will receive higher pay for this 40-hour week than for the ordinary day-work 47-hour week. The wages bill of the company is the same for the four-shift system as it would be for the three-shift system.

Food Standards

The Departmental Committee which is considering the desirability of altering the law so as to enable definitions or standards to be prescribed for articles of food met recently, and amongst the witnesses examined were Dr. J. T. Dunn, Mr. F. W. F. Arnaud, and Mr. E. Hinks.

New Factory for Production of Aluminium Foils etc.

The Wolverhampton Industrial Development Association announces that the Star Aluminium Company has completed negotiations to take over a large portion of the former "A. J. S." motor-cycle factory to start production on the manufacture of aluminium foils for packing purposes, and other articles in aluminium, early in the New Year. When in production the factory will employ well over 200 people. Mr. Arnold Heckle, the Wolverhampton development officer, hinted that tariff walls had made it necessary for some foreign industrialists to open up branch factories in England in order to compete in the home market.

Institution of Chemical Engineers

The Institution of Chemical Engineers' public lecture for the year is to be given by Prof. G. T. Morgan, on Friday, October 27, on the subject "Engineering in the Service of Chemical Research." The address will be given in the Institution of Civil Engineers, Great George Street, Westminster.

On Wednesday, November 15, Dr. Friedrich Bergius will present a paper to the Institution on "The Utilization of Wood for the Production of Foodstuffs, Alcohol and Glucose," describing some important work recently carried out in Germany, and on Friday, December 8, a paper on "The Protection of Light Magnesium Alloys by Selenium and Other Coatings" will be read by Dr. G. D. Bengough and Mr. L. Whitby.

Paper Machinery Production at Sheffield

A development of importance to industry in Sheffield is promised in the announcement that a new company, Millspaugh, Ltd., is to manufactire paper-making and other machinery within the works of Hadfields, Ltd. Plant is being installed in a building adjoining Hadfields' foundry to make large bronze tubular castings required in paper-making machinery, and it is expected that the new concern will supply copper, bronze, and steel engraving rolls to the textile and printing trades. Mr. W. H. Millspaugh, who has carried on the manufacture of paper-making machinery at Sandusky, Ohio, for many years, is at the head of the new concern.

Tests of a New Leather

Some novel tests have been used at the Mellon Institute on a new type of leather, called "Vici Special," which has been developed at the Institute by C. H. Geister. This leather is stated to require no dressing in the shoe factory or whilst in service and will polish simply by rubbing. The resistance to scuffing and wearing abrasion has been tested by a drum apparatus that throws shoes, resembling those in service and loaded with sand-bags, against the abrasive and the drum at the rate of eighteen times a minute. In tests continued for an hour the new leather has been shown to be superior

... ordinary shoe leathers in the number of scuffs, area ... affed, and depth of disfigurement. Copies of a report ... these tests can be obtained free from the Mellon Institute, Pittsburgh, U.S.A.

Statistical Methods in Industry and Agriculture

The Council of the Royal Statistical Society has decided to form a section for the purpose of promoting the application of methods of statistical analysis to problems in industry and agriculture. The facilities provided by the section will be (1) the holding of regular meetings, and (2) the publication of a supplement to the *Journal of the Royal Statistical Society* devoted to the study of this aspect of statistical science. The first meeting will be held on Thursday evening, November 23, at the Royal Society of Arts, John Street, Adelphi, London, at 5.30 p.m. A provisional committee has been formed until officers can be appointed in the usual manner. This committee has as its chairman Dr. E. C. Snow, with Mr. L. R. Connor of Imperial Chemical Industries, Ltd. its honorary secretary. The other members are Dr. J. O. Irwin of the London School of Hygiene, Mr. A. T. McKay of the Boot Trade Research Association, Dr. E. S. Pearson of the Department of Applied Statistics, University College, London, and Dr. J. Wishart of the School of Agriculture, Cambridge. Full particulars can be obtained from the honorary secretary of the section at 9, Adelphi Terrace, London, W.C.2.

A Correction

In the account of the meeting of the Glasgow Section published last week it is stated (p. 819, col. 1, last paragraph) that "fluid film lubrication would be established and this could happen without the oil passing under the ball." This should read "this could not happen" etc.

COMPANY NEWS

ERINOID, LTD.

The net profit of the company, manufacturing plastics, for the year ended July 31, 1933, was £41,845, as compared with £37,214 last year. The report of the company states that a new process for producing "Erinofort" is expected to develop considerably during the current year. The dividend, as previously announced, is at the rate of 11½%, an increase of 1½%.

ELECTROLYTIC ZINC CO. OF AUSTRALIA LTD.

The company records a net profit for the year ended June 30, 1933, of £223,093, after allowing £145,000 for depreciation and £49,706 for taxation. The profit last year was £85,090.

IMPERIAL SMELTING CORPORATION, LTD.

Following the announcement (see last week's JOURNAL) of an agreement with the Sulphide Corporation, Ltd. to acquire its Seaton Carew works, the Imperial Smelting Corporation has now formed a subsidiary named the Northern Smelting & Chemical Co., which is registered as a private company with a nominal capital of £250,000 in £1 shares. The subscribers are Mr. L. B. Robinson and Mr. F. A. Crew.

MARKET REPORT

This Market Report is compiled from special information received from the manufacturers concerned.

Unless otherwise stated, the prices quoted below cover fair quantities net and naked at sellers' works.

The following alterations in prices are reported since the publication of the last Market Report (cf. CHEM. & IND., Oct. 6, 1933, p. 802).

RUBBER CHEMICALS

Carbon Black.—3¾d.—5d. per lb., ex wharf.

TAR PRODUCTS

Toluole. 90%, 2s. 5d.—2s. 6d. per gal. Pure, 2s. 10d. per gal.

ESSENTIAL OILS

Camphor.—Brown, 75s. per cwt.—White, 95s. per cwt. Cananga, Java, 10s. 6d. per lb. Cinnamon Oil, Ceylon.—3s. 3d. per lb. Cassia, 80/85%, 4s. 3d. per lb.

Eucalyptus, Australian B.P., 70/75%.—1s. 2d. per lb Lavender.—Mont Blanc, 38/40%.—16s. per lb. Lemon.—5s. per lb. Lemongrass.—4s. per lb. Orange, Sweet.—6s. 6d. per lb. Otto of Rose.—Anatolian, 33s. per oz.; Bulgarian, 45s. per oz. Palma Rosa, 8s. 6d. per lb.

Peppermint.—Japanese, 5s. per lb. Wayne County, 13s. 6d. per lb. Petitgrain.—5s. 6d. per lb.

Sandalwood, Mysore.—30s. per lb. 90/92%, 20s. 6d. per lb. Australian, B.P. and French Codex, 92/95%, 15s. 6d. per lb.

INTERMEDIATES

Dinitrotoluene 48/50° C.—8¼d. per lb. 66/68° C.—10d. per lb.

m-Xylidine acetate, 4s. 6d. per lb., 100%.

PATENT LIST

The following is a list of complete specifications of chemical interest which are open for inspection under Section 91 (4) (a) of the Patent Acts. Printed copies are not available, but photographic copies may be obtained at a charge of 9d. per page (minimum 1s.) from the Patent Office, Chancery Lane, W.C.2.

I. 8245 (1933). Bosch A.-G. Filters for liquids.

9664 (1933). Ebel. Drying or cooling bulk goods.

III. 3388 (1933). Henkel & Co. Preparation of higher ethers.

9067 (1933). I. G. Farbenind. Manufacture of sulphuric acid esters of leucoanthraquinonazines.

9068 (1933). I. G. Farbenind. Manufacture of 1 : 4-diaminoanthraquinone-2 : 3-disulphonic acid.

IV. 9067 (1933). I. G. Farbenind. *See* III.

9191 (1933). I. G. Farbenind. Manufacture of vat dyestuffs of the anthraquinone series.

9651 (1933). Du Pont de Nemours & Co. Manufacture of azo dyestuffs.

9802—3 (1933). I. G. Farbenind. Manufacture of water-insoluble azo dyestuffs.

9882 (1933). I. G. Farbenind. Manufacture of dyestuffs of the azine series.

VI. 9201 (1933). Brit. Celanese, Ltd. Application of liquid-treating agents to yarns etc.

VII. 18,517 (1932). Aluminium, Ltd. Manufacture of sodium aluminate.

5738 (1933). Mathieson Alkali Works. Production of alkali metal carbamates.

VIII. 8641 (1933). Gen. Ceramics Co. Increasing the density of ceramic masses.

X. 16,940 (1932). Gravell. Cleaning metal surfaces. 8204—6 (1933). Goetz. Extracting metals from ores.

XI 9866 (1933). Brit. Thomson-Houston Co. Coating electric incandescent filaments.

XIV. 31,840 (1932). Goodyear Tire & Rubber Co. Treating vulcanized rubber.

XXI. 9337—40 (1933). Claus. Producing photographic media.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific number. *Australia:* Anti-friction metals and aluminium alloys (396). *Canada:* Pigments, such as zinc oxide, lithopone, etc. (398); Centrifugal pumps (399). *Syria (Damascus):* Chemicals, including dyes, tanning extracts, etc. (417).

Import Duties Act

The Commissioners of Customs and Excise have issued an Order (No. 280, October, 1933) giving particulars of the scheme for the allowance of drawback of £15 per ton on the exportation of slabs of stainless steel sheets from 3 to 26 S.W.G. in respect of stainless steel of austenitic quality (18/8) used in their manufacture. The drawback is allowed in respect of material imported after October 9, 1933. The procedure to be followed by exporters is given in Notice No. 221, obtainable from Custom House, London, E.C.3.

Import Duties Advisory Committee

The Import Duties Advisory Committee gives notice of applications for the addition to the Free List of solid insoluble quebracho extract and diatomaceous earth, whether ground or unground.

Representations should be addressed to the Secretary, Import Duties Advisory Committee, Caxton House, Tothill Street, London, S.W.1, not later than November 2, 1933.

Nickel Cast Iron

A useful booklet has been issued by the Research and Development Department, Mond Nickel Co., Ltd., Thames House, Millbank, London, with the name "Nickel Cast Iron To-day." The publication deals in a general way with the various types of cast iron containing the smaller proportions of alloy additions, and refers especially to castings made by some of the newer processes used for the development of high strength and hardness. The use of nickel cast iron has several points in its favour. From the point of view of the designer, its use enables reductions in section to be effected without loss of strength. It can be used to give longer life to parts subjected to abrasive wear, and the addition of 1%—2% nickel in good quality cast iron offers the engineer a simple and effective means of improving the properties of castings. This booklet discusses the subject in a concise manner, and a number of illustrations give it additional interest.

Surface Treatment of Concrete

When silicate of soda solution is applied to the surf of concrete it is rapidly absorbed by the porous surfa where it combines with calcium hydroxide and calci salts to form a tough glassy material consisting chi of calcium silicate and silica. Two or three applicati cause the surface pores of the concrete to become fil with this glassy deposit, and all concrete, whether v made or badly made can be improved by the proc which is described in an excellent little booklet cal "Surface Treatment of Concrete," published by Impe Chemical Industries, Ltd. The booklet deals with application to dust-proofing, waterproofing, coner roads, oil-storage tanks, acid-resistant concrete, prec work, and special types of cement. The printing of booklet is excellent.

PUBLICATIONS RECEIVED

TABLES SHOWING THE RELATION BETWEEN THE SPECI GRAVITY OF SPIRITS AT 80° FAHRENHEIT, THE COR SPONDING PERCENTAGE OF PROOF SPIRIT AND THE P CENTAGE OF ALCOHOL BY WEIGHT. Pp. 47. Londo H.M. Stationery Office, 1933. 2s. 6d.

REPORT ON THE ECONOMIC SITUATION IN ESTONIA AS THE END OF JUNE, 1933. Ref. No. C. 4183. Pp. London: Department of Overseas Trade, 1933.

INDUSTRIAL CHEMISTRY: AN ELEMENTARY TREATISE F THE STUDENT AND GENERAL READER. By E. R. Rieg Ph.D. Pp. 784. New York: Chemical Catalog C 1933. $6.

A SHORT ORGANIC CHEMISTRY. By F. S. Taylor, Ph.I M.A., B.Sc. Pp. viii + 378. London: Wm. Hei mann, Ltd., 1933. 5s.

QUANTITATIVE CHEMICAL ANALYSIS. By G. McPh Smith. 3rd ed., revised and enlarged. Pp. xii + 1 New York: Macmillan Co., 1933. 12s.

SURVEY OF THE IMPORT TRADE OF INDIA DURING THE FI THREE MONTHS OF THE FISCAL YEAR, APRIL TO JU 1933. Ref. No. C. 4184. Pp. 24. London: Departme of Overseas Trade, 1933.

ARTIFICIAL TRANSMUTATION OF THE ELEMENTS: BEING T THIRTY-FIFTH ROBERT BOYLE LECTURE. Delive before the Oxford University Junior Scientific Club June, 1933. By Lord Rutherford. Pp. 12. Londo H. Milford, Oxford University Press, 1933. 1s.

RUBBER IN CHEMICAL ENGINEERING. By H. P. Steve M.A., Ph.D., and M. B. Donald, M.Sc. Pp. London: Rubber Growers' Association, Inc., 1933.

KINETICS OF REACTIONS IN SOLUTION. By E. A. Moelw Hughes, D.Sc. Pp. vi + 313. Oxford: Clarend Press; London: H. Milford, Oxford University Pre 1933. 15s.

SOLVENT TREATMENT OF DISTILLATES IS NOW APPLI WITH SUCCESS TO THE HEAVIER OIL FRACTIONS. A. W. Nash. Reprinted from the *Oil and Gas Journ* Okla, March, 1933.

LUBRICANTS AND LUBRICATION. By A. R. Bowen, D.S Ph.D. Pp. 14. Reprinted from the *Journal of t Institution of Petroleum Technologists*, Vol. 19, N 117, Pp. 578—591, July, 1933.

CALENDAR OF THE IMPERIAL COLLEGE OF SCIENCE A TECHNOLOGY, LONDON, FOR THE SESSION 1933—34. F 570. London: Imperial College of Science and Tec nology, 1933.